



IXN for the **NHS**

2015-2023

Book of Abstracts

Industry Exchange Network supporting NHS and digital healthcare projects with computer science students



“We want the NHS and healthtech groups to know that the IXN for the NHS is there to support their digital transformation processes and their early R&D projects.

“There are many challenges for the NHS, whether they are experienced by staff on the ground or at director level. A fundamental attribute of IXN for the NHS is that we provide opportunities to address these varied problems, large or small.

“The students and our industry partners are committed to developing concepts at a rapid pace in line with NHS endeavours, as shown over the several years of projects cited in this book. Their work over the height of the COVID-19 pandemic is also testament to this.”

Professor Dean Mohamedally, co-founder of IXN for the NHS



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“The rapid advances in technology and artificial intelligence will have a profound impact on the NHS and healthcare delivery. IXN for the NHS allows students to engage at the heart of this process, building an appreciation of the opportunities and constraints, while engaging with NHS staff to explore how practical software systems can be developed and deployed.”

Professor Graham Roberts, co-founder of IXN for the NHS

Educational programme developed by:

Professor Dean Mohamedally
 Professor Graham Roberts
 Dr Atia Rafiq
 Sheena Visram
 Professor Neil Sebire
 Professor Joseph Connor
 Alan Fish

Book edited by:
 Professor Dean Mohamedally
 Lucy Walker
 Janine Clayton

“IXN for the NHS allows students and researchers to foster closer connections with NHS colleagues and accelerates the translation of digital innovation into the NHS.

“This aligns closely with the UCL Institute of Healthcare Engineering’s aims to deliver cutting-edge innovation into patient care, which can only happen through collaboration with clinical partners.”

Professor Marianna Obrist, Deputy Director (Digital Health) for the UCL Institute of Healthcare Engineering

Welcome

IXN for the NHS book of abstracts

The power of computer systems to change society is immense – over the past 50 years there have been constant developments in hardware, software and, latterly, AI which reset the baseline of what is possible and what our future world will look like.

In UCL CS a key part of our educational offering is the opportunity for students to work with real-world clients on current problems that are the basis of future change. The IXN, conceived and developed by Profs Dean Mohamedally and Graham Roberts, is the vehicle we have created to achieve this, and many thousands of students have now benefitted from experiences with companies and with charities. However, from the very beginning, one of our key partners in this journey has been the NHS – the cornerstone of healthcare in the UK and both a reflection of, and the bedrock under, our open and inclusive society.

One of the single most important areas in which we see technological advances is in medicine, in areas that include better medical imaging; the move towards data-driven, personalised, treatment; the increased use of technology in surgery; and greater openness between doctors and patients in terms of their medical records.

To see our talented students learn to appreciate the challenges and opportunities that come from thinking about how to deliver this future, in true collaboration with those responsible for delivering healthcare in the present, is both humbling and a source of immense pride for me as Head of Department. Truly, it is through such experiences that the industry leaders and researchers of tomorrow are forged – those who will continue to transform society and will do so in the knowledge of what it is to aspire to deliver positive change.

With best wishes,

Professor Steve Hailes
Head of Department
UCL Computer Science



IXN for the NHS: accelerating digital health R&D

Endorsed by the Topol Review



How does the NHS deliver the digital future? The Topol Review recommends seeking 'expertise and guidance to evaluate new technologies using processes grounded in real-world evidence'. Introducing the Industry Exchange Network (IXN) for the NHS, its methodology cited as best practice by the Review.

IXN for the NHS brings together clinicians, healthcare workers and managers, educators, industry, and computer science students to advance healthcare. These multidisciplinary teams devise proofs of concept to tackle challenges within the NHS. All with minimal cost and low risk.

“Digital innovation in healthcare is at the heart of the GOSH digital strategy. Our engagement with the IXN programme allows our staff to co-develop prototype concepts with the potential to impact delivery of medical care and improve the healthcare experiences of patients and families at GOSH.”

Neil Sebire, Professor of Pathology and Chief Research Information Officer GOSH/UCL



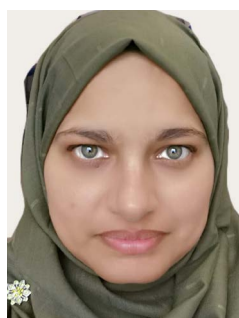
IXN for the NHS was officially developed and launched in 2019 by UCL Professors Dean Mohamedally and Graham Roberts and clinicians Dr Atia Rafiq and Sheena Visram. However, digital health has been a core focus of the IXN programme since its inception in 2011. Early partners were Great Ormond Street Hospital's Data Research, Innovation and Virtual Environments unit (GOSH DRIVE), the Royal College of General Practitioners, Health Education England and the Apperta Foundation. Today, IXN for the NHS projects run with hundreds of hospitals, trusts, charities and companies across the UK.

The highly acclaimed IXN programme is mutually beneficial for students and partners. Students gain unparalleled experience of the working world, building skills and important contacts. Matched to projects that reflect their interests, they enjoy helping organisations solve genuine problems. Our partners love that the programme allows them to innovate without incurring risk. They appreciate the students' fresh approach to problem-solving and often hire them after they finish their studies.

We strongly believe that technology should have a positive impact on people's lives. That's why the IXN framework specifies that at least one-fifth of projects must be dedicated to healthcare and charities. Our tech partners share our commitment to making a difference. They number many but include Microsoft, Intel, IBM and NTT DATA. They supply the latest software, hardware and technical thinking. With clinicians modelling requirements, there's a tacit understanding of healthcare challenges and the complexities of designing for the NHS.

The framework for IXN for the NHS is built upon three pillars: Interoperability, Efficiency and Innovation (IEI). Projects fit within these pillars. For example, we've worked extensively in Fast Healthcare Interoperability Resources (FHIR). Projects range from smaller proofs of concept to multiteam interdisciplinary endeavours that roll over multiple years. We also run hackathons.

The partnership with GOSH DRIVE led to one of our first rapid design and prototyping hackathons for healthcare in 2019. The success of this hackathon resulted in six student abstracts being published in the British Medical Journal (BMJ) Archives of Disease in Childhood.



L to R: Prof Dean Mohamedally, Prof Graham Roberts, Dr Atia Rafiq and Sheena Visram.

Multiyear projects include the UCL HoloRepository, a FHIR-enabled research demonstrator project. The HoloRepository renders scans of the brain, lungs, chest, abdomen and kidneys in holographic 3D. Sight ++, a collaboration between several hospitals and tech leaders such as Intel, has been running over successive years. It addresses how we can make hospital spaces more accessible by assisting people who are visually impaired.

Our largest project to date is UCL MotionInput, available for free on the Microsoft Store. The software has several applications. It began in 2020 as an investigation into how we could reduce contact with shared computers in hospitals during the COVID-19 pandemic period. Designed to work with NHS software, it promotes hygiene and has pioneered new modes of touchless interaction. UCL MotionInput also revolutionises computer use for those with mobility issues; it enables them to control a computer with only face and body movements. The software, produced in collaboration with Microsoft, Intel, IBM and the NHS, has been endorsed by charities and trusts, including the International Alliance of ALS/MND Associations and GOSH DRIVE. Over 150 students and academics have worked on UCL MotionInput.

IXN for the NHS gives thousands of students an insight into how their computer science skills can improve health outcomes. The clinicians and industry mentors have a real understanding of the issues within the NHS. All parties in the programme have a shared desire to progress patient care, and we're combining our expertise to meet the needs of the NHS at scale and low cost. We're using engineering to solve big problems together. Join us.

“The goal of the programme is not to undermine the complexities of introducing technology into the NHS but rather to excite clinical staff about the possibilities that emerging technology brings.

“Early stage prototyping often involves a sketch or somebody pitching an idea. Our students build functioning prototypes. Clinicians wouldn't normally get to access these kinds of technologies, and our prototypes can help them decide if they would like to progress these ideas further.”

Sheena Visram, co-founder of IXN for the NHS

“The programme is a safe place for the NHS to try new things with technology without burdening the system financially. It's where healthcare professionals can explore new avenues, alongside industry leaders and incredibly talented students. This process is vital to the growth of our healthcare system.”

Dr Atia Rafiq, co-founder of IXN for the NHS, NHS GP, GP trainer, and lecturer



The IXN teaching methodology

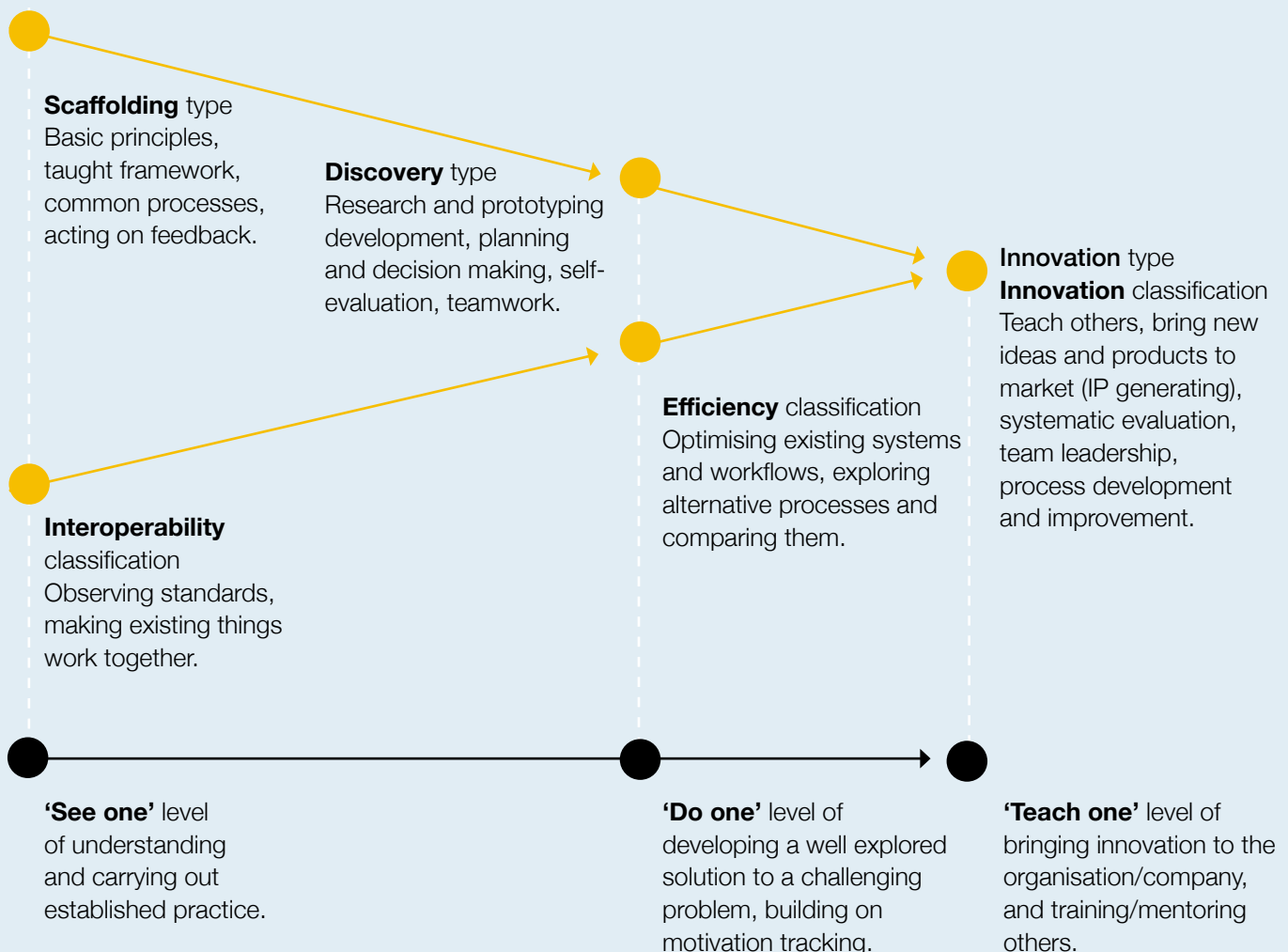
IXN is a unique programme enabling students to work on real-world problems. Students' IXN projects are core components of their courses and are assessed.

At the heart of the IXN for the NHS programme lies our acclaimed pedagogical approach, based on the 'see one, do one, teach one' principle. Projects fit into the Interoperability, Efficiency and Innovation (IEI) framework, progressing through the stages of 'see one, do one, teach one'.

We use a motivation-tracking approach to focus on students' particular interests, identifying the fields in which they want to work. They are able to become specialists who don't need to retrain before starting employment.

What has made the IXN process so successful is that it is integrated into degree programmes, works at a large scale, and enables students to develop a wide range of personal and technical skills.

SDI and IEI chart: types, classifications and levels of IXN student projects
(Mohamedally, Roberts, Rafiq, Visram, Fu and Cameron, 2017)



Support for partnerships

UCL Computer Science Strategic Alliances Team

IXN for the NHS is currently managed at UCL. Fourteen other universities in the UK are members of the programme.

At UCL Computer Science, our Strategic Alliances Team (SAT) are specialists in building and nurturing successful long-term relationships with our partners. Across the NHS alone, they have supported numerous collaborations.

SAT are committed to delivering impactful projects. They take care of the paperwork, ensure processes run smoothly, and report on the results, bringing you valuable insights into how to optimise innovation in computing.

We focus on creating long-term, mutually beneficial strategic alliances. Partnerships come in all shapes and sizes, and forming an alliance can be inherently complex. SAT ensure each partnership is built on a trusted relationship with shared objectives.

It's worth noting that ethics clearance and data preparation for educational projects need considerable planning, so please allow time for this.

To find out more about partnering with the UCL Computer Science department, please contact SAT: cs.strategicalliancesteam@ucl.ac.uk

“This programme is a superb opportunity for clinicians to explore potential software device, data and communication solutions. It enables life science partners to contribute to varying components of patient pathway innovation and health charities to ensure patient-centricity for new technologies.

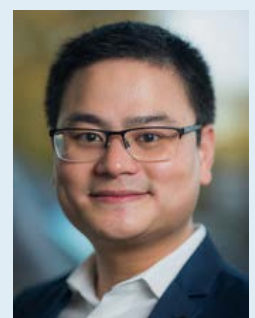
“Through working on real-world problems with students, this model of combining skills and understanding can facilitate incredibly agile early R&D. Some proofs of concept have already been taken through to product deployment over the last couple of years.

“This is a not-to-be-missed, risk-free opportunity to accelerate problem-solving in the NHS.”

Dr Julia Manning

Dr Julia Manning is the Digital Health Lead and Strategic Alliances Adviser (Healthcare) on IXN for the NHS. Julia identifies and nurtures possible new high-impact collaborations between UCL Computer Science staff and students with NHS clinicians, NHS Trusts, life science industries, charities and private providers nationally and internationally. She also supports the development of entrepreneurial activities based on research conducted in the UCL Computer Science department.

From left: Dr Julia Manning, Digital Health Lead, IXN for the NHS; Mehran Allybaccus, Strategic Partnerships Manager and Emerging Technologies Network Coordinator; Tim Bodley-Scott, Strategic Alliances Director; Dr Yun Fu, App Project Manager



Schedules for submitting a project proposal

Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun

The **third and final call** is for master's dissertations by January. They start in May and finish by early September.

The **second call** is by the end of November for small-scale web app projects running from January to March.

For UCL, the **first call** for proposals ends on Monday 4 September 2023. This is for finalist dissertations and team projects by undergraduates in all fields of computer science. They start in October and finish in April. Ethics approvals and project checks are required by May and June.

Master's projects are 100% of the students' time, all other projects are 25%.

There are three coordinated calls for projects every year at UCL. Please submit your proposal using this form: <https://www.tinyurl.com/IXNproposals>

Other university partnerships may have slightly different timelines.

Case study: UCL IXN and GOSH DRIVE



Professor Neil Sebire, Professor of Pathology and Chief Research Information Officer GOSH/UCL, on the benefits GOSH derives from partnering with IXN for the NHS.

Great Ormond Street Hospital has been collaborating with the UCL Computer Science IXN programme since 2018, specialising in data science, and AI and machine learning in healthcare. The UK government's Topol Review, published in 2019, which also cited UCL IXN, demonstrates the value of introducing these technologies further into the NHS.

Despite the Topol Review's recommendations, there wasn't a clear plan for how the NHS should increase the adoption of digital technologies. Of course, training clinical staff to code isn't feasible. However, we've found that working with UCL students on early phase proofs of concept is a step towards the aims of the Review.

UCL IXN allows clinicians to play around with ideas with a quick turnaround time. We identify specific problems, and students present their solutions. Students learn to design for the end user, and the NHS receives a proof of concept that helps us explore which technologies we could use. These technologies aren't always healthcare-related but can be general computer science infrastructures, like databases.





The students often produce two-minute videos for every project. Using short videos is an excellent way of prototyping, as hospitals don't have teams of software developers to prototype. UCL IXN enables students to gain insights into the genuine needs of clients and to form connections with the GOSH team, who mentor them.

Furthermore, as GOSH is a children's hospital, there's an opportunity for gamification. Several concepts use a game-like interface. One example, Project Fizzyo, is an app encouraging cystic fibrosis patients to have fun while doing their physiotherapy exercises.

The programme has been helpful to GOSH in unexpected ways. It has highlighted new considerations. While working on a project using augmented reality for training, we realised the importance of an effective content management system for this data.

Some projects become long term, such as the HoloRepository or UCL MotionInput. Successive groups of undergrads or MSc students, or individual UCL students, work on them towards a larger common goal.

In some cases, the proofs of concept have become products we use in clinical practice. One example is an app that monitors nephrotic syndrome for renal patients.

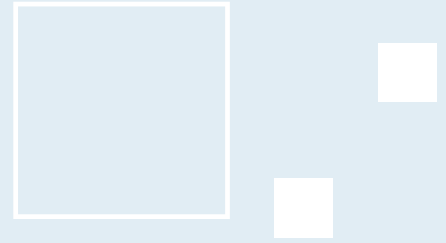
"I'm sure some UCL Computer Science alumni would not have chosen careers in healthcare without the experience of working with GOSH."

Neil Sebire, Professor of Pathology and Chief Research Information Officer GOSH/UCL

We also run hackathons with the IXN programme. In 2020, just before lockdown, GOSH and UCL Computer Science ran the FHIR hackathon with 140 students. FHIR is the industry standard for sharing healthcare data between systems. We'd expected two or three good ideas, which would have made the process worthwhile, but we received several incredible concepts.

Ultimately, the programme gives students the chance to use their computing skills to genuinely help people. We've had students progress to internships and employment with us. I'm sure some UCL Computer Science alumni would not have chosen careers in healthcare without the experience of working with GOSH.

Case study: UCL MotionInput



UCL MotionInput is a pioneering suite of touchless computing technologies. The multidisciplinary, multiyear IXN project is a collaboration between UCL Computer Science students and academics, the NHS with GOSH DRIVE, the UCLH Institute for Child Health, and industry partners Intel, Microsoft and IBM.

What is UCL MotionInput?

UCL MotionInput is a major software package for touchless computer interactions using just a webcam and PC. It responds to nearly all ranges of human movement.

The platform allows users to control and interact with a computer using physical gestures captured by their webcam. It replaces input functionality normally provided with a keyboard, mouse or joypad, and instead uses movements of their hands, head, eyes, mouth, or even their full body joints.

MotionInput v3

As of 2023, the third generation of MotionInput enables varied combinations of human movements. It has federated and offline speech processing for live captioning and speech commands for existing applications. It also has several orders of magnitude improvements in efficiency and has an architecture for supporting the growth of touchless computing apps as an ecosystem. We're also starting the journey towards developing the software for multiple platforms.

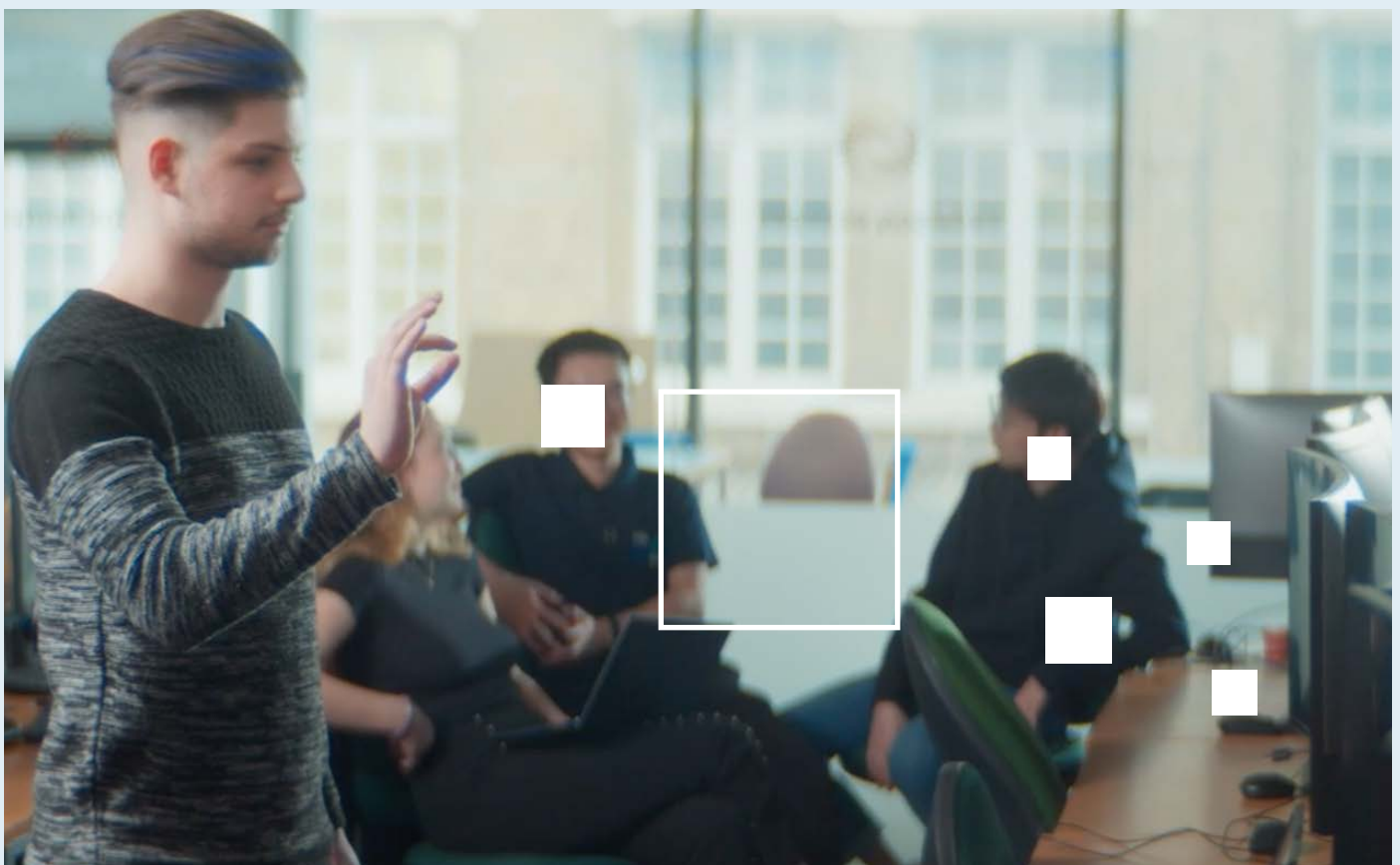
UCL MotionInput is the first title published by UCL on the Microsoft Windows Store. It is free for personal use.

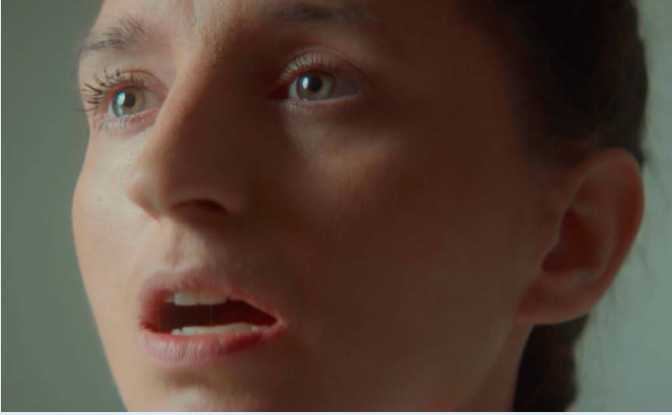


[Download In-Air Multitouch](#)



[Download Facial Navigation](#)





How UCL MotionInput started

UCL MotionInput was first created in response to the COVID-19 pandemic.

As lockdown forced staff and students away from campus, UCL launched a range of initiatives to make teaching remotely work for all. In particular, UCL began conversations with the NHS, Intel, Microsoft and IBM about possible additions to the NEWS2 protocol, a system used by the NHS to triage patients quickly that required physical touch and examination.

At the same time, machine learning technologies such as Tensorflow and Computer Vision techniques such as Convolutional Neural Network (CNN) Training models were accelerating in their development.

This led to UCL MotionInput being proposed as a final year project in the IXN programme in September 2020

“It is a hugely inspiring experience to be part of this exceptionally innovative programme, using technology to overcome the barriers of physical limitations to bring digital services, education and play to those who need them most. The development of MotionInput is an exercise in collaboration, design, inclusivity and enablement, and this is clearly demonstrated in its end result and its societal impact. A huge thank you to Dean Mohamedally for his inspirational leadership and to the talented UCL technologists that have made MotionInput a reality.”

Professor John McNamara, IBM Master Inventor

What are the benefits?

The software has many features and benefits.

Any screen is now a multitouch touchscreen

Multitouch touchscreens can be used anywhere, in schools and hospitals as well as at home.

A lecturer can control PowerPoint without reaching for the laptop. A chef can navigate pages without touching a screen. A surgeon can review and annotate CT scan images without needing assistance to navigate the computer.

Facial navigation

Facial navigation enables a greater degree of accessibility by letting a user navigate either with their nose, if they have spinal conditions, or with their eyes, if they have more limited mobility.

Users can combine facial navigation with various keywords and customise their applications with shortcut phrases. For example, saying “click”, “right click” and “double click” carries out those actions. Moving facial features by smiling, raising an eyebrow or opening the mouth can also perform those actions.

VR without the VR

MotionInput enables you to control your existing Windows games through movements and speech, either by mimicking your game control pad with your hands or by setting targets to hit in the space around you.

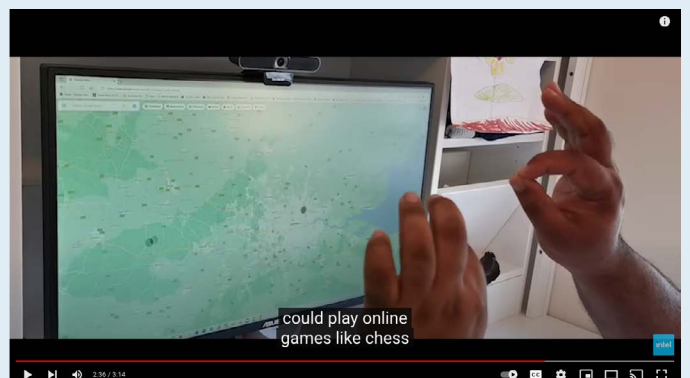
It puts you into the game. You can walk on the spot to make your game character move and your gestures in real life become actions in the game.

In-air keyboard and drawing

For industrial settings, the software will let you type on a virtual keyboard, or draw and annotate with digital inking and depth, in the air.

Live captioning, dictation and phrase shortcuts

Live captioning and call out phrases for keyboard shortcuts are available in any existing Windows applications and games. The phrases can be defined by the user.



Who is involved in the project?

Academic

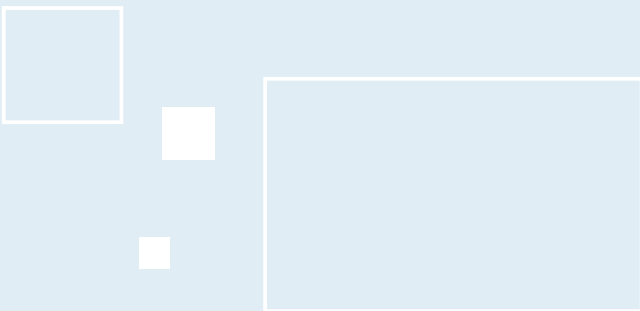
UCL MotionInput has the following project academics:

Prof Dean Mohamedally (Project Lead and Director)
 Prof Graham Roberts
 Sheena Visram
 Dr Atia Rafiq (honorary)
 Prof Joseph Connor (honorary)

Industry

Prof Lee Stott (Microsoft)
 Prof John McNamara (IBM)
 Prof Neil Sebire (NHS/GOSH DRIVE)
 Prof Costas Stylianou (Intel)
 Prof Phillippa Chick (Intel)
 Cathy Cummings (Intl. Alliance of ALS/MND Associations)

Senior directors, engineers, designers, and testers from Intel, IBM, Microsoft, Google and the NHS (including GOSH DRIVE) have participated in several years of development at various stages with the students, engaging them, enabling them to present their findings and giving them feedback to refine the solutions in the project.



UCL Students

UCL students, as part of the IXN programme:

Version 1 (Summer 2020)

- Lu Han
- Emil Almazov

Version 2 (Summer 2021)

- Ashild Kummen
- Ali Hassan
- Chenuka Ratwatte
- Guanlin Li
- Quianying Lu
- Robert Shaw
- Teodora Ganeva
- Yang Zou

Version 3 (Oct 2021-June 2022)

Version 3.0-3.02

- Sinead Tattan – Lead Student Project Architect (Final Year CS)
- Carmen Meinson – Lead Software Development Architect (Second Year CS)
- Aaisha Niraula
- Abinav Baskar
- Adi Bozzhanov
- Alexandros Theofanous
- Ali Amiri Souri
- Andrzej Szablewski
- Aryan Jani
- Aryan Nevgi
- Ben Threader
- Chris Zhang
- Clarissa Sandejas
- Daniel Rempel
- Eesha Irfan
- Eva Miah
- Fawziyah Hussain
- Felipe Jin Li
- James Zhong
- Jason Ho
- Jianxuan Cao
- Jiaying Huang
- Kaiwen Xue
- Karunya Selvaratnam
- Keyur Narotomo
- Kyujin Sim (Chris)
- Lama Alluwaymi
- Mari Takeuchi
- Michelle Chan
- Oluwaponmile Femi-Sunmaila
- Phoenix Sun
- Pun Kamthornthip
- Radu-Bogdan Priboi
- Rakshita Kumar
- Raquel Sofia Fernandes Silva
- Samuel Emilolorun
- Elyn See Kailin
- Siam Islam
- Sibghah Khan
- Sricharan Sanakkayala
- Thomas Langford
- Tianhao Chen
- Yadong(Adam) Liu
- Yan Tung Cheryl Lai
- Zemiao Huang

UCL Students



Versions 3.03-3.1 (June 2022-September 2022)

- Anelia Gardarzhieva (Lead Architect 3.1)
- Gincarlo Grasso
- Thomas Langford
- Jiahui Shi
- Vivek Vijay
- Elynor Kamil
- Version 3.11 Windows Store Build (December 2022)
- Alex Clarke (Lead Architect 3.11 In-Air Multitouch and 3.2 Facial Navigation)
- Joseph Marcillo-Coronado (Compiler and Windows Store Team Lead)
- Nerea Sainz De La Maza Melon (Compiler and Windows Store Team Lead 3.2)
- Anelia Gardarzhieva (Lead Teaching Assistant and MFC Base Code)

- Abriele Qudsi
- Chaitu Nookala

Version 3.2 Full Team (Sept 2022-April 2023)

- Anelia Gardarzhieva and Mohseen Hussain (Joint Lead Architects v3.2)
- Aaryaman Sharma
- Abdullah Ahmed
- Abdurrahmaan Ali
- Abid Ali
- Abriele Qudsi
- Adil Omar-Mufti
- Aishwarya Bandaru
- Ajay Mahendrakumaran
- Akram Ziane
- Alex Clarke
- Alexandra Irimia
- Amir Solanki
- Arvind Sethu
- Aryan Agarwal
- Baixu Chen
- Calin Hadarean
- Can Ertugrul

- Chaitu Nookala
- Chan Lee
- Chidinma Ezeji
- Chris Zhang
- Damian Ziaber
- David Nentwig
- Donghyun Lee
- Dongyeon Park
- Eloise Vriesman
- Fabian Bindley
- Filip Trhlik
- Filipp Kondrashov
- Gauri Desai
- Ghalia Alsayed
- Hadi Khan
- Harryn Oh
- Imaad Zaffar
- Jason Kim
- Jianheng Huo
- Jie Li
- Joseph Marcillo-Coronado
- Julia Xu
- Kaartik Nagarajan

- Liv Urwin
- Luis Rodrigues Vieira
- Luke Jackson
- Maria Toma
- Mateusz Krawczynski
- Minghui Cai
- Molly Zhu
- Nandini Chavda
- Nerea Sainz De La Maza Melon
- Peter Xu
- Pooja Chhaya
- Rebecca Conforti
- Robin Stewart
- Setareh Eskandari
- Taha Chowdhury
- Takuya Boehringer
- Tina Hou
- Vincent King
- Weiyi Zhang
- Yidan Zhu
- Youngwoo Jung
- Zhaoyan Dong
- Zineb Flahy

Case study: AI in Healthcare and NHS Wales

Prof Joseph Connor, CarefulAI & NHS Wales

Professor Joseph Connor, Chairman at CarefulAI, explains how the programme helps the NHS.

The work between CarefulAI, the NHS and IXN for the NHS primarily focuses on machine learning and AI. IXN for the NHS enables us to produce open-source systems, some of which have been featured in NHS publications or are used by GPs.

Most NHS staff have little understanding of machine learning, and the IXN for NHS programme provides healthcare workers with a simplified knowledge. Through data visualisation, the IXN for the NHS programme validates ethical machine learning and explains algorithms.

Many of the IXN projects have been adopted into Welsh NHS custom and practice. Some have been identified as Exemplars by the Bevan Commission. Others have been promoted as part of the NHS Adopt and Spread Programme, or are being delivered as a service to the NHS by Welsh Innovation Consortiums.

The projects are also rewarding for the students. Not only do they get to work with the latest technologies, but they have a large degree of ownership over the designs. Of course, mentors from the NHS, industry and academia are there to guide them.



The students are keen to use technology to do good. They want to make a difference to people's lives. Many have experienced the NHS first-hand and want to give back to the health system. Through our partnership with the NHS, we're proud that we're inspiring students to work in healthcare. We need people who want to innovate and build an NHS for the future.

If you want to discover how to transform your idea into a technology-driven product, I urge you to take part - you've got nothing to lose.



IXN project abstracts

These abstracts showcase the breadth and depth of our projects with the NHS and other healthcare providers. They run from 2015 to 2023 and were undertaken by undergraduate or master's students

The works in this abstract book are all first-generation proof of concepts and early R&D. They are each handed over to their respective clients for future curation and further development. For any repositories not currently accessible, contact those clients directly. Any that are already accessible will have their own IP notices.

2015-2016

Brain Marbles

Authors: Luke Roberts, Kamrul Islam Taiff

Partners: Professor Nilli Lavie and Jake Fairnie, UCL Faculty of Brain Sciences

Organisation: BrainFocus

Technologies used: Unity, Photoshop Image Manipulation, iTween, C#, SQLite, BCrypt

Abstract: Gaming has always been a controversial topic, and although reactions are changing: the medium still has a long way to go before it's entirely acceptable in our society. Parents are concerned about the adverse effects of video games, especially those such as 'first person shooters' depicting guns and violence.

However, a genre that very few people have issues with is 'brain training' games. These games usually consist of mini-games that test and train areas of the user's brain. The games claim to increase brain performance through regular use over some time. With the surge in smartphone technology in recent years, it's no surprise that game developers have recognised and jumped on the market of mobile brain training games. The convenience of having an app in your pocket that you can easily pick up and play for a small amount of time is used by current mobile game developers as an easy way to train your brain. However, after these 'brain training' games were tested, they did not affect brain performance. On the other hand, games such as 'first person shooters' that require the user to track objects evidently improve brain activity.

The issue here presents a problem due to the nature of first-person shooters advocating guns and violence; they're not suitable for many audiences, including children, the elderly, and people sensitive to violence.

Therefore, our task was to create a brain training game that was fun and used the same concepts around 'first person shooters' and perceptual load theory, so our users could improve brain performance.

UCL TB

Authors: Jay Jeyaruban, Pius Jude, Mihai Ionescu

Partners: Professor Nilli Lavie and Jake Fairnie, UCL Faculty of Brain Sciences

Organisation: UCL Faculty of Brain Sciences

Technologies used: Firebase, Ionic, Yeoman

Abstract: The aim was to develop an app for Android and iOS that UCL tuberculosis (TB) patients could use. The app should be able to provide users/patients with convenient and offline access to information regarding TB, clinical times, staff information and more. Offline access was essential to the clients as they felt it was a significant advantage over a simple web application to ensure patient confidence in using the readily accessible information.

Repository: <https://bitbucket.org/ucltb/ucltb/src/master>

YouTube: <https://www.YouTube.com/watch?v=rrcG-nchxQI>

Apollo: Clinical Research Tracker

Authors: Desislava Koleva, Christoph Ulshoef, Timur Kuzhagaliyev

Organisation: UCL School of Life Sciences and Medicine

Technologies used: PHP, TypeScript, MySQL, jQuery

Abstract: The Apollo web application is a database created for Colby Benari from UCL School of Life and Medical Sciences. The primary purpose of the database is to help Colby and her team efficiently manage information about clinical researchers without having to use proprietary formats like a Microsoft Access database. The Apollo web app is a tool to understand the clinical research trainee community at UCL better. Furthermore, there is an ambition to extend the Apollo web app further and make it accessible to other UK universities, providing a good picture of clinical research training on a national scale. The app has the potential to become very high profile within the entire tech academic community.

Repository: <https://github.com/thechrisu/Apollo-Clinical-Research-Tracker>

Overcoming Disordered Eating

Authors: Vu Ngoc Dung Luong, Alasdair Hall

Partners: Theresa Lash, David Sandy

Technologies used: Ionic, Angular, ngCordova

Abstract: Our client told us about self-monitoring and the benefits it provides; however, it does have its drawbacks. For example, when recording meals on a paper record, if the user is out and has forgotten to take their sheet with them, they can't record their meal until

they get back home, by which time they may have forgotten about it. Theresa's idea was for us to create a cross-platform smartphone app that patients could use as an electronic equivalent to the self-monitoring sheets. A smartphone app is an excellent platform for such a system because sufferers of eating disorders tend to be mainly between the ages of 14 to 25, and most 14 to 25-year-olds will likely have a smartphone with them at all times. We would need to create an app that would run on Android, iOS, and, if possible, Windows to provide the system to cater for the most significant proportion of those suffering from eating disorders. Given the time we had available to create the app, we thought it would be inappropriate to try and create native versions of the app for each of these platforms. We would have to find a framework that would allow us to create one version of the application which could be ported to all of these platforms.

Stem Cell Lab

Authors: Christopher Hammond, Matthew Police, Minh Kim

Organisation: UCL Institute of Neurology

Technologies used: Unity, HockeyApp

Abstract: We have been working with the UCL Institute of Neurology's researchers who specialise in neural stem cells. One of their primary research aims is to convert normal skin cells (easily obtained by a simple biopsy) into stem cells. They can then 'reprogram' these stem cells by implanting specific genes into them so they grow and divide into neural cells like the ones in the brain. Long-term goals for the institute include understanding how ageing works so that these cells can be chemically (and reliably) fast-forwarded to the state that they would be in, for example, a 70-year-old person. From this, they could conduct experiments to understand how conditions such as Alzheimer's might be cured or slowed down.

The neurology department was interested in our support because there is insufficient public interest in or understanding of this ground-breaking research. They have asked us to create a free, accessible and multi-platform game that simulates their day-to-day work. We called this game Stem Cell Lab, and it simulates the process from when a research target is asked to sign a biopsy consent form to when useful neural cells are created. It is built in Unity and is, therefore, inherently cross-platform.

EMOS V2**Authors:** Pranav Nashikkar, Jas Semrl**Partners:** Mr M. Codispoti**Organisation:** Papworth Hospital NHS Foundation Trust**Technologies used:** Bootstrap, Angular, Firebase

Abstract: While undergoing training, surgeons must observe and practice a variety of specialised techniques. They must not miss any details, and this process is usually done by learning the surgery and observing a professional surgeon undertake the procedure. A paper-based solution is the chosen method in current use, with extensive manuals of techniques, only a few of which may be relevant to each day's work. Consequently, trainee surgeons have to worry about making specific notes about the task, which may be inconvenient to match up to the correct article.

It is a burden to carry around lots of work and time-consuming searching to find the relevant parts and organise it. Our application intends to alleviate these issues by having an extensive repository of surgical techniques available for surgeons to study at any time, as well as offering convenient note-taking and collation techniques such as bookmarking so that each surgeon may adapt the tool to be personalised for their needs. Thus, helping streamline the learning process and reduce wasted time and effort in dealing with large amounts of specialised information. Our task was to build upon the existing work done in version one of the projects and to offer a complete and more valuable functionality so that the application will be convenient enough to use regularly.

Spoken Everywhere**Authors:** Maya Afshar, Megan Lucas**Partners:** Dr Atia Rafiq**Organisation:** NHS**Technologies used:** Apache Cordova, HTML, CSS, JavaScript

Abstract: Our vision was to create an application that healthcare professionals could use on iOS and Android devices as well as web browsers. The application must be completely cross-platform. The design would be simple and clean, making it easy to use for everyone. The application would use different APIs to give the user access to thousands of books using the search bar and secondly, an API that converts text to speech for the user to listen to the content. Dr Rafiq emphasised the value of the application's ability to help those learning to read. So, during the audio, the application needed to highlight the words in the text. Also, the need for seamless transitions between platforms meant that the application could store virtual bookmarks. So, the application would also have a page where the user could continue reading where

they left off. Although our client would prefer using the application for visually impaired people, it raised the issue that creating a different kind of user interface is necessary, so they were able to use it. We would have also needed to research how visually impaired users use applications on their devices. We discussed this new found problem with Aisling Okane and our client and agreed that it was impossible to do it within the time we had for the project.

Repository: <https://github.com/lespetitefilles/SpokenEverywhere>**Pathways****Authors:** George Pirlea, Shivam Shah**Partners:** Saira Chowdhury, Sarah Payne, Alan Fish, Peter Coates**Organisation:** NHS Open Source England/Guys' and St Thomas's Hospital**Technologies used:** Ruby on Rails, Bootstrap, JavaScript, jQuery

Abstract: Pathways is a web application that aims to make it easier for patients to access information regarding their treatment history, help them make informed decisions about available treatment options, develop their understanding of their medical condition and reduce their anxiety and confusion about the future. At Guy's and St Thomas' Trust, clinicians would often pass patients information meant to assist their decision making in the form of photocopied handouts. The problem with this system, as the trust discovered, is that clinicians would sometimes not have the required documents on hand, and even when they did, patients would very often misplace the handouts they received. The result? Patients were not informed well enough, resulting in stress and confusion for the patient and low satisfaction scores for the trust. Pathways is supposed to solve this problem. For a patient, it is a simple and intuitive way to access and navigate their treatment history and related documentation – in a secure fashion. For a doctor or nurse, it is a communication tool

APPetite**Authors:** Cesar Ferradas, Hai Xia**Partner:** Saira Chowdhury, Sarah Payne, Alan Fish, Peter Coates**Organisation:** NHS Open Source England/Guys' and St Thomas's Hospital

Technologies used: APPetite is a Web Application that records patient data, namely food and fluid intake, symptoms and weight, and displays these in various ways, making monitoring progress very user-friendly. The NHS commissioned this app to specifically target cancer patients undergoing chemotherapy to allow doctors and clinicians easy access and thus enable an analysis of the

patient's weight according to the food and fluids they are consuming. There have been two previous developers who have worked on APPetite. The first of these came up with an 80,000-line single file Java program which was challenging to understand, maintain and improve. The latter were UCL master students from 2015. They took ideas from the first project, completely rewrote the program in AngularJS, and condensed the source code into 5,000 modular and easily manageable code lines. As we understood at the beginning of our project, APPetite was not functional. Thus, our main task was to produce a functioning version of APPetite, and if possible, to improve on some features.

Drug chart

Authors: Edward Obree, Hirsh Jaykrishnan Pithadia, Fanos Zavrosx

Organisation: UCL Medical School

Technologies used: HTML, CSS, SQL, Apache Cordova

Abstract: An application that will allow medical students to practice drug prescriptions. To enable students to practice more on this skill, UCL Medical Sciences requires an application to fill in 'Drug Charts'. The content for the application is ideally composed of two sections. The first section is the fictional medical case itself, setting the scene for the basis on which the questions are asked. It includes the background of the patient and any supporting medical data that may allow the user to diagnose their exact condition and provide a prescription. The second section comprises the actual drug charts to be filled out by the user based on the case and the question asked. The drug charts have a standardised format, industry-wide, that the application needs to conform to.

TB Detection Application

Authors: David Kelly, David Hanson, Simon Grice

Organisation: UCL TB

Technologies used: HTML, CSS, JavaScript, Python, Ionic

Abstract: Despite a well-established battery of effective drugs, tuberculosis (TB) remains common, especially in dense urban areas. Presently, the diagnosis of latent TB is due to using either the Mantoux test or the Igra test. The administration of both is through the medium of an injection. However, the interpretation of the results need to be after a certain period has elapsed. The basis of the interpretation is on measurement, a questionnaire, experience, and a paper reference, the NICE guidelines. This process is slow and does not allow for the batch diagnosis of patients. There is a need for an application that accelerates and improves the current Mantoux test administration, freeing the clinician from complex

calculations and significantly improving workflow. Such an application would also reduce the role of experience in the diagnosis process, an experience that would not be present in many junior doctors. The client envisages an application that a clinician can use in school or other environments where mass screening occurs. In such an environment, an app must be quick, easy to use, and accurate. It must provide all the information with the clinician needs but do so in a way that does not seem threatening or scary to the testee, potentially a young child. It must be available for use offline or in areas where internet access is unreliable or problematic.

Psybase

Authors: Chun-Wei Hsu, David Wiesenfeld, Jack Zamattio

Organisation: Faculty of Brain Sciences, UCL

Technologies used: Google Cloud SQL, Ionic, Google App Engine

Abstract: The design of the Psybase app is to help clinical and research psychiatrist's look up psychiatric assessment scales and to be a repository for a large set of scales. Over time, the creation of a plethora of psychiatric assessment scales has taken place. All have come about via academic research – typically a researcher writes a scale, tests it and reports the results. Different scales have different focuses. Some may focus on depression in the general population; some may focus on depression in a specific population, and some may focus on rare conditions or be completely different approaches to assessing common conditions. Some of these scales become 'standards', and are generally well known and well documented, while others are more obscure and less used. Psychiatrists are generally free to choose an assessment scale that they feel will give insight into a particular patient's condition, so it is not uncommon, according to our client Dr Bell, to come across a patient whose chart shows a score on a scale that the reader of the chart does not know or does not remember. In these cases, the reader would have to find some documentation or a copy of the original journal article to find out about the scale in question and, in particular, how to interpret the score in the patient's chart. The design of the Psybase system is to help the psychiatrists find details about the scales in this sort of situation. Additionally, it becomes possible to use the database in other ways by putting together an extensive database of scales and their components. A psychiatrist could use the database to find scales for a particular condition one of their patients has without conducting extensive research. Or a researcher could quickly find a set of scales for a specific condition, say bipolar disorder, to compare against each other.

Cognitive Bias App V1

Authors: Clarice Hilton, Jeffrey Yong, Benjamin Kremer

Organisation: Faculty of Brain Sciences, UCL

Technologies used: JavaScript, Redux, React, Apache Cordova

Abstract: The CBM App project focuses on developing a mobile solution for controlled experiments in cognitive bias modification for the UCL Neuroscience Department. cognitive behavioural modification (CBM) exercises aim to change perception and reaction to different stimuli by using training techniques. These techniques have proven to change the emotional state and perception of situations by the subjects. The CBM app will be used for research into the effectiveness of these exercises for students with anxiety. For previous research projects, the client has used a 'pen and paper' method. The exercises consist of the subject reading a scenario, followed by a word fragment that has letters missing (for example, w_ll rec_ived). The app provides the subject with a matching number of input fields below the word fragment, which the user must fill to solve the scenario puzzle. Afterwards, the app asks the user a follow-up question to which the user answers 'yes' or 'no'. Each training session consists of multiple exercises; the subject should do these sessions regularly for at least four weeks. Research into the effectiveness of these exercises has concluded that many subjects do not complete the four weeks of training. Researchers believe this is because the exercises tend to be repetitive and unstimulating. By not completing the training exercises, subjects forgo the full potential effects, nullifying the study. Many psychologists believe that it is possible to overcome such barriers by moving training to applications and 'gamifying' said exercises (Boendermaker, Pier and Reinout, 2015). The UCL Behavioural Institute of Neuroscience attempts to test this hypothesis by transferring their training exercises, commonly used to tackle anxiety, into an accessible digital format. The set goals of the project were to migrate the exercises to a digital format while maintaining the simplicity of the training and gamifying the process of partaking in the experiment to make the daily exercises more compelling. The critical challenges specified by the client are twofold. Firstly, to translate the current pen and paper format of the experiment's exercises into an accessible digital format, which matches the pen and paper medium's simplicity of use. Secondly, to make the sessions more engaging by 'gamifying' the exercises.

MyCareMaker

Authors: Edward A. Mothershaw, Andreas Stamatari, Asier Gutierrez Buruchaga

Organisation: OPM

Technologies used: Apache Cordova, Ionic

Abstract: MyCareMaker is a mobile device application developed for people with disabilities to better help organise their care. With features including an expenses logger, events creation with reminders, medication logging and reminders and the ability to save a quick dial list of friends and family and urgent care numbers such as an emergency carer. The creation of events adds to the phone's native calendar, and the application may add the quick dial contacts from the directory of the mobile device. The application's design and writing use the Ionic, AngularJS and Cordova frameworks that employ a 'write once, run anywhere' approach. The application languages used were the basic front end website development family; JavaScript, HTML5 and CSS. A primary focus of this application was to make it accessible to people with disabilities. This aim drove the application's design to have bright, bold and contrasting colours and a large font size. Due to the Cordova plug-ins used in this project, the application will only compile and run correctly on Android and iOS.

2016-2017

M2R Meditate to Regenerate

Authors: Johannes Landgrafa, Marcus Wallbauma, Sujun Wang

Organisation: UCL Institute of Health Informatics

Technologies used: GraphView, WaveView, SQLite

Abstract: In a society continuously increasing in complexity and speed, the quest to find inner peace is growing. Meditation as a concept can provide the required mindfulness. It has numerous physical and mental benefits promoted by our client Meditate to Regenerate in workshops for young people, mainly in the Arabic world. We sought to develop a mobile application providing a solid UX and increasing the 'meditation retention' of former workshop participants and new meditators. We decided to develop an Android native application based on Java and XML based on a detailed client requirement list and holistic background research. Our technology stack comprised, among other things, Android Studio as an IDE and Git as a version control tool. By applying object-oriented design patterns and focusing on visually attractive functionality implementations, we developed an app that fulfils all client requirements and implements extra features such as a rotatable mood wheel, an animated audio wave, and an enhanced progress section. The application encourages everybody to continue or learn about meditation with guided audio and video files. After an intense testing period, it will be available to download in the Google Play Store. The following report outlines our line of thought throughout the development process and explains the rationale behind our decision-making process.

YouTube: <https://www.YouTube.com/watch?v=KmEZQombiVY&feature=youtu.be>

Blood Sugar Monitoring App

Authors: Katherine Adham, Mabroor Ahmed, Titaporn Janjumsang

Partners: Dr Fu

Organisation: UCLH

Technologies used: Ionic, Cordova, Firebase, Chart.js

Abstract: Dr Patrick Riley from the University College London Hospital is developing an inflatable finger cuff that uses oximeter pulse detection at the fingertip instead of auditory pulse detection widely used in measuring blood pressure (BP). He wanted to develop an app that would send readings from the device directly to a smartphone. However, the device is still in the prototype phase and needs comparison to conventional BP devices to determine its accuracy. The desired app then changed to a cross-platform app that would allow users to manually input their BP readings and visually compare them based on the monitoring device and the medications they are taking.

We carried out the project over three months. The design phase of the app involved conducting user research through questionnaires. This research determined who a typical app user may be and what features they would want from a blood pressure monitoring app. We used these needs, combined with Dr Riley's requirements, to design the app and determine its functionalities. Developing the app also involved researching various cross-platform mobile technologies and tools.

We built the app using an Ionic framework with AngularJS. Medication, blood pressure readings and other user input were stored in a Firebase database. Dr Patrick Riley was pleased with this iteration of the app. Improvements on the app for the future include statistics reporting and further input validation.

Thyroid Test App

Authors: Brian Ho, Miguel Marin, Leo Edwards

Partners: Emily MacDonald

Organisation: Code4health

Technologies used: Ionic, Cordova, TypeScript, Firebase

Abstract: We made a mobile device application developed for people who are anxious about blood tests and what they mean for their health. Features include a reminder to collect results, informative pages and reassuring videos from a GP, and the ability to keep track of previous tests you may have had. We designed and wrote the application using the Ionic, Angular.js and Cordova frameworks that employ a cross-platform development approach. The application languages used were the basic front-end website development family; JavaScript, HTML5 and CSS.

The solution developed is a concept app that meets the above requirements, and we implemented the app to be built upon easily.

Kidney Stone Clinic App

Authors: Ayrand Cruz, Ping Ren, Gun-Woo Nam

Partners: Dr Shabbir Moochhala

Organisation: UCL Centre for Nephrology

Technologies used: Ionic, Cordova, Firebase, Balsamiq, Justinmind

Abstract: Our client, Doctor Shabbir Moochhala, a consultant at the Royal Free Hospital, asked us to create an app that would ultimately improve how the kidney stone clinic could treat its patients and prevent them from contracting more kidney stones. Healthcare professionals would use the app to enable patients to give their doctor's a detailed record of their dietary intake over 24 hours.

The app would require functionalities that allow the patients to search a database for the food they have consumed, specify the quantity, add this to their log, and send the information to be accessed by the doctor. The integration

of the data into the hospital's patient database then takes place. A secondary function would allow the patients to record any stone events they may suffer when away from the hospital.

We worked on the task as a team by breaking down the work into tasks that we could give to each group member to complete. We began designing the user interface (UI), implementing a backend, and finally testing the apps with our client and the clinic's patients.

Overall, we achieved the main requirement of the app, which was the collection of the patient's dietary intake. Although some aspects need further development, our app shows excellent potential. It could improve patient care for kidney stone clinic patients, but healthcare professionals could apply the app to other clinics in the hospital.

Intention Journal

Authors: Jarrod Joshua Sherri Lee Yehia El Gendi

Organisation: KCL Dentistry

Technologies used: Xamarin, SQLite, NuGet

Abstract: The Intention Journal is a cross-platform mobile application to motivate users to improve their wellbeing and happiness by appreciating the things in their lives.

A hybrid of a traditional journal app and a mindfulness app, the Intention Journal allows users to make journal entries associated with particular moods, like joy, gratitude, creativity, etc. Users can also attach photographs to these entries, stored in a database and for later viewing or editing. The app has a progress tracker in the form of a tree, which grows every time a user makes an entry. This tree can be viewed in a tab within the app and will allow users to track their progress and encourage them to keep using the app and working towards their personal goals. By getting users to reflect on the positive things in their lives, the app enables them to seek out more positivity in the world in simple, daily living.

The design and development of this app took place in two primary stages: the design and prototyping phase in the first five weeks of the first term, and technical development, which took place in the second half of term and over the Christmas holidays. During the design and development phase, we met with our client to confirm the functional and non-functional requirements of the app. We went through several design iterations, eventually settling on a final prototype for the client and our human-computer interaction (HCI) TA. In the technical phase, we started researching frameworks and libraries we could use to implement our app. We discussed the app functionalities further with our client and reached a common understanding about the importance of each feature (must-have, should-have and could-have functionalities). We decided to use the Xamarin framework to develop the app for both iOS and Android devices. For data storage, we implemented a local database using SQLite. We also did further research on

how to implement key and should-have functionalities using our chosen framework. Towards the end of this phase, we finalised the look and feel of the app, which involved creating images, icons and custom renderers and getting the contents of the app (especially the tree) to display appropriately on several devices. We created multiple icon sizes to conform to both iOS and Android HCI guidelines.

We have successfully developed a functioning cross-platform mobile app that can be successfully deployed to and run on several Android and iOS devices. All key functionalities, namely adding, editing and viewing past entries with associated pictures and categories, and creating a settings menu, have been implemented. We have also implemented approximately half of the should-have functionalities, such as a progress tracker in the form of a tree, displaying random quotes on the home screen and allowing users to add their custom quotes to the app and add photos to their entries.

Patient and Treatment Management Platform

Authors: Laurence Tennant, Geraint Ballinger, Lucas Valtl

Organisation: Royal Free Hospital

Abstract: Asclepius is a web-based patient and treatment management application created for the Royal Free Hospital in London. The app development was by Laurence Tennant, Geraint Ballinger and Lucas Valtl in close cooperation with the client representing the Royal Free Hospital, Dr Douglas Macdonald. The unnecessary plethora of inferior IT systems and immense new Hepatitis C treatment capabilities prompted Dr Macdonald to approach the team to replace the current treatment management infrastructure. This process consisted of several legacy applications and a Microsoft Access database, with a single, unified web application. This application is on par with today's web development standards.

The app's focus is on efficiently guiding patients through a Hepatitis C treatment via a web interface. Requested features included:

- the input and altering of patient data
- movement of patients through the treatment process
- list views of all patients on specific steps of the process

We created a web app based on the popular MEAN framework, connected to a SQL database entirely conceptualised and implemented by the team. Further, the front-end design was per the prototype developed in the human computer interaction part of the Apps Design Course.

The scale of the project in combination with the minimal time provided made the successful completion of the task difficult. However, even with these challenges, the team delivered a working version of the app that fulfils all 'must have' and 'should have' requirements agreed upon by the client. Hence the project can be considered a success.

Given that apps that run on the NHS network need to go through a unique approval process, further work is necessary to deploy the project successfully,

Neuro Response Patient Portal: Database

Authors: Stanley Mwangi, Aleksei Rozhnov, Ryo Mochizuki

Partners: Dr Delmiro Fernandez-Reyes, Bernadette Porter

Organisation: NHS England; NHS Digital; Janssen Pharmaceuticals

Technologies used: Django, PostgreSQL, Heroku

Abstract: In medical facilities, it is necessary to register and record patients' data to give them the correct treatment and help with their symptoms. The Neuro Response department of UCLH has required us to create a database system specifically for patients who have multiple sclerosis. In developing our project, we cooperated with two other teams, team 25 and team 46. The system consists of the web application, the mobile application and the patient database. The two teams we worked with have developed the web interface for the clinicians and the mobile app for patients, and we have developed the database, which is the backend part of the system.

The database stores the patients' data, such as demographic information, medical history, carer info etc., which the clinician enters during the first meeting with a patient. The important information is only accessible by healthcare workers who have authentication. The patients can also register with the mobile application to obtain information about their current treatment and report their symptoms. Their healthcare workers can view the patients' reports at any point.

UCLH Peach Reality

Authors: Yvette Pinder, Immanuel Baskaran, Justin Yung

Organisation: NHS

Technologies used: React, React Storage, Bootstrap

Abstract: For our project, we have been working with a second-year student, Tim, who has been working on a project converting CT images of kidneys into holograms. The converter's design and use aid surgeons and consultants to view a virtual image of a patient's kidney through a HoloLens. The aim is that this will help them to make surgical and diagnosis decisions. His application allows the user to add annotations to the virtual images. The user needs to upload the CT images and other file formats, such as PDF files, to the application. Additionally, the application will work with confidential data, and therefore access to the data must be restricted.

Our job was to create the web application part of the project that would fulfil these requirements. To go about our solution, we used React js with CSS and HTML. The web application allows the user to upload CT images to be converted and other file formats such as PDF to

upload notes. The application makes the user create an account and log in to view individual patient cases to restrict access. It has a model viewer to view the virtual image of the patient's kidney and additional pages such as documentation and FAQ pages.

Metabolic App

Authors: Kiran Gopinathan, Yihang Li, Ivaylo Stefanov

Partners: Dr JS Bamrah, Dr Desai, Tina Annus

Organisation: NHS England; NHS Digital; Janssen Pharmaceuticals

Technologies used: Ionic, Django, TypeScript

Abstract: It is evident that patients diagnosed with mental illnesses have shorter lifespans than the general population. There is evidence to suggest that a primary cause of this phenomenon is depression. Furthermore, records show that drugs prescribed to combat psychotic symptoms correlate with weight gain, cardiac abnormalities, and sudden death. There is a need for increased support for these patients.

The design of the Metabolic App is to empower patients diagnosed with schizophrenia to take ownership of their healthcare. It does this by providing a system through which clinicians can securely send test results to their patients. The patients can then use the application to set reminders for their subsequent test screenings and view infographics of their past test results to help them keep on track.

Over the course of this project, we developed a system satisfying these requirements. The system consists of a multiplatform application targeted to patients and a website for clinicians. This system supports functionalities such as securely connecting patients to their specific clinician and securely handling and organising sensitive patient test results.

Pharmacist Interventions

Authors: Noa Luthi, Radu Bors Filimon, Fazaan Hassan

Organisation: NHS

Technologies used: Ionic

Abstract: When errors in a medical prescription occur, a pharmacist must complete a contribution record. The generation of records is by hand. But the NHS pharmacists needed a faster and more efficient solution than the outdated paper forms. To meet this need, we created an app that stores every contribution made in a database. The data can be accessed, searched and retrieved using keywords. This idea is to provide a more efficient recording method that also allows for better retrieval and analysis.

We were assigned to build this app by the department of computer science. At first, we got to know the team and established rules for each team member before meeting with the client. We met with the client via Skype and discussed the product and the requirements for the app.

We did the MoSCow diagram, which helped us to keep track of the progress. We made a use case and a class diagram to highlight how the app intends to work fully. Then we started to research similar apps and different technologies for building the app. After we completed the application, we uploaded it to our phones and debugged it.

Hand Hygiene Audit Tool

Authors: Ana-Maria Belciug, Eric Chamoun, Ng Zheng Onn

Organisation: NHS

Technologies used: Ionic, TypeScript

Abstract: The data collection of the handwashing and bare below elbow (BBE) audits within the organisation is currently a paper-based process. This process encompasses the number of handwashing opportunities taken by individuals, healthcare professionals, ward location, and capturing the percentage of staff compliant vs non-compliant. This approach has some significant drawbacks for the hospital. This is currently a timely process for nursing and administrative staff throughout the organisation. This audit takes place monthly. The audit aims to allow members of staff to identify where issues occur and to address them to ensure the individual receives appropriate feedback to drive improved practice.

Our solution is an application that captures such audit information through the user's input of data and displays the compliance rate using charts. The app itself was built upon the Ionic framework, using JavaScript, HTML and CSS languages. This framework allowed the team to conveniently create a cross-platform app boasting a minimalistic design.

As a result, we have successfully developed a functioning app that can be successfully deployed and run on iOS devices, mainly an iPad. The implementation of all critical functionalities, namely adding, editing, and viewing audit information, occurred. The app can display the compliance percentage of a particular ward in the form of a line chart using the Chart.js library.

Paracetamol Overdose Pathway Application

Authors: Marton Takacs, Anton Hristov, Irina Popi

Partners: John Salter

Organisation: NHS

Technologies used: jQuery, AJAX, Bootstrap, Laravel, Microsoft Azure

Abstract: Automation in the healthcare system has drastically increased in the past few years, and the treatments area is by no means an exception. Determining if a patient has experienced a paracetamol overdose and, if he did, estimating the optimal medication dosage requires many calculations that currently have to be done manually by doctors. As a result, a system automatically determines if a patient needs treatment and calculates the appropriate

treatments in high demand. The main aim of our project was thus to design and create a web application satisfying the requirements stated above, using the openEHR data model. We split the development into two phases: firstly, designing the system and, secondly, implementing it. We commenced the designing phase by identifying the requirements and worked alongside the client to create a prototype. The implementation phase involved developing the prototype design and constructing a PHP API that communicates with an openEHR server. The leading technologies used for the front-end were HTML, CSS and JavaScript, focusing primarily on the JQuery library. Furthermore, openEHR would enable our application to store, manage and retrieve electronic health records (EHRs).

CAHMS

Authors: Francesco Benintende, Dennis He

Partners: Charlotte Mitchell

Organisation: Royal Bolton Hospital

Technologies used: Ionic, TypeScript, HTML, CSS

Abstract: Hope not Harm is a cross-platform tablet application created for the Royal Bolton Hospital NHS. Francesco Benintende and Dennis He developed the application in collaboration with the clients representing the Royal Bolton Hospital NHS, Dr Mark Bowers and Charlotte Mitchell. The client reached out to our team to improve mental health treatment with a simple but effective tablet application.

The app focuses on being a guide to help clinicians assist young people during CAHMS (child and adolescent mental health services) sessions and send valuable contacts or feedback about the appointment to the patient, his family or another clinician. The application structure is a workbook with several pages containing questions and exercises to help the patient practice overcoming insecurities and coping with self-harm.

We have successfully developed a functioning cross-platform application for iOS iPad and Android tablets that meets all the functionalities and requirements requested by the client. Furthermore, the application displays correctly in every device, opens links in the stock operative system browser, and integrates the share functionality flawlessly.

Rubin App

Authors: Anton Bogdan Cristian, Dakov Nikolay, Istrate Vlad Andrei

Organisation: Medical Physics and Biomedical Engineering UCL

Technologies used: Java, C#, android-crop, Microsoft Azure, SQL

Abstract: The project is to create an app to aid parents in checking their newly born children for jaundice, a disease

that can appear a short time after birth. The app will provide an excellent aid for parents, enabling the computerised checking of this condition before seeking further medical attention in the case of a positive result.

This app makes the process much easier, as the family will not need to unnecessarily go to a hospital if the child's condition is not severe.

The application uses an eye recognition algorithm to cross-reference the picture of the baby with a database containing both healthy and disease-prone eye figures. In the initial phase of the app, this database will be created by asking each user whether they agree to use their picture for medical purposes. In this phase, the app will consist of a 'baby's eye recognition game' to collect enough pictures for the algorithm to have relevant accuracy. In the final phase, the app will add the proper jaundice recognition functionality.

The project aims to implement the first phase of the app, namely the functionalities related to taking a picture, sending this to a database, showing the relevant information to the user and defining an appropriate interface.

Radio Log

Authors: Xiaohan Shen, Sergio Hernandez, Dhen Padilla

Organisation: NHS Foundation Trust

Technologies used: Swift, Xcode

Abstract: People who want to be an interventional radiologist need to have a specialist training in the NHS for eight years after university. And during training, they are expected to record their procedures.

Our RCR/BSIR logbook is an iOS app that enables radiologist trainees to record their daily procedures for demonstrating their experience or record interesting events and lessons they have encountered.

During the first phase of this project, our team began to design the UI and functionalities of the app by identifying the client's requirements. And for the second phase, the team developed the app referring to the client's needs.

We have successfully developed a functioning iOS app that provides the trainee with a structured recording of their procedures and lessons by adding new cases with text, pictures, and external resources such as websites, searching through existing cases, reviewing cases, and exporting cases. The app can use an iCloud server to transfer data and is also able to export all the cases into a CVS file and send it by email.

Healthcare Outcome Measures Database

Authors: Samin Torabi, Ronglong Ke

Organisation: Northumbria Healthcare

Technologies used: HTML, CSS, PHP, SQL

Abstract: The project is a user-friendly web-based application created for Northumbria healthcare (NHS), aiming to give the users the ability to input patients' information, answer sets of questionnaires based on patients' operations, and store all these data in the database that operates on the client's server. Also, the clients would be able to export all the data stored in the database.

Samin Torabi and Ronglong Ke developed the application in co-operation with the Northumbria clients, Dr Mike Reed and Dr Anji Kingman.

The app focuses on the questionnaires that should be answered by the patients. For one specific operation, the completion of several related questionnaires is necessary. The questions must be answered both before and after their operation and once more after a period. We used HTML and CSS for the front-end development of the website to fulfil the requirements. The connection is in place between the PHP and SQL database that the team members completed.

The project was intricate, and the time we had was minimal, but the team was able to complete all the requirements and all 'must have' and the 'should have' requirements agreed upon by the clients.

Young Carers App

Authors: Lucy Walsh, Chaojie Ling

Partners: Rachel Forbister, Marc Rice, Nick Ainslee, Chris Branson

Organisation: NHS; Sunderland Carers Centre

Technologies used: Android Studio, Java, C#, SQLite

Abstract: The Young Carers App is an Android application created for young carers at the Sunderland Carers Centre. A young carer is a young person aged between 5 – 25 who has caring responsibilities for a family member, friend, neighbour or another person in their lives. The app's purpose is to provide another support system outside of family, friends and the carers centre for when these networks may not be available. Our solution is an app that provides essential information about being a young carer, including information about coping mechanisms, contacts at the carers centre for emergency help and advice, and information for parents and guardians about how they can support young carers and what the centre provides for them. The app also contains vlogs from other young carers, so young people can share their stories and experiences to help others in the same situation. It includes:

- recipes and cooking tips appropriate for young people with limited time, money and resources
- game suggestions to relax and alleviate panic symptoms
- extra info on fun places to go and free things that young carers can access
- and account logins to access a custom calendar and a profile area.

It is a multi-functional application that provides many different features to support and improve a young carer's day-to-day life.

We worked closely with four clients from the NHS and the Sunderland Young Carers Centre and valued having the input of several different professionals with different areas of expertise. Two of our clients were based at the Sunderland Young Carers Centre to pass on requirements, design ideas and feedback from the young carers themselves, which was invaluable as we always had the group of

carers at the forefront of the development process. We consistently received positive feedback from the design stages through to the prototype and final product stages. The completed app is a fully functional application ready for publication and use by young carers. The main obstacle that we had to overcome was our lack of experience in project development, but we completed all of the possible 'must have' and 'should have' project requirements. The only few that we failed to deliver on were down to technical problems with the Sunderland Carers' website and technical limitations due to the app not being published on the app store yet. We also were able to complete several of the 'could have' app requirements, extending its functionality and usefulness to the young carers.

Dental Emergency

Authors: Becky Zhang, Tomasz Czernuszenko

Organisation: NHS

Technologies used: JSON, UXPin

Abstract: Dentists must be familiar with emergency procedures specific to their profession as they are responsible for their patients' safety. However, due to insufficient training, there's a need for a tool to help dentists revise what they are supposed to do in such difficult situations.

That's where emergency comes in handy: by processing lengthy medical articles into digestible chunks and displaying them in a simple, appealing app, we hope to enable dentists (and longer-term also doctors from other professions and ordinary citizens) to access extensive and reliable information right in their pockets.

We have delivered two native apps, for Android and iOS, that serve precisely this purpose: to enable dentists to access quick information in case of an emergency and memorise the material better with the help of a quiz.

Everything in Place

Authors: Tom Collyer, Cavan Black, Abdur Rejah

Organisation: NHS

Technologies used: Ionic, Java, HTML, CSS

Abstract: The task presented to team 21 was producing an application for patients of the NHS approaching their deaths. The NHS has a programme whereby they take these patients

in groups and fill out booklets revolving around all the critical areas that require attention should the patients pass away. For example, how they wish to be remembered, their funeral plans and many more.

The team in NHS Sunderland spent a long time developing this booklet, collecting lots of different information and using many various resources. The team wanted a way to spread this information to the masses. This reason is why they opted for a mobile application.

The client approached our team to take this process and convert it into a digital format, making it easier, more intuitive, and more accessible for these patients. Our solution was to implement a web-based application, which contains video tutorials and printable PDF versions of the user's booklet.

OpenOdonto FP17 Data Collection Web-based Application

Authors: Elvinia Cui, Kenneth Forbes, Lay Othniel Adeosun

Organisation: OpenOdonto

Technologies used: HTML, CSS, JavaScript, Angular, Bootstrap, jQuery, PHP, MySQL

Abstract: Odonto FP17 is a web-based application designed for dental clinics to collect patients' dental activity electronically based on the inputs of the FP17 and FP17O forms. According to the NHS, around three million forms are being processed each month in the UK. Though there is similar software in place, according to our research, a minority of dental clinics are still using mail and paper to send completed forms, as the cost of these electronic systems are all privatised and costly. Another problem also relates to the long processing time involving forms sent by mail and paper due to errors and mail time. As such, to help dental clinics, we've developed an open source web application, the Odonto FP17, to provide dental clinics with a platform to collect and send data electronically to the NHSBSA. By doing so, dental clinics would not have to spend exorbitantly on software while simultaneously accurately and efficiently send data. Providers submit forms (FP17) to the system detailing dental activity data. The data recorded on the FP17 shows the patient charge collected, the number of units of activity performed, and treatment banding information, which is then sent to the database and eventually the NHSBSA, where they would be processed.

Overall, our project successfully developed a web application conforming to all the primary requirements and the specifications of how the FP17 forms should be processed. For instance, using PHP and Angular.js, we can provide server-side, and client-side validation (respectively) such that the user will always enter required inputs or users will not be able to submit forms. This reduces inefficient processes like human errors or the bouncing of form from the NHSBSA to the provider required to make these minor changes. As specified by the NHSBSA, only handwritten signatures recorded digitally in real-time are allowed, and typing does not conform to a signature.

As such, using a JavaScript called Signature-pad.js, we've successfully developed a feature where users can sign operating devices like a touchscreen or using the cursor on the web. Last, but not least, we've added guidelines to accommodate and guide our users using the application. These help users to make sure they fill out the correct detail and thus claim a valid claim. This app will be especially beneficial if users are of an extreme of which they may not have the necessary documents or cannot process how and what should be in the forms.

UCLH E-Consent form

Authors: Nathan Djanogly, Will Guerrin-Ciccone, Vijeykannen Vijayaratnam

Organisation: UCLH

Technologies used: HTML, CSS, PHP, MySQL, Microsoft Azure

Abstract: Our team is developing a web application as part of University College Hospital's (UCLH) Platform for Enhanced Analytics and Computational Healthcare (PEACH) initiative. The consent collection for surgical procedures is currently via physical consent forms, which are cumbersome to store and susceptible to loss and damage. Our application will collect and store consent in digital form, circumventing the problems associated with physical consent forms. Our application will also provide educational resources on surgical procedures, ensuring that permission provided by patients is informed, educated and ultimately, legally binding. We initially sketched the application's design with pen and paper before creating an interactive prototype using InVision. The prototype allowed us to demonstrate the web application's flow before building the final application.

The feedback we received from the client helped shape the final design of the application. The implementation of the application used HTML, CSS and PHP for the front-end and MySQL for the back-end. The application is hosted on Microsoft Azure.

From the very outset, it became abundantly clear that the size and scope of the project were considerable. Our E-Consent application would be a small part of a larger ecosystem of digitised health services for PEACH/NHS. Given the short time frame, we quickly realised that our work was the beginning stepping stone of an ongoing iterative process that would not culminate with us. Given this realisation, we approached this project very much with a future focus; we would lay the groundwork, doing the bulk of the research and design while providing a semi-functioning prototype that could be expanded in later generations. Thanks to the cooperation and vast team effort, the final version of our application is fully functioning and meets almost all the requirements set out by our client. What began as only a semi-functioning prototype blossomed into a mature final product that, in the future, would require only minor improvements.

NeuroResponse: Web App

Authors: Frederick Bird, Miquel Rigo, Kaihan Huang

Organisation: NHS

Technologies used: Django, SQLite

Abstract: Multiple Sclerosis (MS) is a lifelong condition that affects either or both the brain and spinal cord and can severely impact things like vision, balance, and movement. There are numerous treatments available for symptoms, which means that it is challenging for patients and clinicians to keep track of important things like side effects. Considering that a vast amount of data is necessary throughout the course of treatment; however, there was no framework to capture this. A team from the NHS, who deal with MS patients, NeuroResponse, approached our group and two others to build a system that can monitor and control data input by both the patient – via mobile app – and the clinician – via a web app. We would create a central database as well to store information and link the mobile and web app.

The task presented to our group was building NeuroResponse: Web Portal, a web application designed specifically to enhance the quality and efficiency of the clinician-patient interaction during appointments. It is tailored especially for patients suffering from MS. We were developing the app with the clinician's needs in mind, which meant that critical features like updating patient notes after meetings and a clear, concise way to store treatment paths were necessary. We used the python framework Django to build this and incorporated an SQLite3 database. The scale of the web app and the necessity to be integrated with the mobile app group's database group meant that a fully completed, the deployable app was unlikely; we set up everything to continue the development in the future. Nonetheless, our team managed to fulfil the 'must haves' and 'should haves' of the project and developed a user-friendly user interface (UI). Before official deployment, the web app still needs to undergo the NHS's unique verification and authorisation process; however, the app itself is working as required.

Demential Planning

Authors: Zakhar Borok, Anthony Cheng, Jessica James

Organisation: NHS (North West Coast Strategic Clinical Networks)

Technologies used: HTML, CSS, Bootstrap, Microsoft Azure, PHP, MySQL

Abstract: The North West Coast Strategic Clinical Network (NWCSCN), a subdivision of the NHS, deals with many patients suffering from dementia. Each patient seen by the NWCSCN requires a care plan – covering their daily appointments with carers, as well as their medical records and end-of-life plans. Currently, the recording of almost all this information is on paper. A secondary system, named System One, allows some nurses to access patient's data;

however, this system is seldom used. Our task was to create a platform that stores patients' records digitally – allowing for ease of access and universal editing. We chose to create a web application. First, we created two distinct, interactive web page prototypes and combined the best aspects of both to create the final design. To implement this, we used HTML, CSS and Bootstrap for webpage layout. Using Bootstrap makes the web app accessible and clear on a range of devices and increases portability. For the database, we hosted a MySQL database on Microsoft Azure – using PHP to display to webpages.

While we have been unable to contact the client and receive feedback, we met all the requirements and provided a transparent, minimalistic user interface meaning the project was successful.

Visual App for UCL Peach

Authors: Sondre Agledahl, Alexandru Bondor, Pierre-Alexandre Gruman

Partners: Dr Navin Ramachandran

Organisation: NHS

Technologies used: Xamarin, XAML, C#

Abstract: As part of an effort to digitise medical forms and data, the task presented was with porting an existing front-end form application for Microsoft Surface to be multiplatform-compatible.

Our application intends to assist doctors at University College London Hospital in taking medical notes as quickly and intuitively as possible and allowing seamless data storage and retrieval. Our client, Dr Navin Ramachandran, requested an app to retrieve and display and edit personal patient information and take associated medical notes. In addition, the client asked for a way to draw on prostate diagrams to allow doctors to quickly indicate the probability of tumour growth in each section of a patient's prostate using a simple colour-graded scale.

Following a thorough analysis of the original project's code, we decided to reimplement its design and functionality through the use of Xamarin and Xamarin.Forms frameworks. Writing a single shared codebase for all target platforms, we implemented a UI that would account for differences in screen size and device architecture and used several cross-platform compatible libraries to replicate what the original application could do. Consequently, our application contains all the Pages and most of the initial Microsoft Surface application functionality. Still, it is now compatible with Android, iOS and the Universal Windows Platform.

UCL Peach Recist Web Application

Authors: Aditya Niraula, Valentin-Sebastian, Burlacu Ibrahim Emara, Kalingen Balasundaram

Partners: Dr Navin Ramachandran

Organisation: NHS

Technologies used: MongoDB, HTML, CSS, JavaScript, Node.js, React, Bootstrap, WebPack, Microsoft Azure

Abstract: Peach RECIST is a web application designed for use by members of the University College Hospital (UCLH) radiology department. Its purpose is to record changes in lesions in response to new drugs and medication. Currently, one crucial issue is that the use of Excel spreadsheets for this purpose. This way of processing lesion data is inefficient, and it is not as secure as would be desired. In addition to this, there was not much in the way of standardisation of data representation. The design was so that we can provide drug companies secure information, highlighting the effectiveness of their drugs and ensuring that the data has not been tampered with at all, while ensuring patient confidentiality is maintained.

Our web application intends to aid doctors in detecting different types of lesions and their status, such as whether these tumours are in a progressive or regressive state. We consider the application to be easy and relatively intuitive. For example, after the medical staff have entered the measures for slices of the desired lesion, all calculations are made automatically, and the status for that tumour is displayed.

Besides the automation we included in our project, we could use MongoDB to ensure more proficient scalability with increasing patients and doctors. For functionality and privacy reasons, we created three users that will be able to edit the data from the application based on their roles.

AR/VR Health Living

Authors: Marcin Praski, Carlo Camurri, Krystal Phuar

Partners: Sheena Visram

Organisation: NHS

Technologies used: Unity, Samsung Gear VR, C#

Abstract: The project is about gamifying physical activity for children between 8 to 15 years old using virtual reality. This app design encourages children to exercise and promote healthy living by playing games to make them more interested in physical activity. The game is based on a reward system to encourage the children to dance more and motivate them by setting a certain number of steps as the milestone. The reward system works by multiplying the virtual characters dancing in the virtual environment once they reach several steps set as milestones.

Our solution for the project is to create a game for the children to dance using virtual reality to get them physically active. The children can choose the song and the environment that best suits their mood to enhance their experience during the game. The user needs to wear the virtual reality gear and have the game installed on their phone to play the game.

Presently, the app allows the user to choose three environments that have been made available in the game. The available virtual environments are: a deep forest where the user dances on a meadow while surrounded by fireflies; a tropical island featuring palm trees and great weather; and a space disco. Additionally, we have bunnies as the virtual character to populate the virtual environment and dance with the children. To ensure that it is safe for the children to play, we have a warning page that will pop up in the middle of the game if the user tilts their head more than a fixed degree. This process is to prevent the user from falling and tripping themselves, causing further injuries.

NHS Living Kidney Donation Film

Authors: Kamil Zajac, Catalin Aioanei, Vinesh Ramgi

Organisation: NHS

Technologies used: Unity, C#, JavaScript

Abstract: The application provides an immersive and educative experience on a specific topic, in our case, kidney donation. An engine is in development that features video selection and playback of 360° videos to depict a story or topic.

Regarding kidney donation, its development is to educate those closely linked to someone who may be donating a kidney or is the recipient of a kidney transplant who may not have access to such information. The information allows the user to know more about the perspectives of medics, families and friends of those linked to an operation, centralised into one application.

The application's distribution will be to anyone who owns an Android phone capable of playing 360° videos and has a VR headset currently, with plans to expand to VR devices such as the Oculus Rift and the HTC Vive.

In terms of the project's achievements, this application will enable the broader context of virtual reality within society, allowing more people to become well versed on a topic.

infoKID

Authors: Rijia Rizvi, Bogdan Nitescu, Weihang Huang

Organisation: NHS

Technologies used: Swift, Xcode

Abstract: The app that we have created targets parents and doctors as our primary audience. It's often hard to keep track of doctor appointments, medication and everything else systematically handled when your child is diagnosed with a kidney problem. Parents even find it hard to fully understand what happened to their child due to a lack of knowledge. When doctors explain the critical details about their child's kidney, parents tend to forget. This app, therefore, provides information on kidney problems related to kids and the necessary treatment, so parents will now

have an outlet to go to at any time during the treatment to get the status quo of their child's medical condition. Our targeted users will also have access to information related to the normal anatomy to constantly compare it with their child's. Our users will register their child on the app and keep track of their child's condition instantly. Included features like arranging appointments according to the availability of doctors are available in this app. Work on this app began by listing the requirements with the clients, following the MoSCoW approach. We created the UI design and prototype sketches, keeping in mind our team's technical capabilities. Built with Swift programming, this app only runs on the iOS platform. The basis of our development model is on the waterfall approach, i.e. the development process happened step-by-step. After a recurrent process of debugging and making improvements, we hope that our users will enjoy the app as much as we did working on it.

NHS Advanced Wound Care App

Authors: Wanyue Zhang, Yudong Rao, Moiz Hassam

Organisation: NHS Sunderland CCG

Technologies used: Ionic, Angular, TypeScript, HTML, CSS

Abstract: Advanced Wound Care is a mobile app that aims to replace the currently paper-based wound care system at Musgrove Park Hospital. It has comprehensive functionalities such as collecting wound information and generating treatment plans, opening the camera and storing images, signing the consent form, saving forms as PDF and printing. Furthermore, Advanced Wound Care provides a visual representation of how wound dimension changes over time to aid healthcare professionals in tracking the healing progress.

We built the app on Ionic 2 and AngularJS2 Framework and TypeScript, HTML, and CSS languages. We included various modules and plugins to extend the functionalities, such as SignaturePad to enable signing consent, Chart.js to generate graphs and Cordova camera plugin to open the camera. The app uses PHP and MySQL to implement user login, search patients, and store back-end data.

Advanced Wound Care successfully captures the entire flow of wound treatment, ranging from filling in wound information to generating treatment plans. An intuitive user interface dramatically minimises the hassle of filling in various forms manually, thus improving the productivity of the nursing team. The app contributes to NHS Global Digital Exemplars agenda, creating a digitally advanced care system to better harness information flow.

OpenOdonto Consent App

Authors: Carmen-Livia Ibanescu, Ioan-Daniel Savu

Partners: Dr Richard Valle Jones, Dr Becky Wassall

Organisation: Musgrove Park Hospital (NHS)

Technologies used: Ionic, Firebase, HTML, CSS, Angular

Abstract: OpenOdonto is an open-source project that includes digital tools that NHS dentists can use. OpenOdonto Consent app is the virtual version of the Consent Form 4 for use in Cornwall for adults who cannot consent to investigation or treatment. It is supposed to be filled in by the guardian/relative/IMCA of the patient.

Making a mobile application for this form is quicker and more accessible for people than to fill forms online. Moreover, the doctors will have all the forms completed electronically, and it will be easier for them to search for one patient through a lot of data. Also, more information about how long a person takes to fill in the form or geolocation might help the doctors see how much a patient travels to the clinic or how many visitors the app has. Not only does the app save time, but it is convenient and can be filled in anywhere and anytime people need it.

Apart from making it easier for people to fill in the form electronically with all the information needed, the NHS doctors have all the data about the patients in a database. The mobile app (both available on Android and iOS) is easy to use by anyone thanks to its clean and simple design. The app stores the data in a Firebase Database and has the Google Analytics plugin incorporated, which is used to track the app's location and usage.

Moreover, to be easy for doctors to search through a lot of data, we designed a database interface. The doctor can search through all the patients and has the form filled in.

Web-based Training Feedback System

Authors: Charaka Abeywickrama, Jian Huawei, George Badea

Partners: Dr Mike Reed, Dr Rebecca Morrell

Organisation: NHS

Technologies used: Node.js, MongoDB, Twilio API, Bootstrap

Abstract: Training Improvement Project is a web-based trainees' progress check application created for the Northern Deanery. The app development was by Charaka Abeywickrama, Jian Huawei and George Badea in close cooperation with the client representing the Northumbria Healthcare NHS Foundation, Dr Mike Reed and Dr Rebecca Morrell. Our application provides a way that will help future doctors taking part in the trauma and

orthopaedic (T&O) training programme to evaluate their weekly experience and supply collated group feedback to the hospitals training them. The basis of the whole process of receiving feedback is on SMS texts, which are centralised and stored in a database where the results are evaluated. The project aim was to produce a measurable improvement in the standard of T&O.

Developing this app involved two phases: the design phase and the implementation phase. The team began the design phase by identifying the project's requirements by researching user needs and technical capabilities. The team then worked with the client through WebEx conferences to develop a straightforward design and a friendly user interface for the web application administrator. The implementation phase involved keeping tight to the client's requirements and adjusting them where needed or simply adding new features to the app, as the client requested.

Isolation Prioritisation

Authors: Andrei-Mircea Barbu, Andrei Margeloiu, Gleb Skryabin

Organisation: NHS

Technologies used: Node.js, JavaScript, Bootstrap, MongoDB

Abstract: IPABM (isolation prioritisation and beds managements) is a web application for managing hospital rooms and determining the patient's priority for isolation. The app provides a centralised hub for managing the patients and planning their distribution across the hospital's rooms. It allows nurses to keep track of patients and their diseases in real time and to have an overview of the patients and rooms, and better manage the rooms assignment across patients.

We built the web application using the Node.js framework, the target integration being for PC and mobile web because of the client's requirements. It provides an easy-to-use interface targeted to nurses and does not require any training to use the application.

It is worth mentioning that the application is much easier to use than current NHS software and the nurses enjoyed using it.

The development process involved two phases: the design phase and the implementation phase. The team began designing the application by having multiple meetings with the client and understanding their problem. After explaining our solution and refining it alongside the client, we got the set of requirements. The implementation phase involved many small iterations and constant feedback from the client. We completed all the requirements, and the team has over-delivered with many features the initial requirements. The application facilitates the nurse's job. Through a meticulous testing and debugging it is an enjoyable and bug-free experience.

HoloLens in the Healthcare

Authors: Dilan Patel, Mashkoor Ahmed, Conner Lukes

Organisation: NHS SLAM (South London and Maudsley)

Technologies used: Microsoft HoloLens, Unity, HoloLens Emulator

Abstract: Often, people with mental health issues will have lowered cognitive abilities and, as a result, declined spatial awareness. This project aims to create a better way of testing and developing a patient's spatial awareness.

Using the HoloLens and its mixed reality technologies, we have created a test environment similar to the Morris water navigation task (MWNT), a task used for assessing a rodent's ability to remember spatial locations of objects in the short term. The program itself is a holographic environment that contains various visual cues and a selected objective point that the patient must make their way to, relying on the visual cues to figure out where they are. By having a patient walk through this environment several times and gradually lowering the number of visual cues, healthcare professionals can determine more accurately how good the patient's spatial awareness is.

The project is designed solely for the HoloLens as mixed reality over true virtual reality allows the user to see our test environment overlaid in the real world. Using this technology, we have a much more efficient way of overlaying a test environment into any room without spending a lot of time mapping the room beforehand. The application, therefore, provides an easy-to-set-up solution to testing a patient's spatial awareness, which healthcare professionals can use worldwide.

Fistula App

Authors: Bharghavi Damodharan, Sai Wo Chu, Affiq

Organisation: NHS Sunderland

Technologies used: Firebase, MySQL, Ionic, Apache Cordova, Angular

Abstract: We are working on a project for the creation of the Fistula App. The app design is for the usage of dialysis patients who have a fistula attached to their arms. The fistula creates a surgical passage on the body surface to facilitate dialysis. These patients can use the app to periodically upload pictures of their fistula and send them directly to the clinician for diagnosis to the database accessed via the clinician web portal. The clinician can access the image uploaded by the patient using the web portal for the clinician created by us or access the patient record from the patient database. We also created a website alongside the app to assist the clinical staff.

Apart from uploading pictures, users can also use the app to record the patient's observations to concerns such as 'Is the fistula painful?', 'Have you had any needling problems during the last dialysis session?', etc. The patients can

upload these observations to the database, and it will also be saved on the app itself for the patients to access their diary log from time to time. The app helps them to keep track of their records.

In a nutshell, the app design provides a means for patients to upload pictures and observations of their fistula to the database for diagnosis by the NHS clinicians.

OpenEyes Clinical and Anatomical Coding

Authors: Tom Ayoola, Mohammed Abdullah, Muhamad Abdul Razak

Organisation: Across Health, NHS

Technologies used: HTML, CSS, JavaScript, JSON, jQuery

Abstract: OpenEyes is a collaborative, open-source project led by Moorfields Eye Hospital. The main collaborators to OpenEyes are hospitals, institutions, academic departments, companies, and individuals. The goal is to produce a framework that will enable clinicians to access and record patient's medical information electronically (through electronic patient records (EPR)). Hence, removing the need for the inefficient, slow, and error-prone paper-based system currently employed by most hospitals in the UK.

The initial focus of OpenEyes is on ophthalmology (eye specialists), but the design is flexible so that clinicians may use it for any clinical specialities.

The system design is so that ophthalmic units of any size can use the structure, design and code to produce functional EPRs at low cost. As a result, support for the OpenEyes system has been gained by many ophthalmic units, including Moorfields Eye Hospital, St Thomas' Hospital, Manchester Royal Eye Hospital, Maidstone, Royal Victoria Eye and Ear Hospital.

However, OpenEyes is incomplete as there is paperwork for ophthalmic units that has not yet been replaced or is present but insufficient. This issue is because some nurses prefer to record information by hand rather than mouse and keyboard. So, to replace the need for paperwork an EPR system would need to feel quick and easy to use. With this in mind, we researched different methods of data entry and settled on the use of drag and drop functionality.

The task at hand was exploring new ways to capture information digitally in OpenEyes by creating a point of concept (POC) prototype that replaces a specific piece of paperwork currently employed by ophthalmic units. The POC prototype was a standalone web application that in the future will be socialised with the OpenEyes user community to seek feedback and refine ideas before incorporating it into OpenEyes software for real.

Virtual Reality Tagger

Authors: Jasper Alizond, Amartya Vadlamani

Organisation: NHS

Technologies used: Unity, C#

Abstract: The Virtual Reality Tagger is a solution to humanising homeless people created by our client Sheena Visram, Immersive Health. The aim is to socialise real-world problems using technology solutions with a focus on empathy. Immersive health tells a story of experiential learning, allowing an average person to experience what others deal with on a day-to-day basis.

The project contains two applications, a VR engine that generates a custom file system, storing tag information in XML format and additional metadata and folder hierarchy to use with the VR viewer. The VR viewer displays the content generated from the VR engine through the Gear VR, displaying these tags in real-time. Creating an immersive experience by allowing the end-user to interact with the video and see additional information to do with what they see on the screen at specific locations and times.

The implementation of the VR engine uses a Django web application reverse proxied through Nginx and UWSGI. There are Django views for each of the basic actions and the basic data types such as project creation and tag deletion. These views handle the actions associated with the view. These are primarily SQLite3 operations, and several of them use Python libraries like FFmpeg and ziplib to generate this data on the fly automatically. The web views themselves compromise HTML and Django templates, and the tag editor is powered by Javascript, which makes Ajax requests to another WebAPI endpoint. The implementation of the VR viewer uses the Unity Engine and Microsoft Visual Studio (using C# as the programming language). A main menu allows users to select which video they want to watch (using the Gear VR input). The 360 videos are then wrapped onto an inverted isomorphic sphere with a camera in the middle, allowing viewing videos in VR. The position from the VR engine of the tag converts into a 3D location, then the instantiation of a clone prefab occurs. This prefab allows viewing of text, images, HTML pages and more.

The HTML content is created by mapping HTML content onto a texture and allows for scrolling and selection when the user looks at the HTML page.

Nuffield Health & Microsoft Health Bot and Digital Assistant

Authors: Matineh Akhlaghinia, Sachchit Prasad, Romain Dumon

Organisation: Nuffield Health and Microsoft

Technologies used: Microsoft Azure Bot, Microsoft Azure, Microsoft Azure LUIS, Amazon Alexa Dev Ki

Abstract: Our team collaborated with Alex from Nuffield and Microsoft to develop a bot that we will deploy over

various platforms such as Facebook Messenger and Skype. We aim to allow the customers of Nuffield Health to book gym classes, eventually expanding to use other services provided by the company.

Our solution is a bot and digital assistant that allows customers to better interact with the company and any bookings they wish to make. It incorporates many of Microsoft's products, such as the Microsoft Bot Framework, LUIS and Azure, while we also use Amazon's Echo and Alexa Skills Dev kit.

The considered achievement would be when the bot and digital assistant can complete their required tasks under expected everyday use and work reliably to process user intents to give a desired outcome.

Transpire: An Innovative Health Platform

Authors: Mo Afsharmogaddam, Marc Fontenay, Jas Semrl

Organisation: Nuffield Health and Microsoft

Technologies used: Microsoft Azure, FHIR, Amazon DocumentDB

Abstract: Transpire is a platform developed by UCL second year computer science students to collect data, process it and share it. Our team is working on an interactive dashboard for Nuffield Health clients that will display their health data and goals in a motivational and interactive manner. We will also be using machine learning to predict the user's performances and create meaningful notifications that will aid the user towards their set goals.

We are tackling the initial problem of creating a user-friendly and informative data visualisation for Nuffield Health clients and sharing these data with third-party platforms. Our goal is to create a health platform ecosystem to encourage data sharing to convey a positive change for the clients and researchers. The platform for clients will consist of interactive and attractive visualisation of their data to help them make better and more informed decisions for their lifestyle. Additionally, we would like the system to recommend the users to improve their health and lifestyle. Additionally, we will be using Machine Learning using Microsoft's Azure Machine Learning platform to perform analysis based on gym attendance to improve the attendance of their clients.

YouTube: https://youtu.be/7HqPGpwmZ_Y

The Human Five

Authors: Keshav Aggarwal, Costin Petrescu, Xuanyi Liu

Organisation: NHS

Technologies used: Node.js, Ionic, PhoneGap, Apache Cordova, MySQL

Abstract: The NHS aims to move towards a service that better meets every person's health and wellbeing needs by inclining towards technology rather than paper. Thus

'The Human Five' aims to improve the health and mental wellbeing of the NHS staff by employing a health assistant in the form of a healthcare and data visualisation app.

The app helps the user by rating themselves in multiple areas (like 'mind', 'world', 'nutrition'). Balancing their stress and performance levels to get maximum efficiency, scale themselves using the WEMWBS to monitor their mental well-being and create goals to improve themselves over time that users can share with groups of people.

The app is expected to be used by the NHS staff and the NHS patients and potentially to help young criminal offenders. As a motivational guide, the app hopes to change the world!

Repository: <https://github.com/Keshav97/NHS-IBM-The-Human-Five>

YouTube: <https://www.YouTube.com/watch?v=d5Opsn3K0eQ>

UCLH Peach: Work Follow Management

Authors: Ben Hadfield, Julien Nahum, Sim Zi Jian

Organisation: UCLH

Technologies used: Next.js, MySQL

Abstract: Currently, the healthcare system relies heavily on paper to collect patient data. This process is a slow, cumbersome, repetitive, and error-prone way of gathering important information. Peach Cancer aims to replace paper records in the NHS. The idea is that doctors can retrieve and update patient data in one federated system, ensuring that details are never outdated. To meet these requirements, we have built a web app that enables role-based access to patient data, along with other valuable features, such as a jobs list and scheduler.

Repository: <https://github.com/comp204p-team35/Backend-Server>

YouTube: <https://www.YouTube.com/watch?v=Eb3ZCDGUIDY&feature=youtu.be>

UCLH Peach: Web Solutions for Clinicians and Patients

Authors: Horatiu Ovidiu Ilie, Georgiana Birjovanu, Beret Baran Cevik

Organisation: UCLH

Technologies used: Keycloak, JavaScript, HTML, CSS, Microsoft Azure Virtual Machine

Abstract: The goal of Project PEACH is to provide a data science tool for medical professionals and researchers that can aid them in diagnostic and analytics processes through the use of big data, machine learning and data visualisation.

Team 36 is responsible for three major subsystems within the PEACH project: Authentication and RBAC system, Internal Messaging, and Collaborative Editing Tool.

Our final project comprises one crucial part of the future PEACH platform by offering the three fully working components.

YouTube: <https://youtu.be/fbFZldx1h0k>

UCLH Peach: Dashboards and Visual Reports

Authors: Connor Daly, Daniil Gannota, Hai Xia

Organisation: UCLH

Technologies used: React, React PlayGround, D3

Abstract: Following a series of constantly evolving requirements, pushing our teams into different research areas and tasks, the final deliverable for team 37, as agreed with the client, will be the completed version of the PEACH Design Guide website, which we started back in term 1. We will use the website to unify the design elements, components and code across various platforms. Any team member from the same project can access and review the guidelines about proper integration and usage of the already predefined elements. They can be quickly and seamlessly updated or changed using our documentation. This allows the change to be seen by all other teams, keeping everyone informed and aware.

YouTube: <https://vimeo.com/213249752>

UCLH Peach and NHS Open: Core Analytics + Generator

Authors: Sandipan Ganguly, Mengyang Wu, Desislava Koleva

Organisation: UCLH

Technologies used: Microsoft Azure, DC/OS, Apache Kafka, Spark, Apache NiFi, Apache Druid

Abstract: PEACH is a large scale open-source community-driven data science project by the Computer Science department at University College London. The goal of Project PEACH is to provide a data science tool for medical professionals and researchers that can aid them in diagnostic and analytics processes through the use of big data, machine learning and data visualisation.

As a sub-project team, our main target is to implement the core architecture, deploy it on Microsoft Azure and test it with a random data generator.

PEACH Reality

Authors: Timur Kuzhagaliyev, Fraser Savage, Laura Foody

Organisation: UCLH

Technologies used: Microsoft Azure, Java EE, React

Abstract: UCL Peach Reality is an interdisciplinary project involving virtual and augmented reality to aid medical workers in their daily tasks. Projects involved working with various VR/AR headsets, such as Oculus Rift, HTC Vive and Microsoft HoloLens.

MSc students from UCL conducted the first iteration of the UCL Peach Reality project. The primary focus was data visualisation in 3D space, including studying 3D models of organs and analysing data produced by various departments of University College Hospital. Students working on the project in Summer 2016 made significant progress on developing an application for interactions with objects in 3D space using various equipment bundled with the headset.

Since our (team of 2016/2017) project focuses solely on HoloLens, we decided not to reuse most of the source code produced in the previous iteration but rather produce our implementation, refining and improving the ideas of previous developers.

Repository: <https://gitlab.com/ucl-peach/peach-reality>

YouTube: <https://youtu.be/dBgjOUKdGm8>

PEACH Chatbot

Authors: Faiz Abdul, Emily Mears, Christoph Ulshoefer

Organisation: UCLH

Technologies used: PostgreSQL, Django

Abstract: Our project is to create a chatbot to gather data from cancer patients, following the holistic health assessment before check-ups. The problem with the current form is that it is tedious, time-consuming, and often needs to be completed with the consultation.

We developed a proof-of-concept chatbot system that makes the data gathering process easier and more accessible for patients and allows for a more tailored experience. This chatbot system includes APIs for the actual chatbot and data retrieval and plans for future interfaces to enable doctors to edit chatbot dialogues.

YouTube: <https://youtu.be/07X227TvZYM>

UCLH Peach Form Builder

Authors: German Mikulski, Nany Amelia, Angela Pan Yuan

Organisation: UCLH

Technologies used: React, openEHR, EHRscape

Abstract: Our team project comprises a fascinating opportunity to take part in the development of UCLH Peach. Along with other groups, we are working on a multi-level and multi-component system intended to facilitate the convenience of patient data management within the hospital.

Our task is to develop a medical form generator, which will comply with a popular standard for medical data storage and processing – openEHR. This ensures ease of transfer of data among UCLH departments and external organisations. The generator will process an openEHR operational template, parse its structure, connect to the back-end, and output a markup file that users can use with standard UI elements in a container application.

Our team have managed to deliver this project successfully. We have developed a medical form generator that enables users to input opt files and generate a markup form. Our system integrated to the openEHR back-end through EHRscape API calls. Our form builder allows users to customise the form and save the customised form.

YouTube: <https://youtu.be/LS-u7oKp17Q>

PEACH ML Voice

Authors: Jess James, Austin Targovet, Lucy Walsh

Organisation: UCL Hospital

Technologies used: Django, Bootstrap, Javascript, Pocketsphinx, SQL, IOTA

Abstract: PEACH ML Voice is a voice recognition project built for University College Hospitals to help staff record patient data by transcribing verbal notes.

Our solution is a responsive web application that hospital staff can access on phones, desktops and laptops. Staff will use built-in microphones to record verbal notes, and the app uses machine-learning-powered voice recognition to translate the voice to text. The technology used recognises medical terminology and adapts to the user's voice patterns and role within the hospital.

Our achievement is that we have built a functional, responsive web application that utilises machine learning and blockchain technology to allow staff at UCH to transcribe verbal notes and store them securely.

Case study: OctiPAT

Natalie Yerlett, Dietetic Lead for EB and Dermatology at GOSH, and Sheena Visram, co-founder of IXN for the NHS

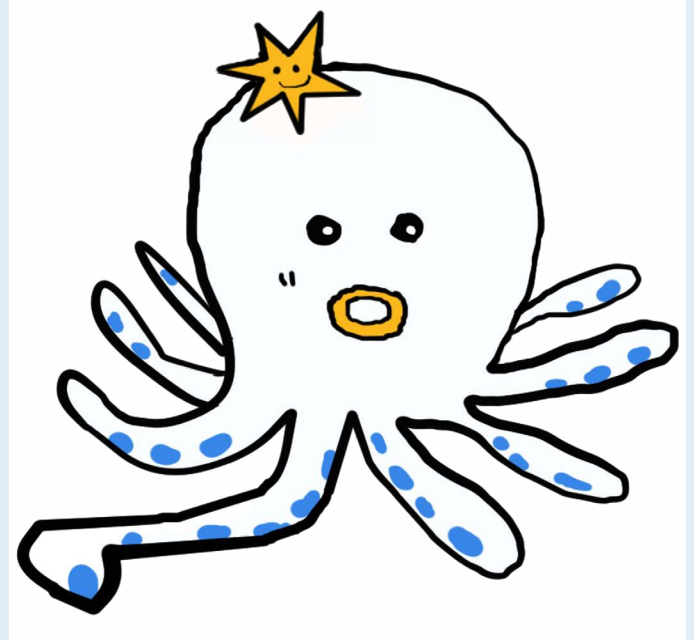
Epidermolysis Bullosa (EB) is a genetic skin disorder characterised by chronic and often severe blister formations. Patients undergoing treatment for EB attend multidisciplinary reviews several times a year, seeing up to nine clinicians during each visit. This process can be an overwhelming ordeal for patients and their families. GOSH wanted to create an app to improve communication and ease their anxiety.

Natalie Yerlett presented the concept for this project to the student team: Shen Hsin-Chin, Ma Zhongjie and Qin Ling. Responding to the brief, the team designed and prototyped an app that allows parents and patients to access different professionals and participate in discussions before an appointment. The OctiPAT team hoped that asking questions beforehand could ensure a more efficient and effective experience for all.

Natalie talks about the design stage: “From the start, [the team] designed the app with the patient’s specific needs in mind. Not only did they make an app that would help our understanding of best practice, it was always about what would be best for the patient... They really took the time to listen to me and try to work out how they could develop this product.”

“From the start, [the team] designed the app with the patient’s specific needs in mind. Not only did they make an app that would help our understanding of best practice, it was always about what would be best for the patient.”

Natalie Yerlett, Dietetic Lead for EB and Dermatology at GOSH



The result of a series of design sprints was a professional-looking proof-of-concept prototype. The team sketched out the app with an underwater theme to match the hospital decorations at GOSH. The user-centred layout intends to make the app simple to use, with specific and precise capabilities.

The students often undergo a steep learning curve on IXN projects. Shen Hsin-Chin explains more: “The project was challenging because my previous major was in mechanical engineering. So actually, I’m a newbie to computer science. So there were a lot of things I needed to learn.”

The IXN for the NHS programme is renowned for delivering opportunities to learn and grow outside of the classroom. The programme allows students to solve real-world industry problems with open-source technology. Qin Ling, another student in the team, explains more: “The requirements were very clear, so it was easy for us to implement the functions that were needed. It was a great opportunity.”

Working throughout the height of the COVID-19 pandemic, the students had multiple challenges to face, the most prominent was working remotely in multiple time zones. In addition, coordinating the group's availability to meet with clinicians was limited due to clinical commitments.

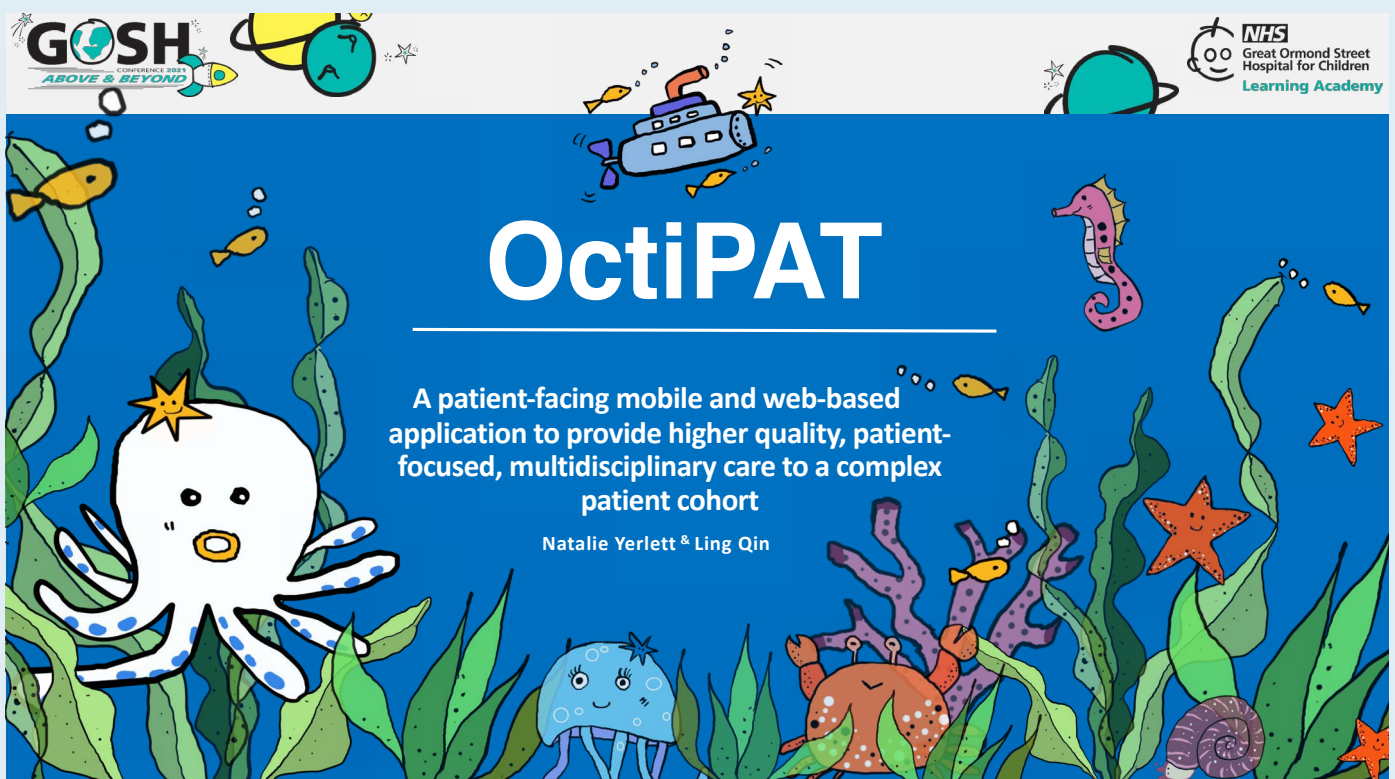
Despite these challenges, the OctiPAT team managed the time zones and limited meeting opportunities whilst condensing the information needed to achieve the client and user needs. Natalie was very impressed by the prototype: "The future of this application is bright. We're trying now to take OctiPAT to the next step at Great Ormond Street where I'm trying to get some feedback from the patients and find out what they think. I hope to eventually start putting it into clinical practice."

OctiPAT has shown great potential, not only for GOSH but also for other areas in the NHS. Natalie explains more: "It's just a great starting point. What I always hoped for the project was that it would be something that I could use for my patients. But it could also be used by other teams in other clinical areas who have similar setups, with large multidisciplinary teams and chronically ill patients. It has the potential to help a lot of patients, not just ours."

The IXN for the NHS programme has been working with GOSH for several years. Students, clinicians and lecturers alike are delighted to work on projects such as OctiPAT, which provide the opportunity to make a real difference.

"The future of this application is bright. We're trying now to take OctiPAT to the next step at Great Ormond Street where I'm trying to get some feedback from the patients and find out what they think. I hope to eventually start putting it into clinical practice."

Natalie Yerlett, Dietetic Lead for EB and Dermatology at GOSH



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OctiPAT

A patient-facing mobile and web-based application to provide higher quality, patient-focused, multidisciplinary care to a complex patient cohort

Natalie Yerlett & Ling Qin

2017-2018

IEP Form

Authors: Fareed Ahmed, Vanessa Lin, Zhizhe Xu

Partners: Dr Katchburian

Organisation: UCL Institute of Child Health

Technologies used: HTML, CSS, JavaScript, Bootstrap, Django, PostgreSQL

Abstract: The integrated care pathway (ICP) is a medical methodology for decision making and care organisation for a well-defined group of patients within a well-defined period. Currently, clinicians at the Great Ormond Street Hospital for Children (GOSH) use a laborious 20-page paper form to monitor patient progress. These inconveniences prompted clinicians to seek an alternative digital methodology that is user-friendly, efficient, and robust enough to store patient information.

Our solution is an online web app that allows clinicians to easily fill in the long medical form and store patient data in an external database. Its key features include:

- integrating login pages eight through 20 of the original ICP form.
- adding and editing patient data.
- searching and filtering login for the patient list.
- a dedicated login system with two types of users.

The front end of the ICP uses HTML, CSS, JavaScript and Bootstrap, while the back end uses Django and PostgreSQL as its infrastructure.

Due to the scale of the project and questionable design choices of the previous team's work, we reached an agreement with Dr Katchburian to finish our portion of the ICP form without integrating it with the previous team's portion. We placed great emphasis on overhauling UI and UX for a responsive, intuitive design. In addition, the code quality itself reflects modularity and robustness, as it is easily scalable, such that future changes are easy to integrate. The team fulfilled all the 'must have' and 'should have' features and essentially delivered the intended initial vision of an online ICP, albeit only with our agreed upon pages 8 through 20. In summary, the live version of the ICP features the ability to add patients, edit patient data, and filter patients from a list, to name some of the key features.

Repository: https://github.com/UCLComputerScience/103P_2018_team2

CPQOL Questionnaire Forms

Authors: Zak Morgan, Kyla Aguillo, Zong-you Chua

Organisation: UCL Institute of Child Health

Technologies used: HTML, CSS, Bootstrap, SQLite3, Django, Azure

Abstract: Cerebral palsy patients aged four to 18 complete the Cerebral Palsy Quality of Life (CPQOL) Questionnaire to assess their quality of life. This information is vital as it helps doctors better evaluate what interventions could be used to improve the patients' lives. The questionnaire forms are currently served as hard copies to the patients. However, they look dull; filling them out can be arduous and boring. Furthermore, data collection is tedious as our client must manually tally the scores. Our task is to create a web app that serves the questionnaire, makes it interesting for the target audience (people aged four -18), and makes data collection easier for our client.

We built the web app using various front end and back end technologies. On the front end, we used HTML, CSS and the Bootstrap framework to create a responsive and child-friendly web app that is both desktop and mobile-friendly. On the back end, the Django framework is used and hosted on an Azure server. The connection to the server is through an SQLite3 database containing all the questions, answers, and user information. The use of Django and the SQLite3 database allow us to serve the questions dynamically.

Ultimately, we created a fully functioning web application that takes the CPQOL questionnaire forms online. We have the foundations, the 'must haves' and the 'should haves' covered – the web application has the same questions, ordering and answer range as the original. We took her request to make it easier to gather data a step further by creating a separate interface for the admin to access the raw data and reports generated from the answers, complete with a login page so that only she can access them. We created the front end with children as our main users in mind, resulting in an intuitive, child-friendly UI design.

Marcos Katch's Database Project

Authors: Qinyi Tang, Jaroslavs Maksimov, Adamos Hadjivasiliou

Partners: Marcos Katchburian

Organisation: NHS

Technologies used: Django, MySQL, HTML, CSS, Javascript

Abstract: Marcos Katchburian is a consultant orthopaedic surgeon who currently uses a database in Microsoft Access to input and view information about his patients

with foot deformities.

The current database has a dull interface, is very daunting to use, and the system does not work well, as it's not efficient nor can it be viewed offline. Though the hospital has spent a lot on the software, there are always problems.

Our app tries to have all the necessary functionality as its predecessors. Still, most importantly, it aims to provide a user-friendly interface that will make using it quick and comfortable instead of dull and annoying as it has been before.

The team successfully deployed the working app on Azure servers, accomplishing all other 'must have' and 'should have' requirements established with the client. Hence the project is considered a success.

World Medical Education: The Open Access Platform

Authors: Tony Siu, Su Cheng, Mohammed Chouman

Organisation: UCL Institute of Child Health

Technologies used: Java, SQLite

Abstract: There are many regions where medical practitioners have inadequate access to educational resources, which is the problem that our app attempts to solve. The app's approach relies on showing the user high-quality videos to learn how to treat people by watching a professional go through the required steps. Moreover, many of these regions are impoverished, so only a small proportion of the population has access to the internet – and an even smaller amount have the fast internet speeds needed to stream videos without significant lag. Thus, a core feature of our app was to allow the user to select from a wide range of videos stored on a USB stick to watch the videos offline.

In short, the vision for our app is that someone can receive high-quality medical education without internet access, wherever and whenever a patient needs treatment.

We designed the app to insert the USB stick sent to them and watch the required video. We integrated the provision of a transcript to help them follow along. The app has a quiz for each video and, when the user has completed the quiz, the app prompts them to correct their answers with hints now provided. The quiz aims to effectively educate the user and give feedback on how effective videos are in medical education. In addition, by surveying the opinions of several people and consistently improving the app based on their feedback, we were also able to create an aesthetically pleasing UI and a layout that makes the navigation of the app intuitive.

Playing videos from a USB proved to be very difficult due to restrictions imposed on us by Android and due to there being very little support as it is a feature rarely found in apps. Yet, we still managed to overcome this difficulty, and we have met all the 'must have' and 'should

have' requirements that our client wanted. We have also added extra features to go above and beyond the initial expectations of the client. For this reason, we believe our project has been a success. We also strongly believe that our app will have an impact comparable to curing a disease. The education it provides can result in many people's lives being improved or even saved.

Moonshot Project 1: Data Normalisation

Authors: Max Bertfield, Paul Yong Hyun Cho, David Pourquery Gonzalez

Organisation: NHS

Technologies used: Unity, C#, SQLite3

Abstract: The problem we were trying to solve in this case was to find a more enjoyable way of going through the monotonous treatment of cystic fibrosis (CF) for young children. For up to hours on end, they must breathe into a tube to release mucus from their lungs, which, if done every day, can become quite tedious, particularly for their very active minds. UCL, Microsoft and the BBC collaborated to solve this problem. The task presented was building a game where these children could control the gameplay using their breath using the Fizzyo framework.

We used cross-platform Unity to develop the game. We aimed to create a game that had simple controls (using a single button and player's breaths) while being entertaining to play.

After brainstorming and design, we decided to create a slalom skiing game where the player can travel through ski slaloms on a mountain. However, we introduced an additional challenge by adding an avalanche that chases after the player to incorporate the breaths. The avalanche can be pushed back by a certain amount depending on the quality of a breath. Because we didn't want to penalise the players too harshly for performing bad breaths or no breaths at all (due to them needing a break), we programmed the avalanche to only slow the skier down slightly when in contact rather than making the game end.

In the end, we were able to develop a working version of the game that entertains children suffering from CF during their physiotherapy treatment. The game includes all features in the 'must have' and 'should have' categories, which we decided in the initial stage of development.

Moonshot Project 2L Label Video

Authors: Tiernan Watson, Wiryawan Mehanda, Stanley Mwangi

Organisation: NHS

Abstract: The NHS is looking for better ways to treat mental illness. Currently, clinician triaging of mental illness patients is ineffective. As average patients consult their clinicians weekly, clinicians are often unable to acquire an

accurate read of their patient's mental state and emotions. The NHS proposed a solution to this problem using a mobile application to recognise emotions from a facial image, trained using machine learning. However, creating such an application is challenging as few easily accessible datasets create this machine-learning algorithm.

Our task was to design a mobile application that could readily produce such dataset(s). The app allows a user, typically a clinician, to record a front-view camera video of a face. The user will then annotate the recorded video with tags any time an emotion appears in the video. The user can choose to classify the emotion into one of six categories (happiness, sadness, anger, fear, disgust, or surprise), then annotate the start and end of that emotion. Once the annotating process has finished, the system should then export this dataset in an easy-to-use format (CSV) for use in machine learning.

Joseph Connor Face Recording

Authors: Ashley Allen, Joey James, Konrad Niedzielski

Organisation: NHS

Technologies used: HTML, CSS, Sass, TypeScript, JavaScript, Angular, Ionic, Cordova

Abstract: With recent advances in machine learning, its potential use within healthcare has become more viable than ever before. A psychiatrist can use image recognition to assess the general emotions that a patient is experiencing via a smartphone camera. After building up a sufficient record, a machine-learning algorithm could aid a psychiatrist in diagnosing a mental health disorder. We can also use image recognition to diagnose different types of cancers through the examinations of CT, MRI, X-rays and other images produced within radiology. This technology could significantly help the patients, as a doctor will diagnose faster and more accurately. The problem lies in collecting a large amount of accurate data with which we can train machine-learning algorithms. Our project was to create an application that would allow many such images to be taken and uploaded to a database, which we could then use to train a machine-learning algorithm.

The application allows users to take an image, assign a customised tag, and upload it to a database. It also contains an introduction with a disclaimer, a set of instructions for using the app, and a settings menu that allows users to create their lists of tags to tag their images. This process will enable the app to be used in a variety of contexts by anybody who could potentially gain use out of it. The app is also open for further expansion by other developers in the future.

Joseph Connor Algo App

Authors: Charalampos Anastasiou, Rahul Kuruvilla, Bingqing Shi

Organisation: NHS

Technologies used: Node.js, Azure, MySQL,

Abstract: Mental Health Triage chatbot is designed for the NHS to ask users questions mainly related to depression. Our client asked our team to improve the existing chatbot by adding a variety of anxiety-related questions, storing the users' answers and allowing clinicians working in the NHS to see the answers so that they can come up with a treatment for each user. Users are primarily patients who face problems with anxiety and stress and want to find a way to be freed from these problems, as well as every other person who wants to find out whether they have anxiety issues but is not aware of it yet.

At first, our team had to analyse how the already existing chatbot was working. This procedure was complicated since it involved reading various documents of how to use the bot and understanding its structure by creating several diagrams, both in terms of the system architecture and the actual questions the bot was asking the users. We had to read and understand the code for the chatbot and storing the answers in a database. We then used another technology called the Woebot to extract some anxiety questions from it that we thought could add to the chatbot. We were also given a flowchart from the IAPT (Improving Access to Psychological Therapies Programme). We also had to carefully choose with our client the questions best suited for the Mental Health ChatBot. After this, we selected a combination of questions from the Woebot and the IAPT flowchart and added them to the code. We stored the answers in a database using Microsoft Azure. Each user chooses a username and password, so the answers for each user are stored under that person's details.

Considering the amount of time we had (approximately two months) and no prior knowledge of the languages we had to use (javascript, node.js, PHP, etc.) and learning how Microsoft Azure works, we are pretty satisfied with the result we have produced. We managed to fulfil all key functionalities we were asked to ('must haves' and 'should haves') and a part of the optional functionalities ('could haves'). We strongly believe we did our best to deliver a working version of the app, given the fact that we had to do deep research for several parameters of the project before we started coding.

GOSH: App for Child Growth Charts in R

Authors: Rajan Hirani, Saleh Khalil, Sander Da Mata Miranda

Organisation: GOSH

Technologies used: R, Plotly, R Shiny

Abstract: When children are born, lots of information is gathered about them as they develop, such as weight, height etc. This data is usually visualised in a graph format and generally on paper. With over 130,000 births last year in London alone, a lot of data must be collected, and the use of resources such as paper to produce the growth

charts for this data. This issue is where our problem lies. Our task was to produce an application for Great Ormond Street Hospital that can create these growth charts and display useful information about the child's growth, for example, what centile their weight/height lies in etc. Our client also wanted us to make this application available on as many platforms as possible, especially mobile devices.

The solution we created was a web app coded in the statistical language R. We used R as it easily allowed us to read and manipulate data from the CSV files in which the app stored the information. We used two main libraries from R for our app. Firstly, we used R Shiny to make our app accessible from the web, allowing our application to be on all platforms with web functionality. As well as giving us web functionality, R Shiny provided the resources for us to create a UI for our application. The other library we used was Plotly. This library allowed us to display the growth charts in a visually stimulating format and contained a lot of built-in functionality that provides a more robust experience for the user, allowing them to zoom in and out, compare data at different points etc. We produced two growth charts for each type of growth and gender. One graph was a measurement/age graph with the child's data and the lines for some centiles so the user can see how the child's growth compares to the rest of the population. The other graph is a z-score/age graph that allows the user to explicitly see how the child's growth moves in centiles, providing more information.

Given the time restraints and lack of experience with the R programming language, the progress we've made with the project is quite remarkable, as we met all the essential and most of the optional requirements the client set for us. With this in mind, we can state with confidence that we have produced a complete product. However, the app isn't ready to be used in hospitals just yet, with more time, we could increase functionality and provide a data store where hospitals can upload their data.

GOSH: Capturing and Quantification of Freehand Medical Drawing

Authors: Maki Egawa, Gassan Abdulraze, Kai Choi

Organisation: GOSH

Technologies used: HTML, CSS, jQuery, JavaScript, Node.js

Abstract: In the ever-advancing field of medicine and child health, an aspect that is yet to develop technologically is medical drawings. Currently, almost all hospitals use paper and draw by hand, and many elements of this process can be made more efficient and beneficial for doctors.

The initial problem is that the physical storage of paper poses many inconveniences. Firstly, you face the simple issue of insufficient space to store such drawings. As the creation of medical drawings increases, you face the possibility of removing old patient information without consent. Atop of this, the laborious and time-

consuming process of retrieval of old drawings and data for comparison unnecessarily wastes time that healthcare professionals could use to see other patients. Finally, physical storage results in a greater possibility for loss of patient information which is something to be avoided at all costs, as it is often crucially important to see the progression of treatment.

Another problem is the quantification of these medical drawings. Many doctors have different interpretations of drawings, and in many cases, it is difficult for other doctors to read each other's medical drawings. So, providing a universal quantification method allows for easier trend identification and allows the graphing of such trends.

GOSH: Safety Toolkit – Design and Approval

Authors: Yiota Krashia, Christian Martin, Rios Sathbha, Odufuwa-Bolger

Organisation: GOSH

Technologies used: Ionic 1, AngularJS, HTML, CSS, JavaScript, Cordova

Abstract: The Safety Toolkit is a cross-platform mobile application that includes various safety tools used at. The main aim of this app is to support the training and induction of newly recruited junior doctors and nurses to familiarise themselves with these safety tools. Currently, information about these tools is only available internally via their intranet and cannot be accessed off-site when junior doctors and nurses leave the hospital.

The app focuses on presenting information about the safety tools in a visually appealing way. This process maximises the comprehensibility and memorability of the data. For this reason, the division of the information about each tool is into subsections. When a user clicks on a heading, the particular information for that subsections will appear below the heading, making the app more interactive and user-friendly. Also, the 'Notes to Self' feature will enable medics to reflect on how they used each tool. Moreover, images and logos used elsewhere in GOSH will make the app more visually attractive. Still, it will also help users become familiar with the content, and help them recognise where else in the hospital the toolkit is used.

We are pleased to say that we have developed a fully functioning cross-platform app that has been tested and can run on both iOS and Android devices and is ready to be distributed to the GOSH staff. We have successfully implemented all the 'should have', 'must have', and 'could have' requirements, except one of the two 'must have' requirements. This app-wide search tool was partially implemented and only available within the video library.

We received very positive feedback from the client, and they are happy that implementation of the app has finally occurred, as this is something they have wanted to do for some time now.

GOSH: Patient Education and Instruction Apps

Authors: Karolina Koupanou, Yida Zhou, Xingyu Liu

Organisation: GOSH

Technologies used: Ionic, HTML, CSS, SQLite, Typescript

Abstract: GOSH-Patient Education and Instruction App created for Great Ormond Street Hospital (GOSH) in London, developed by Karolina Koupanou, Yida Zhou, Xingyu Liu in association with the great staff at GOSH. Doctors need an easy way to provide instructions like physiotherapy exercises that the children should follow, after a hospital visit, so that parents get all the necessary information. Presently, these are often on paper, which is easily lost, poorly transferrable and does not allow multimedia. The best idea for facilitating the parents is to have quick access to videos that show the steps of each exercise.

This is an instruction app to be used by specialists to customise each patient's exercises list, so that the required instructions are within a range of media for the patients and their families. We used a well-known framework Ionic connected to an SQL database created and developed by our team to achieve this.

We consider the project successful since we completed the 'must have' and 'should have' requirements despite the limited time provided and the difficulties to deliver some requirements.

To deploy the project to the patients, further work is required to approve all the hospital's safety requirements.

GOSH: Training and Gamification (Eg Dig wings), Leaderboards Etc.

Authors: Nanxi Zhang, Ksenia Pavlina, Qingshuo Meng

Organisation: GOSH

Technologies used: Ionic 3, MongoDB, Cosmos, Azure, Node.js, NoSQL, Express

Abstract: We designed GOSH Undergraduate Education for Great Ormond Street Hospital to provide an engaging and efficient way of training and familiarising students and the hospital's staff with any necessary information and regulations. The main aim of the app is to motivate users to learn something new in a game format.

The content available to a user depends on their needs and assignment is according to the data provided. The divided information is into study modules, and the assessment of the comprehension of information is via quizzes. We can track the progress using leaderboards and the level and points of the user.

The app was built upon the Ionic 3 framework in the front end and using Node.js, MongoDB and Cosmos DB to have REST API at the back end with the data stored

on the Azure server. We can easily scale the app as it successfully supports adding, deleting, or updating study modules and users.

The development of the app consisted of two phases. The first phase is on research, design and prototyping, and the second one is technical development.

As a result, we implemented an application that supports all the key functionalities and more than half of the additional functionalities, which can become a very successful app when deployed.

GOSH: AR Gaming like Pokémon GO for GOSH

Authors: Ayushmaan Seth, Granit Mullahasani Dula, Martynas Janonis

Organisation: GOSH

Technologies used: C#, Dream, Unity3D, Vuforia

Abstract: Reward Rush is a cross-platform interactive augmented reality (AR) game created for Great Ormond Street Hospital (GOSH). It is like an in-house Pokémon GO but for the hospital. Developed by Granit Mullahasani Dula, Ayushmaan Seth and Martynas Janonis in close cooperation with the client representing GOSH, Dr Ward Priestman, Dr Sue Connor and Prof Neil Sebire. Dr Priestman initiated the idea as he said being in hospital is a scary experience for most children, especially when moving around the hospital to go for X-rays, blood tests, etc. To help them cope with such great stress, we developed an AR game to take their mind off hospital-related things and help them relax. This game consisted of several smaller game scenes integrated using the game engine – Unity, with other important tools.

The main problem and objective were to create an interactive and user-friendly game and make the children roam around the hospital, making them exercise, bringing excitement, joy, and happiness. So, we made the outline and the intro scene very eye-catching from a child's perspective using software like Adobe Photoshop. The main game consists of 3D models projecting out of the images on the background on the hospital's walls as soon as one aims their back camera on the wall/image, just like Pokémon emerge out in the game Pokémon GO. These 3D-rendered models also have animations and can interact with the user when touched on the mobile screen. We used Unity as our game engine and Vuforia SDK – a development kit that helps 3D model recognition and is an AR plugin for Unity.

To make the game a little competitive, we introduced the feature of a timer and scorecard. This addition is where children have to roam around the hospital looking for gems and stars and collecting them to increase their timer and destroy some objects by touching on them through their phone to earn points. Then we added the feature of a leaderboard among the children to see their scores and positions.

The scale of the project, in combination with the limited time provided, made the successful completion of the project difficult. However, even with these challenges, we delivered a working application that fulfils all the 'must have' and 'should have' requirements as agreed upon by the client.

GOSH: DRIVE Website Interactive Tools TV Kiosk

Authors: Alexandros Frangos, Jiahao Wang, Klajdi Lamce

Organisation: GOSH

Technologies used: HTML, CSS, JavaScript, MySQL, PostgreSQL, PHP, Ruby on Rails, Azure

Abstract: The Digital Research, Informatics and Virtual Environment Unit (DRIVE), part of Great Ormond Street Hospital (GOSH), will be getting a dedicated physical space in 2018. One purpose of this new physical space is to host events that will be open to the public. Therefore, DRIVE needs a website that displays various upcoming events and allows users to book places for these events. A way of displaying information about these upcoming events on large TV screens within the hospital for passers-by is also required.

The ICT Projects Team is already creating a DRIVE website. This website will have an events tab that, when clicked, will redirect to our events website. We built our events website using PHP, HTML, CSS and MySQL as the database. For the kiosk app, which we will display on the TV screens, we built upon some code that the ICT Projects Team originally wrote for a kiosk app used within the UCL Engineering faculty. We used Ruby on Rails as our web framework and PostgreSQL as our database.

For the kiosk app, we managed to implement all of the 'must have' and 'should have' features and most of the 'could have'. For the website, we also implemented all of the 'must have' and 'should have' features and also 50% of the 'could have' features.

Therefore, we consider our project to be a success.

GOSH: DRIVE App

Authors: Yacoub Ahmed, Duncan Rowe, Li Hou

Organisation: GOSH

Technologies used: HTML, Ionic, CSS, Javascript, Node.js, JSON

Abstract: Our client Dr Ward Priestman wants us to create an app for GOSH (Great Ormond Street Hospital) called DRIVE. Users will utilise DRIVE: to collect and display data about the hospital (such as the amount of blood used today etc.); to provide a QR code generator so that people can gain access to events using their phone and a 'security level' page which details how secure the GOSH network is.

Our solution will be built in Ionic and solves these problems using a combination of typescript and HTML coding. The result will be an app that brings together many aspects of the hospital into one functional package that both employees and patients can use.

GOSH: R Shiny App Development

Authors: Tariq Jamal, Jessica Hong, Felix Ingham

Organisation: GOSH

Technologies used: R, XML, R Shiny

Abstract: Great Ormond Street Hospital is currently developing a research analytics platform for clinicians and researchers. Considering that many clinicians are likely to have little to no programming knowledge, our client would like the team to develop an application written in R and Shiny. This application would introduce its users to the language and guide them through a taught session using a quiz-like interface that offers R programming challenges.

The team started by designing the user interface after collecting requirements from our clients in weekly meetings and researching existing projects. We had a sketch template of the layout of the widgets converted into interactive Shiny UI. We used a range of different technologies in the development process, including HTML, CSS and XML. We will host the finished product on the platform directly in the form of a mini-app. We will upload the source code, and our clients may make changes to the source code in the future.

We had satisfying feedback from the client on the prototype during meetings. They are glad to see a functional application that serves the proper purpose with a simple yet very professional style theme. We managed to implement most key functionalities we recorded initially in our MoSCoW analysis, as well as some of the optional functionalities to make the application content richer.

GOSH: Project Touchstone

Authors: Sam Gao, Shoab Omar, Rod Matveev

Organisation: GOSH

Technologies used: Ionic, Nginx, node.js, express.js, MySQL, Typescript

Abstract: We aimed our product at sick children (ages under seven) hospitalised for prolonged periods. Being in hospital is a scary experience for most children, and anything that can aid connections with friends and family can help them feel more at ease.

The Touchstone is a device designed to allow family members to transmit messages and soothing sounds to a child's bedside from a mobile phone app, so they can continue to feel connected even at times when their family members may not be present.

We have created a no-frills realisation of this idea, which can be operated intuitively and easily by all parties involved, providing a smooth and simple experience.

GOSH: AR Lagoon Hotspots Tags

Authors: Mingyi Lim, Xiang Li, Yomna Ghannam

Organisation: GOSH

Technologies used: Unity, Vuforia

Abstract: Great Ormond Street Hospital (GOSH) is a world-leading hospital that specialises in providing healthcare for children. Integral parts of their approach to healthcare are their belief that children require a different approach to healthcare than adults and their dedication to providing every child with the most suitable form of care. One of the essential factors in ensuring that children are receiving the care and support they need is making the hospital a relaxing, engaging, and stress-free environment to the greatest extent possible.

Often children's feelings of missing out without social interaction with friends and peers are compounded by the fact that being in a hospital can be somewhat intimidating and lead to an overall sense of dissatisfaction or stress. In an attempt to counteract this stress, the patient satisfaction team at GOSH wanted to give children an opportunity to interact with their environment at the hospital in an engaging and entertaining way through augmented reality (AR).

We designed the application to allow users to view an AR and facts about GOSH by scanning several different QR codes placed at 'hotspots' around the hospital. The main requested features for this application were the appearance of an AR upon scanning QR codes and a way to display facts about the hospital to users.

We used Unity as our game engine to build the overall application that fulfils the requirements above and has all the associated music, sounds, images, and features. Moreover, we utilised Vuforia as an augmented reality platform within Unity to create the augmented reality component of this application.

Given the limited time frame for this project and the necessary learning curve for interacting with Unity and Vuforia, completion of this project can be deemed onerous. However, we could deliver a working version of the application to serve as a prototype for expanding into a more comprehensive and full-scale app. As a team, we were able to fulfil all the 'must have' and 'should have' requirements, as well, as the majority of them could have requirements; therefore, we deem this project a success overall.

GP App 1: Sepsis Traffic Capture

Authors: Ralf Michael, Yap Haixiang, Sun Kailun Shen

Organisation: NHS

Technologies used: HTML5, CSS, Bootstrap, Javascript, Django, MySQL

Abstract: The factors that indicate if a child is possibly suffering from a lethal infection are different from adults and even vary among children of different ages. GPs need to diagnose such cases accurately and effectively to provide proper medical care as efficiently as possible. We sought to build an easy-to-use tool that allows GPs to quickly work out the risk with patients' signs and symptoms.

Our app is built on the Django framework and connected to a MySQL database. GPs who have authorised access to the app can calculate a patient's risk of developing a severe illness by simply entering and submitting the required factors. A function on the server calculates the overall risk, shown using a red, amber, green traffic light system symbolising high, moderate, low risk, respectively. The information is recorded in the database so that GPs can keep a log of previous uses of the application.

While our team was relatively new to web development, both in terms of front end and back end, we were able to deliver a fully functioning solution that meets a vast majority of the client's initial requirements. We hope that our app can assist GPs in aiding patients in need of care and attention as part of the core mission and unified duty of the NHS.

GP App 2: Input Sheets to Letters, DMARDs

Authors: Simon Fattal, Yifan Liu, Sehej Sethi

Organisation: NHS

Technologies used: HTML, CSS, Azure, PHP, MySQL

Abstract: The website we created is a patient management system for the Bridge House Medical Practice, a branch of the NHS. Developed by Yifan Liu, Sehej Sethi, and the team leader, Simon Fattal, in close cooperation with the client representing the Bridge House Medical Practice, Dr Atia Rafiq. The current system of paper forms is becoming progressively more challenging to manage and maintain. This issue prompted Dr Rafiq to change the system into an electronic format, namely a web portal. This unified portal allows GPs, clinicians and patients to enter the relevant information for a specific diagnosis. All information can then be stored in a database.

This website also allows GPs to generate multiple forms within the click of a button, making the process much easier and complying with today's web development standards.

The app focuses on efficiently guiding patients who require different medications via a web interface. Requested

features include; inputting and altering patient data, generating many forms at once, and a messaging system to trigger a GP after form completion. To do this, we had to build both the front and back end of a website.

The front end was written in HTML and CSS, while we created the back end in PHP and MySQL.

Our team conceptualised and implemented this entirely. It involved much coordination with our client through meetings and emails.

The scale of the project in tandem with constantly changing requirements made the successful completion of the project very difficult. However, even with these challenges, we built and delivered a working version of the application that fulfils all the 'must have' and 'should have' requirements agreed upon by the client. Hence, this project can be considered a success. We have also deployed the website, so it is now live and available for people to see.

Tagging Repo Data

Authors: Mohsin Ahmed, Noa Luthi, Mohammed Abdullah

Organisation: NHS Digital

Technologies used: HTML, CSS, ReactJS, RESTful, MongoDB

Abstract: Our web app is a cross-disciplinary desktop tool for all specialist doctors, which aggregates medical web sources for doctors to search easily, filter, and make available for patients, who can receive further information about their diagnosis.

Ideally, the app would aggregate clinical data from a large number of predefined resources, which will enhance the accuracy of the search results.

Our current development uses web scraping and crawling methods on a limited pool of websites. By applying natural language processing to label the scraped data, we could incorporate filter tags and free text in the search and provide an intuitive and accurate search for our users.

YouTube: <https://youtu.be/Qf012I0nMQw>

PEACH Data Mining

Authors: Gavin Shek, Saqib Jahangir, David Stepanovs

Organisation: UCL Hospital

Technologies used: Java, JavaFX, ARX, Kibana, Elastic Stack, Docker, Apache

Abstract: The Platform for Enhanced Analytics and Computational Healthcare (PEACH) is a project delivered by the UCL Computer Science department and University College London Hospitals (UCLH). The project has two primary objectives; to build a data anonymisation tool, and extend the PEACH's core analytics system by implementing a visualisation solution.

This project has created a data anonymisation tool designed for healthcare that combines a simple user interface for medical professionals and advanced privacy models to anonymise sensitive patient data. We built the anonymisation solution for use in various areas, including for research and statistical records.

We designed the core analytics system to provide a modern data analytics suite to support routine care, business intelligence and research. We have created a data visualisation tool during this project and integrated it into the analytics system so analytics data can be visualised and easily accessible to users. Medical researchers can create interactive graphs, charts and displays to gain a practical insight into medical data.

With an open and innovative platform, this project allows medical professionals and researchers to use data to advance medicine through research — all while protecting the sensitive information the NHS holds on its patients.

YouTube: https://youtu.be/_rkqeLtpbJA

PEACH ML Voice

Authors: Jess James, Justin Targovet, Lucy Walsh

Organisation: UCL Hospital

Technologies used: Django, Bootstrap, Javascript, Pocketsphinx, SQL, IOTA

Abstract: PEACH ML Voice is a voice recognition project built for UCL Hospitals to help staff record patient data by transcribing verbal notes.

Our solution is a responsive web application that staff can access on phones, desktops and laptops. Staff will use built-in microphones to record verbal notes, and the app uses machine-learning-powered voice recognition to translate the voice to text. The technology used recognises medical terminology and adapts to the user's voice patterns and role within the hospital.

Our achievement is that we have built a functional, responsive web application that utilises machine learning and blockchain technology to allow staff at UCLH to transcribe verbal notes and store them securely.

Nuffield Health 1 Data Reporting

Authors: Dhen Padilla, Kiran Gopinathan, Alexandru Bondor

Organisation: Nuffield Health

Technologies used: React, Redux, Node, Express, Apache Drill, MongoDB

Abstract: FHiR Visualization is an open-source health data visualisation platform built on a FHiR based data schema. This health-data framework has been gaining popularity in many health organisations for transferring medical records. By utilising the FHiR schema as its primary data format, the system demonstrates that the FHiR data format is

suitable for data transfer and capable of supporting larger systems. The deliverables of this project – the system source code and data schemas – have been released as an open-source library for use by the larger medical technology community. Furthermore, one can find the publication of the process of constructing the system and the problems encountered by the project team in a short paper for the ICT4 Ageing Well conference.

YouTube: <https://youtu.be/Z1a0Lr-6uWY>

Fizzyo Fitbit Extend Cross-Platform

Authors: Anton Hristov, Anthony Cheng, Conner Lukes

Organisation: GOSH

Technologies used: PostgreSQL, Node.js, WinRTXaml, Microsoft Azure, Express, FitBit.NET

Abstract: Project Fizzyo attempts to tackle some of the key challenges associated with cystic fibrosis physiotherapy. It combines physiotherapy (a series of breathing exercises) with gaming to make it a better experience for patients. To achieve this, we are using a wireless sensor embedded in conventional breathing equipment. The main task of our team was to store and process the breathing data from the device and integrate Fitbit data into the project. We developed the API with two other teams who are also working on the project.

NHS Digital C4H220 Beacons in Hospital Setting

Authors: Nathan Djanogly, Marton Takacs, Dongfan Zhang

Organisation: NHS Digital

Technologies used: BLE, MySQL

Abstract: Every year in NHS hospitals, thousands of pounds and countless lives are lost due to lost, stolen or misplaced medical equipment. Currently, hospitals rely on antiquated systems such as paper check-in lists or simply doctor memory. Our vision is to solve this problem by using wireless beacon technology to track and locate these items, saving the NHS time, money, and ultimately human lives.

Our system comprises small Bluetooth low energy (BLE) beacons detected by cheap, readily available Raspberry Pi's that transmit their information to a server, which will triangulate the position and display it in a responsive web application.

We have successfully developed a program to scan, detect and transmit the BLE beacons using Raspberry Pi's. The data from the pi's is automatically sent to a load balancing positioning API hosted on a TomCat server. This server precisely triangulates the beacons position and sends it to a MySQL database, which our responsive front end web application displays.

YouTube: <https://youtu.be/-ZTWkuwl7yo>

Microsoft/ GOSH Fizzyo 3

Authors: Cosmin Vladianu, Andres Rojas, Ryo Mochizuki

Organisation: GOSH

Technologies used: PostgreSQL, Unity, Node.js, Angular

Abstract: The goal of the game developer framework is to provide a way for clinicians to assess the impact of gamifying cystic fibrosis physiotherapy treatment.

We achieved this task through two tools: the Fizzyo Unity Package and the Fizzyo Web Portal. The unity package is a framework that parses both patient data, such as the breath quality during a treatment session, and game analytics for game developers. All this information is then available to clinicians and game developers through the Fizzyo Web Portal.

Developers will use the game developer web application to add and change games and achievements for their games and view game leaderboards, providing an accessible way of managing them. Providing a better experience for integrating games into the Fizzyo framework and ultimately motivate more developers into contributing to cystic fibrosis research.

We have successfully extended the Fizzyo web portal for game developers, including the supporting API endpoints, and created extensive documentation for the Fizzyo Unity package and implementing the package into Unity games.

YouTube: <https://youtu.be/D48eE3FWnns>

Fizzyo Data Visualisation

Authors: Aleksei Rozhnov, Marcin Praski, Maria Iacobici

Organisation: GOSH

Technologies used: React, Redux, Redux-thunk, Bootstrap, Recharts, Reactstrap, Lodash, Moment

Abstract: One in every 2,500 babies born in the UK is affected by the chronic, life-limiting genetic disorder cystic fibrosis (CF). Clinicians prescribe a series of breathing exercises called CF physiotherapy as the main treatment, which the children find physically consuming and tedious. Fizzyo will entertain the patients throughout physiotherapy and track their physical state and progress to make for a seamless experience for patients, their families, physiotherapists, and project researchers. The application aims to stimulate the patients and give their doctors the information necessary to prescribe an accurate number of breathing exercises, which is crucial in prolonging the lifespan of children with CF.

Nuffield Health Alexa Skills

Authors: Bharghavi Damodharan, Yung Chan, Ivaylo Stefanov

Organisation: Nuffield Health

Technologies used: Node.js, DynamoDB, OAuth 2.0, JOVO

Abstract: Amazon Echo is a hands-free speaker you control with your voice. Echo connects to the Alexa Voice service to play music, provide information, news, sports scores, weather and much more.

Nuffield Health currently has an online booking system. While this is perfectly fine, Alexa will render an even more intelligible experience. We have built an Alexa Skill Kit configured to a smart speaker. Users can apply this technology to make quicker and more efficient bookings using voice control. Our solution is much more user-friendly, through the usage of additional functions and capabilities.

Repository: <https://github.com/justinchan12138/Alexa-Nuffield-health>

NTT Data: Sota Story Telling analysis

Authors: Weihang Huang, Thomas Collyer, Tsz Hey Lam

Partners: Hiroki Huang, Neil Sebire

Organisation: NTT DATA

Technologies used: Sphinx4,

Abstract: Across the world, countless children in hospitals suffer from a lack of social interaction due to prolonged periods of stay pre and post-treatment. SOTA is a humanoid robot equipped with object recognition and speech recognition functionalities to tackle the problem. With SOTA, children will show their favourite toy and experience an interactive storytelling session with SOTA, inducing social activities.

YouTube: <https://youtu.be/azR5ST6Fqig>

PEACH 3 PEACH Reality

Authors: Mashkooor Ahmed, Othniel Adeosun, Danchen Lou

Partners: Dr Navin Ramachandran

Organisation: UCL Hospital

Technologies used: HoloLens, Unity3D

Abstract: Cryoablation is a process used to remove kidney tumours. It involves inserting needles through the skin, towards the tumour, to destroy it. In this project, we built a HoloLens app used as a proof of concept simulation of cryoablation. We aim to see how accurately we can insert needles towards a target when basing the insertion on holographic cues and guidelines over the real target.

Key features:

- allows a user to superimpose a holographic mesh on a given phantom box
- allows the user to locate the position of the tumour using the holographic mesh

allows the user to insert needles into the tumour using the mesh and guidelines as a guide.

Case study: data insights from infusion pumps

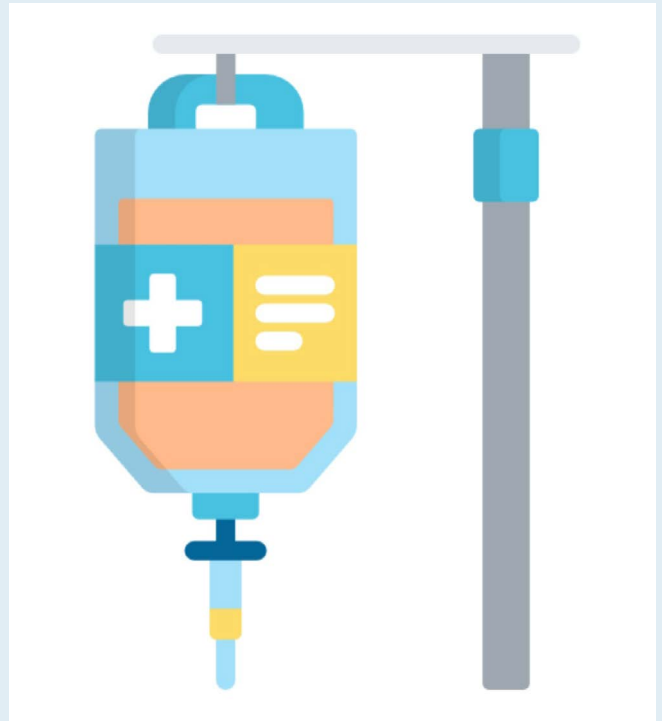
Gemma Renshaw, Dietetic Team Lead - Blood, Cells and Cancer, GOSH & Sheena Visram, co-founder of IXN for the NHS

GOSH's Paediatric Cancer Dietetic Team collaborated with IXN for the NHS on a project to improve access to crucial nutritional information about children undergoing treatment for cancer.

Background

Many children being treated for cancer struggle to meet their full nutritional requirements throughout their treatment. This problem is due to factors such as the location of the tumour site, changes to nutritional requirements, side effects of treatment (such as nausea, vomiting, diarrhoea, abdominal pain) and mucositis. Therefore, these children may need assisted feeding using prescribed feeds, delivered down artificial feeding tubes using a feeding pump.

While patients are in hospital, the ward nurses set up the feed, volume and rate. Nurses type into electronic medical records the hourly rate that is delivered, and then as dietitians, we would look at those records to interpret how much of the target feed is being received. This process is more complicated when a child is at home because their parents, or the patient themselves if they're old enough, will set their own volume and rate as advised by their dietitian. In this instance, we rely on parents reporting back to us on how much feed is delivered.



The solution

To improve this experience, we wanted to remove the need for human reporting. We know that the pumps already store the data from inbuilt sensors, and so we wanted to read that data and put it into an intuitive dashboard. This data is instrumental, so creating this dashboard can remove reporting errors and enable the sharing of data with appropriate healthcare professionals.

In 2020, meetings started with the student team at UCL Computer Science, led by Daulet Batayev, to develop this dashboard. Part of the build specifications required that we put specific procedures and confidentiality elements in place to safeguard sensitive data like patient information. Unfortunately, because of the COVID-19 pandemic restrictions, the team couldn't access a pump; therefore, as a first step, they created a prototype version of a dashboard, demonstrating its use with synthetic data, in readiness for future development.



Benefits

The information gathered by this dashboard should improve patients' experiences of care in several ways.

The dashboard itself could allow healthcare professionals involved in a patient's care to access the data securely. We hope that over time we might integrate this into a central electronic patient record. Importantly, as a dietetic team, we could ascertain if a patient is losing weight without delay and make changes to the prescribed feeding regime. Collecting accurate data over a longer period, perhaps over several months or years, could also drive improvements in clinical judgement by enabling a more thorough clinical assessment.

With patients and parents in mind, we created a feature for parents to comment on and add details to data points. We intended this design to add context to the times when a feed is not delivered as intended. Examples of this might be if the child had vomited or felt nauseous that day. For healthcare professionals, this data is invaluable, especially in specialities like cancer treatment.

To make this data more meaningful to clinicians, we added a function to set alerts. This system would flag the data to the team looking after a patient at a time when a patient is consistently receiving less feed than prescribed. We hope that by joining up care with this technology that the data in the dashboard improves aspects of patient safety, team and family communication and demonstrates efficiency gains for staff.

A partnership

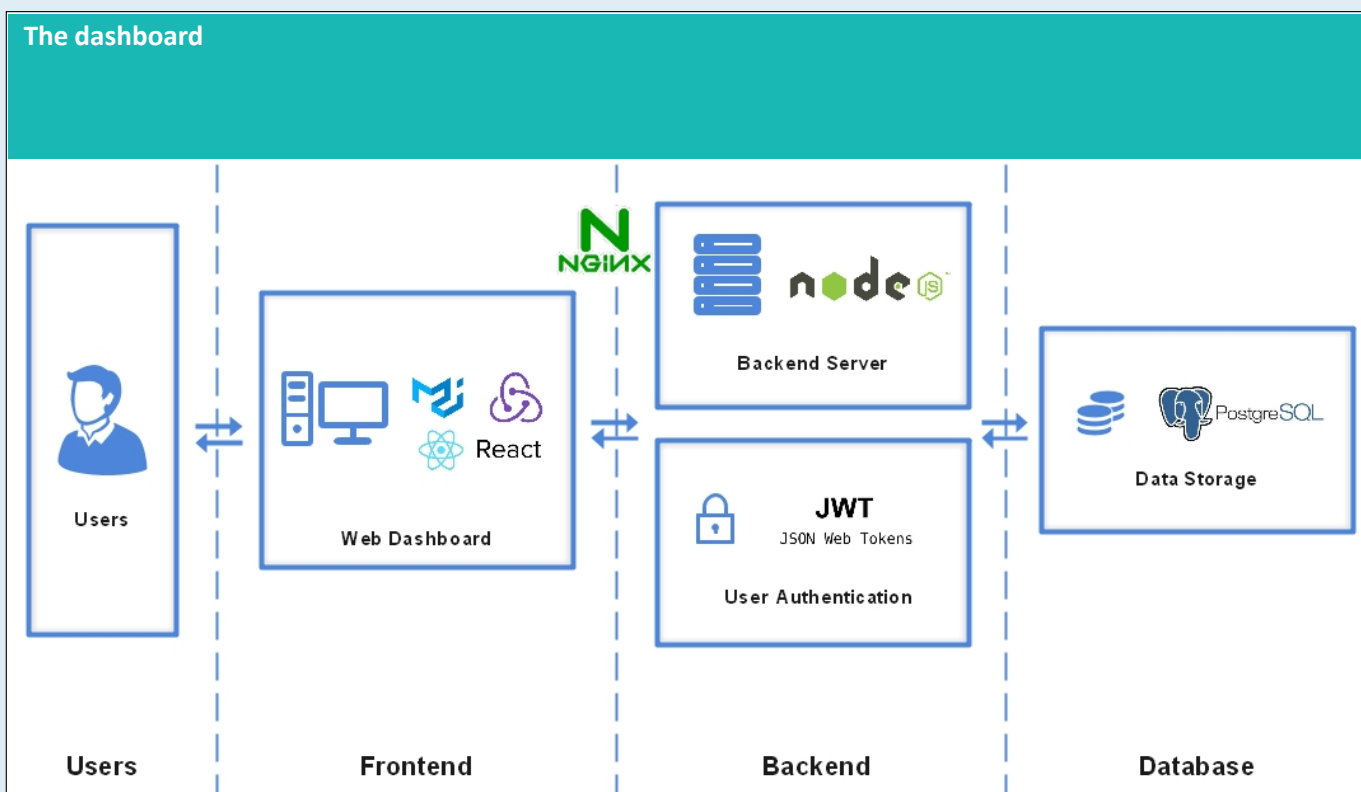
Throughout this project, the team at GOSH were exposed, often for the first time, to aspects of prototype development. They gained an understanding of what these projects entail, what is possible and, most importantly, an insight into data security.

For the students, having a clinical link meant they could focus on the solutions to the problems and envisage the endpoint while understanding the end users who would benefit from what they were prototyping. So together, we partnered well to ensure we could achieve each other's end goal.

The students were a fantastic team and an absolute pleasure to work with. They worked very hard, and all credit to them: it's sometimes easy to have a vision but not so easy to put it into place. The academic team worked tirelessly to ensure the success of this project from beginning to end. Having this link with IXN for the NHS gives us the opportunity to put some of our ideas into practice.

Students involved in the project

Daulet Batayev, Henry Ching, Tianang Chen – all second-year Computer Science students at UCL.



2018-2019

Generating Synthetic Healthcare Data for Development and Research Use

Authors: Ali Zia, Sifang Du, Dylan Vakeria

Organisation: GOSH

Abstract: With the recent introduction of GDPR, personal data has become more restricted. This is evident in fields such as healthcare. As a result, we cannot use some NHS medical datasets for machine learning, data science and clinical research.

As such, our project aims to tackle this issue by producing representative synthetic data, enabling clinical researchers to use quality data in their investigations whilst still complying with GDPR.

YouTube: <https://www.YouTube.com/watch?v=F6IHMOMeayg>

Optimisation of FHIR Infrastructure and SMART on FHIR App Development for Healthcare

Authors: Ralf Yap, Qinyi Tang, Ziyang Dong

Organisation: GOSH

Technologies used: Azure, HTML, CSS, React, JS, Django, SQLite

Abstract: The Fast Healthcare Interoperability Resources (FHIR) is a standard for exchanging electronic healthcare data and records between medical institutions and applications. In a secure yet convenient method, a common framework makes it easier to read, write, and transfer medical data, such as patient information, medication, and conditions. It is becoming more widely used around the globe by several organisations, including NHS Digital.

SMART is a platform that builds upon the FHIR specification and provides developers with a set of APIs to create applications on top of FHIR. These applications range from retrieving a patient's medication history to evaluating a patient's risk of cardiac arrest.

We aim to help individual doctors, small teams of developers, or significant medical organisations, who may not be too familiar with FHIR, discover SMART APIs' capabilities and build applications for this next generation of digital healthcare.

We have developed a web application with a collection of modular SMART functions, written in JavaScript, that developers can use and implement in their applications. It is a library of runnable code snippets that can act as a helpful tool and reference when building SMART applications.

Healthcare Machine to Platform Secure IoT Infrastructure

Authors: Ho Jiahui, Xin Deik Goh, Adamos

Organisation: GOSH

Technologies used: MySQL, Azure

Abstract: The main focus of our project is to create a prototype of a system where a wearable device (we used a smartwatch since it is highly accessible) is attached to the discharged patient. In addition to collecting health data from the wearable itself, it also collects data about the environment using separate sensors. These combined data allow for more meaningful analyses, such as when a patient has a seizure, the doctor can look at the info on the environment at that time and possibly determine the cause of the seizure (e.g. high light & humidity).

SOTA / Jibo as a Patient

Authors: Phu Sakulwongtana, Khanh Hguyen, Klajdi Lance

Organisation: GOSH

Technologies used: React.js, Python, Nginx, Flask, Azure, TensorFlow, Swagger UI, Docker, Atom, Docker Compose

Abstract: JIBO as a Patient is a platform that enables medical practitioners to learn how to interact with patients. The platform is powered by Isabel Differential Diagnosis and a state-of-the-art deep learning algorithm, and our ultimate goal is for it to be extensible.

How JIBO as a Patient works is that doctors try to guess the disease the chatbot might have. We can evaluate this by comparing their predictions to what Isabel predicts. This practice will encourage doctors not to give only one correct answer but to give a range of possible diseases.

We did work both in terms of implementing usable services ready to be extended to the JIBO robot and experimenting with state-of-the-art Neural Network Models.

YouTube: <https://www.YouTube.com/watch?v=mlxR89jY9Xc>

Healthcare Sensor Fusion Hardware

Authors: Alexandros Frangos, Ahmed Adeeb Fawzy, Nikolay Bortsov

Organisation: GOSH

Technologies used: Raspberry Pi, GPIO pins, Django, React.js, Azure, BootStrap, RESTful API, MVC

Abstract: This project aims to help predict unsuccessful surgeries and warn professional staff. The final product will run during the surgeries. Our solution was to collect data from the surroundings, identify patterns, visualise the collected data, and alert users when the collected

data exceeded 'normal' conditions. We have successfully created a sensor hub, which collects data and feeds it to an algorithm to calculate normal conditions. A dashboard for users to visualise and interact with data.

Computer Vision for Object Detection in Medicine

Authors: Benedict Wei Chong Chan, Shirin Harandi

Organisation: GOSH

Technologies used: PyQt, Azure, Python, TensorFlow, MySQLAdapter, ListObject, MySQL

Abstract: Working in an operating theatre is always nerve-racking and can be busy, leaving such an environment prone to making mistakes. With recent advances in computer vision, current technologies can identify vast numbers of objects in a wide variety of scenarios. We can train machines to detect and identify different medical instruments used in clinical environments by utilising such technologies.

We wanted to create a system that allows doctors and nurse practitioners to monitor instruments used in their operating theatres. The system will display which instruments are present in the operation tray and correctly identify what and when instruments are currently in use when removed, thus allowing all staff to gain a more precise overview of the operation at any given time.

By gathering all this data, we can produce complete operation summaries and timelines. This real-world data can be analysed and shared, allowing surgeons, junior doctors and medical students alike to improve and learn. We hope our system will open up avenues in the medical field and hopefully enable the field to advance further.

YouTube: <https://www.YouTube.com/watch?v=7kmK1xSjasc>

Vusix Glasses / HoloLens to Support Clinical Information Display for Teaching and Training

Authors: Amy Jeffcoate, Petros Xen, Elena Aleksieva

Organisation: GOSH

Technologies used: HoloLens, Unity3D, C#, Lexigram, JSON

Abstract: We are using the HoloLens platform to utilise the power of mixed reality (MR) to aid clinical teaching and training.

Our application gives young medical professionals the unique experience to jump from the hospital straight into the world of mixed reality. We provide them with the chance to access interactive medical information right in front of their eyes without disturbing a patient consultation. Annotate a room with notes such as dosologies or patient information and extract medical entities from speech to see definitions and diagrams.

YouTube: <https://youtu.be/VYNWxQbDGps>

Developing Technology for Accessibility for GOSH Sight and Sound Hospital

Authors: Harry Thomas, Sidak Pasricha, Xingyu Liu

Organisation: GOSH

Technologies used: Meridian SDK, Buru-Navi, bStim2, Meridian REST API, Google Cloud Services, NoSQL

Abstract: Great Ormond Street Hospital is a children's hospital based in Bloomsbury, London. It is the country's leading centre for treating sick children and caring for various complex illnesses. However, a hospital can be a frightening place to be, especially for young children. Hospital visits become even more difficult for patients who suffer from hearing and/or sight loss. Many patients depend on staff or carers to help them perform simple tasks, such as finding their hospital appointment room. This issue depletes valuable hospital resources while also reducing the independence that many children often desire.

The Great Ormond Street Sound and Sight Centre, set to open in 2020, is the UK's first dedicated facility for sight and hearing loss children. The centre is designed specifically to support the needs of children with sensory loss. Our project is to produce a mobile method of indoor navigation for patients of the Sound and Sight Centre. The system will allow hearing and/or sight loss users to select a destination using an Android phone application and receive turn by turn directions through haptic feedback. In our specific deployment, we will be using the NTT DATA supplied Buru-Navi to provide haptic feedback to the user. This hardware device offers the illusion of a user's hand being 'pulled' in a specific direction. We hope that our project will help to improve patient independence within the hospital by allowing users to navigate without the aid of carers or staff.

An Automatic System for Gathering and Visualising Patient Readiness to Get Well

Authors: Nanxi Zhang, Zuka Murvanidze, Azizan Wazir

Organisation: The National Health Service

Technologies used: Node.js, JavaScript, EJS, Azure, MySQL

Abstract: There has been no cost-effective and non-invasive method of tracking an individual's wellbeing until the development of the WellWellWell app. Historically, GPs relied on patient honesty and their inference to determine an individual's wellbeing. With the WellWellWell app, there will be no more guesswork in understanding what the phone has tracked.

The app tracks the user's pedometer data (number of steps taken), social media and other telecommunication app usage to generate a wellbeing score, indicating how closely the user is following the NHS framework. With the user's permission, this data is shared privately with the user's GP and/or anonymously transferred to an NHS nationwide database to aid GP's and healthcare professionals in making decisions and efficiently allocating resources.

Demystifying the Process of Optimising 111 / 999 Using ML / AI

Authors: Warren Park, Mohammed Chouman, Ziyang Cheng

Organisation: The National Health Service

Technologies used: Chart.js, pyLDAvis, Twilio, SQLite3, PyQt, Python, sklearn, JavaScript, UIKit3, HTML, CSS

Abstract: This project developed a toolkit that can help 111/999 (emergency telephone number) call handlers to optimise their call handling practices for the NHS 111 and 999 services.

We achieved this by solving three problems by providing tools to analyse: call content, queuing optimisation and an automated care advice system and using various natural language processing techniques from Azure Cognitive Services, IBM Watson, Google Cloud, and many machine learning techniques.

The outcome of the project is an application that runs on Windows, Linux and macOS platforms.

Making Black-Box Algorithms for Purpose in the NHS

Authors: Zhong Yi, Ayushmaan Seth

Organisation: The National Health Service

Technologies used: Flask, Python, Azure, Docker, TensorBoard, LIME

Abstract: Our project's inspiration stems from the stream of XIA - eXplainable artificial intelligence. The complex-looking structures of neural networks are hard to explain even by the person who designed them. The project aims to interpret and explain, in lay terms, the various black-box algorithms. Algorithms and artificially intelligent models used in different streams, especially in healthcare, raise the issue where the slightest miscalculation can cause catastrophe. The tasks explain the decision taken, what could have happened if the inputs were something else, how close worthy inputs from the flipped decision are, and how we can audit the model to make it suitable for the real-world data.

AI Test Platform

Authors: Wei Tan, Haixiang Sun, Zixuan Wang

Organisation: The National Health Service

Technologies used: Django, Microsoft SQL, JupyterHub, Python, AKS, YAML

Abstract: The project aims to provide a comprehensive web platform for the NHS to post challenges (with its accompanying data) solvable by AI. The developers can work on the challenges on the platform itself and submit their solutions, which we will rank according to their accuracy.

Our solution is a Django-based web project split into smaller Django applications, e.g. challenges, solutions, users, etc., which handles different project areas.

The on-site coding environment, provided using JupyterHub, and Azure Kubernetes Service, manages the hub itself. Additionally, the platform has additional features such as a discussion page for developers to interact and also a tutorial page.

YouTube: https://youtu.be/_-EuEXtKb58

Image Processing, Chatbot and OpenEHR Template for Expanding the use of HaMpton to Include Monitoring of Diabetes

Authors: Zhizhe Xu, Yifan Liu, Yomna Ghannam

Organisation: Trakka Medical

Technologies used: Azure, Xamarin, ASP.NET, Microsoft QnA Maker

Abstract: Healthcare professionals advise pregnant women with a high concentration of protein in urine, hypertension, or diabetes to frequently visit the hospital for testing to monitor for the development of any complications. These visits can cause anxiety for patients and have significant cost implications. Our project aims to mitigate the financial impact and time-consuming nature of this process by extending the Hampton app to allow patients to record and monitor blood glucose and urine dipstick results through a mobile app while displaying these values to doctors through a web app for their evaluation. The app will use image processing to analyse urine dipstick results through pictures and include a chatbot to discuss their results. It will also alert patients and doctors to abnormal results and advise patients to consult their doctor. Overall our app is intended to make this systematic process efficient, cost-effective, and stress-free for both patients and doctors alike.

OpenEHR Compliant Devices Bridge Façade Library for Apps to Collect Further Sensor Data to Combine with HaMpton and NHS Technologies

Authors: Sonia Shah, Yanke Zhang, Yusi Zhou

Organisation: Trakka Medical

Technologies used: Firebase, Ionic3, AngularJS

Abstract: A new care pathway involving an innovative smartphone application for mothers-to-be monitoring high blood pressure and glucose at home to develop pre-eclampsia.

Pregnant women with high blood pressure and diabetes require frequent hospital visits for pressure and glucose monitoring during pregnancy; however, this can now be done at home, saving time and additional costs.

Mothers-to-be have to put on the measuring device, and the application will automatically pick up the readings via

Bluetooth and update these values on the application in real time.

While receiving readings out of the normal range, the application instantly notifies the pregnant women of this. It raises the doctor's contact details while at the same time the hospital system is notified too.

The hospital computer system is integrated with the application and devices where clinicians constantly monitor the data.

This system eliminates the need for mothers-to-be to visit the hospital every day. They can engage with the system, and be alerted instantly.

PEACH Core Data Engine for HaMpton Pregnancy

Authors: Wiryawan Mehanda, Max Bertfield, Selena Li

Organisation: Trakka Medical

Technologies used: Azure Cosmos, Azure Kubernetes, Azure virtual machine, Spark, REST API, Python, Django

Abstract: Early detection of pre-eclampsia is an ongoing goal and challenge in the field of maternal-fetal medicine. To detect this leading cause of preterm births and stillbirths among pregnancies, Dr Asma Khalil of St. George's Hospital is looking for solutions to analyse existing data of numerous pregnancies. Initially, this project aims to develop a data engine that houses datasets of the HaMpton Medical application developed by Dr Khalil. The database engine requires a web application front end that enables data visualisation and provides a friendly interface to download and upload queries. Ultimately, future data scientists can then use this data engine to perform statistical learning.

As we progressed with the project's initial requirements, we acknowledge that the tools we have built in the back end, namely the framework surrounding the Cosmos Database and its API, could be a valuable asset for software developers and data scientists in the future. Hence, we have created a generalised data engine whose API could handle requests of various formats of patient health metrics across various healthcare fields, complete with an authentication system. To showcase the engine's compatibility with modern data analytics solutions, we have also integrated the Django web application interface with an Apache Spark server which queries from the engine API. While the data engine currently houses HaMpton Medical's relatively small dataset by big data standards, we have developed our back-end storage and processing systems with scalability in mind with these technologies mentioned above.

The HaMpton web application front end has fulfilled the need of the client and HaMpton. However, we believe that the data engine framework, along with its API documentation, would have arguably more significant implications for software developers, data scientists, and PEACH teams of the future looking to house data in a

centralised, standardised and secure platform.

YouTube: <https://youtu.be/XFLkZMt1bEA>

Sensing Spoken Distress in Care Homes with ARM Cameras

Authors: Shoaib Omar, Longxi Yin, Kimia Pirouzkia

Organisation: Arm

Technologies used: Raspberry Pi, Node.js, rnoise, CMUSphinx, MongoDB

Abstract: "Preventing tragedies in healthcare" Being in a clinical setting is a scary experience for most people, especially if you're alone.

We designed the EDVS system to give people peace of mind. Its main objective is to alert staff when people are in distress so they do not go unnoticed in times of need.

Users will mainly use the technology in hospitals and care homes. The node will passively monitor and locate every area in which there is an EDVS node. If the node detects potentially interesting auditory activity, it analyses the audio for keywords. If a suspect word/noise is detected, an alert is sent to the dashboard.

YouTube: <https://youtu.be/frgeNepznks>

St George's Implementation of the GOSH DRIVE Holorepository with Depth Scanning Input on Patient's Surgeries

Authors: Rod Matveev, Lovepreet Singh, Jeff Cai

Organisation: St George's Hospital

Technologies used: React, HoloLens, Java Enterprise

Abstract: The project we are working on is an implementation of the HoloRepository for 3D viewing on HoloLens to help in surgical planning for operations. The data in surgery is stored as required, along with the patient records. It should also have a feature for training aid.

The project is to build a system with a cloud data exchange technique that provides the users with information about the patients and 3D data for complex surgical operations.

So, we decided to use a web app, Maven, to manage our repository, developed using React, and deployed through tomcat locally for development. We also have a HoloLens application from the previous iteration of the project, which lets you view the scans in a minimal number of clicks.

Features of our project:

- All the patient data is stored in one place (cloud architecture).
- Accessible from different medical centres.
- Tools to view 3D imaging on a HoloLens.
- An intuitive and unobstructed user experience.
- Partially map HoloRepository entries with patient data.

St George's DepthVisor Surgery Camera with IoT

Authors: Kyla Aguillo, Venet Kukran, Kailun Shen

Organisation: St George's Hospital

Technologies used: DepthVisor, Kinect V2, Azure, C#, Kinect SDK

Abstract: Currently, there are numerous limitations to the way surgeons train. With this project, we are particularly interested in how many people who can fit in an operating theatre during a given time. Surgeons then supplement medical students' learning by providing videos of their surgeries, allowing any number of students to observe their mentors anytime, anywhere.

The main objective of this project is to create a system that will make use of the new Kinect for Azure camera in conjunction with an application to facilitate the learning of medical students by improving the e-learning of students via recorded surgical videos.

Our solution is to create a platform that eases the way the surgeries are recorded and increases the amount of information provided to viewers. We aim to achieve this by having a simple, intuitive interface and producing a normal RGB video of the surgery recordings and a 3D file. This 3D file would be interactive while playing, allowing viewing surgeries from more than one angle.

Initially, we had planned to ultimately create a web application that uses the Kinect for Azure camera. Our requirements changed midway due to unplanned obstacles during the year, such as not having access to the Kinect for Azure camera and initially working with the Kinect V1. We had to rethink another way to implement our solution.

OpenEHR Clinical Knowledge Explorer

Authors: Leo McArdle, Christian Martin Rios, Daniel Kyung-Hwan Min

Organisation: NHS Digital

Technologies used: JavaScript, Jest, openEHR, Nock, Electron, JSDoc

Abstract: OpenEHR Explorer is an open-source application to query OpenEHR CDRs, targeted at developers working in a clinical context. Previously, developers did not have a standardised method of querying, and we created openEHR Explorer to solve the problem. OpenEHR Explorer can query multiple CDRs concurrently with a single AQL query and federate their results into a table.

Key Features:

- Login system to accommodate multiple users with different lists of CDRs.
- Supports authentication of CDRs from multiple vendors.

- One AQL to query one or more CDRs at once and federate results into a table.

YouTube: <https://www.YouTube.com/watch?v=jmtJvnSaQUg>

Exploration of Using Leap Motion and BuruNavi to Manipulate 3D Models at GOSH

Authors: Samuel Bouilloud, Christopher Obasi, Yue Wu

Technologies used: HoloLens, Leap Motion, Buru-Navi, Unity,

Abstract: In collaboration with Sopra Steria and Great Ormond Street Hospital, this project is about creating a way for surgeons at GOSH to simulate operations. The goal here is to increase the security and efficiency of medical interventions. In addition, medical students could also use it as a tool to learn and test their skills/knowledge.

We aim to integrate the Microsoft HoloLens (augmented reality headset) with a Leap Motion (hand-tracking device) and a Buru-Navi (device that guides the user with vibrations) to manipulate 3D organ objects in mixed reality.

We successfully integrated the HoloLens with the Leap Motion, allowing the user to manipulate any 3D model using a set of defined natural gestures. Indeed, the user can move or rotate the objects and add markers on them and strip layers. In addition, we use Buru-Navi's haptics to guide the user's hand to a chosen identification. Finally, complete documentation is available, including a tutorial and a training mode.

AR sOps Platform for Healthcare

Authors: Joseph Halse, Duncan Rowe, Xuanwei Chen

Organisation: NTT DATA

Technologies used: Fritz, Tensorflow Lite, IBM Watson

Abstract: Our client NTT DATA, asked us to make an application to demonstrate their capabilities and gave us a use case of medical professionals needing hands-free technology. Therefore we designed an application based on Epson smart glasses. The user wears the smart glasses, that by using the inbuilt camera, will "see" and recognise various medical equipment, label them and display information about their use. This system gives the user assistance in identifying the item, understanding its purpose, and using it. Instructions are further displayed as text on the glasses, allowing users to keep their hands free from printed manuals, saving time.

In our final prototype, we achieved this by using Fritz API for performing real-time object recognition for the app and TensorFlow to create machine learning models of items to be recognised.

AR Portal for GOSH

Authors: Yin Ho, Chirag Hegde, Haonan Zhang

Organisation: NTT DATA

Technologies used: ARCore, Unity

Abstract: Patients, especially younger ones, tend to be worried before an operation, as they are unfamiliar with the operation theatre environment. Our solution and project are to create an augmented reality (AR) portal within a mobile app that patients can explore to familiarise themselves with the environment so that it is less daunting for them, easing their worries. The app generates virtual medical equipment in a room where users can interact and learn about the operation room and equipment beforehand.

There is also a web application that doctors can use to build and customise their rooms to share with patients. Our achievement and project can then also be used generically instead of just for medical usage.

Rare Disease Resource

Authors: David Elston Georgi Krastev Max von Borch

Organisation: GOSH DRIVE

Technologies used: HTML, CSS, Bootstrap, SQLite, Azure

Abstract: The classification of a rare disease is a disease that occurs in fewer than five in 10,000 people. Due to the low incidence, research on rare diseases is limited, and it is hard for doctors to identify them due to the lack of precedence cases. 75% of rare diseases affect children, and 30% of these patients die before their fifth birthday.

In 2015 GOSH opened the world's first centre for research into rare diseases in children. Our project aims to build on that research to create a comprehensive educational platform that allows trainee doctors to view anonymised clinical observations of patients with rare diseases. The platform will improve their knowledge and training experience and prepare them better to identify and recognise rare diseases in their future careers.

The rare disease website allows users to browse a database of anonymised real medical cases categorised by disease and disease category. Access to the cases does not require registration. Users are required to have an NHS email address to create an account. Creating an account allows users to submit new cases, which they can then post on the website. Before putting it online, a new case is reviewed by a moderator to ensure its quality and compliance with the anonymity requirements.

From a technical perspective, the site has several aspects that we should highlight. It has a responsive design with an 'NHS look and feel'. We implemented facial recognition to prevent pictures with faces from being uploaded as part of the disease documentation and ensure patient anonymity. Furthermore, we implemented a bookmarking system to

allow logged users to save cases. Finally, an autocomplete search function generates search results as a user types the search query. This system ensures that users find what they are looking for as quickly and efficiently as possible.

Looked after Children Health Plan

Authors: Christopher Pettinga, Nilay Patel, Anthony Williams

Organisation: North Tyneside CCG

Technologies used: CSS, HTML, JavaScript, jQuery

Abstract: The NHS is responsible for the health and safety of Looked After Children (LAC), a designated class of 10-18 year-olds who are at risk for a variety of reasons.

A critical development in their care involves a need to lead healthier lifestyles, both physically and mentally. Typically, the LAC group may not have the health skills needed to lead healthy adult lives.

Healthify.io is a web application that focuses on two key areas; firstly, it facilitates the nurse-LAC setting of goals on critical health skills (exercise or drug usage, for example) that nurses and doctors of the LAC group identified as essential to future healthy lifestyles. The setting of goals also links with the NHS's current LAC care guidelines that involve an annual and formal health check-up with a nurse.

Secondly, it is an educational and motivational tool that 'nudges' the LAC group to lead healthier lifestyles by giving medically approved health tips and allowing them ownership by tracking their attainment of goals. The app also aims to be visually attractive to both younger and older children to encourage repeated use.

In conclusion, Healthify.io is a framework for continuous improvement and meets its goal of promoting healthier lifestyles for looked after children.

Clinical Training App

Authors: Anna Rolland, Shirajul Hussain

Organisation: GOSH DRIVE

Technologies used: Ionic 4, HTML, CSS, Node.js, PostgreSQL, Azure

Abstract: Great Ormond Street Hospital Digital, Research, Informatics and Virtual Environments Unit, also known as GOSH Drive, would like to improve the learning of rare diseases for medical students. The

diagnosis skills for these rare diseases include specific tests and knowledge. It is challenging to get sufficient practice on these skills as they are rare, and practical training is time-consuming and resource-heavy.

The solution is to digitalise this learning experience, making it viable, cheap, and easily accessible. The resolution, in practice, will be a mobile application. The concept is a quiz-like question and answer game. Areas

of medicine can be selected, with questions on rare diseases, following a patient scenario environment.

The solution was implemented for deployment on both iOS and Android and developed with the Ionic 4 framework. Ionic 4 allows front-end development with traditional web technologies such as HTML, CSS and JavaScript. Whilst it allowed compatibility with Node.js in the back end.

We used Microsoft Azure to deploy the server, whilst we selected PostgreSQL to be the Database Management System. The core functionalities have been 100% implemented whilst carrying out 50% of optional functionalities.

GOSH Visitor Management App

Authors: Benjamin Smith, Chao Ding

Organisation: GOSH DRIVE

Technologies used: HTML, CSS, Balsamiq, JavaScript, Azure, MySQL

Abstract: The DRIVE technical unit of Great Ormond Street Hospital regularly host events in their office space and, during this time, they have a large number of visitors in the building whom they would like to keep a record of. Visitors can either book onto an event beforehand or drop in, so paper records are the current method to collect their information as they enter the building and determine which type of visitor they are. The paper records are necessary during evacuation to ensure the safe evacuation of all signed-in visitors. Therefore, the clients requested a method of digitising this process so that the records are easier to manage. There is a smaller chance for human error, and the data is in a single, centralised location.

We conducted initial research into the user types and the possible technologies to determine the best way to tackle this problem. From this research, the proposed solution involved a web admin panel managing the event and visitor data, plus a mobile application that visitors could use to sign in/out. The selected technology for the mobile application development was Ionic 4, and the chosen technology for the web app was Node.js. This web app would provide a back end for the system to serve standard HTML, CSS and JavaScript files to clients when users requested pages, and it also provided an API for these web pages and the mobile app. We took a HCI approach during the user interface design for both components, and we considered several design principles throughout the process.

Upon completion of the design, testing was carried out on both components to increase their robustness. The resulting solution to the initial problem then satisfied most of the key requirements established at the onset of the project and a handful of the optional requirements. The web app was deployed to a virtual machine and then deployed on Azure alongside the MySQL database. We then generated an APK file for the mobile app that we

could use to install it on a device. We then discussed future modifications to the components to identify the systems advancement with more development time.

OpenEPCIS Medicines Tracker

Authors: Joseph Savidge, Haow Jern Tee, Lee Simmonds

Organisation: University Hospitals Plymouth NHS Trust

Technologies used: Ionic 4, Angular 7, Typescript, SCSS

Abstract: Moving medicine packages around hospitals is an incredibly tedious task; packages get lost daily, wasting hundreds of hours of staff time searching for their whereabouts.

At Plymouth Hospital, there are currently no means of tracking patients' medicine around the building and between staff members. Staff can misplace medicine and patients regularly change wards leading to significant delays in discharging patients (as they must wait for their medicine) and potential safety breaches as packages remain unmonitored.

The solution, a mobile app deployed to staff devices, integrated with scanning technology, tracks the whereabouts of medicine packages using a sophisticated barcode system. The app would allow each phase of the bag's movement to be recorded in the hospital's database, increasing transparency and drastically reducing time spent searching for lost bags.

Pop ups notify the staff in real-time if the patient has moved ward or passed away, streamlining the process. Authentication will restrict non-approved individuals from handling bags helping to avoid malicious behaviour. The client requested the app's design to be as modular as possible to ensure deployment across the NHS following a successful trial in Plymouth Hospital.

We built the app using the Ionic 4 and Angular 7 frameworks, along with Cordova plugins, using Typescript and themed to match the hospital's existing apps using SCSS. This combination allowed for cross-platform deployment and responsive design to work smoothly on the hospital's various devices. The OAuth2 protocol authenticates users. JSON data is received and manipulated to fit the correct OpenEPCIS (internal) standard. Data is currently passed between users and states locally on a device; however, there is scope for API integration in the future, although the client did not release it before the deadline. The technologies mentioned above allow for a scalable, modular solution capable of being used across the NHS network.

GOSH Informed Consent App

Authors: Dan Ward, Ross Murray, Azariah Kusi-Yeboah

Organisation: GOSH DRIVE

Technologies used: PHP, Ionic, MySQL

Abstract: Great Ormond Street Hospital (GOSH) is a specialist children's hospital that invests significant effort in medical research studies. Before a patient can participate in a study, they (or a family member) must give informed consent, depending on their age. This process involves reading information sheets about the study and completing and signing a consent form.

The current patient consent process for studies is entirely paper-based, making it time-consuming for the frontline staff (such as nurses) who register patients' consent.

For example, they have to make multiple photocopies of forms and store them in different physical locations. Paper records can also be misplaced and are not compatible with GOSH's long-term plan to move to fully electronic patient records.

GOSH asked us to create an application that streamlines the consent process. This report sets out the design and implementation of our application, Informed Consent. It has two parts: a web application through which study decision-makers ('administrators') can create information sheets and consent forms; manage frontline staff permissions to take consent for their study; and view completed consent forms and simple statistics about them. The other part is a tablet app that frontline users can use to take consent from patients and parents; they can read information sheets and fill in consent forms on screen and then, at the press of a button, save the completed forms to a cloud database.

Overall, we consider that Informed Consent is a success. We have delivered a working application that meets all of the 'must have' and 'should have' requirements we agreed with GOSH. Due to the complex legal framework around the use of patient-level data in the NHS, GOSH will need to go through some additional approval processes before deploying Informed Consent for real-life use. We received strong positive feedback from GOSH staff involved in the current consent process.

GOSH Device Management App

Authors: Wilfrid Berry, Cecilia Pretus, Poyzan Taneli

Organisation: GOSH DRIVE

Technologies used: HTML, JavaScript, CSS, PHP, Azure, PHP, MySQL, Cordova, Ionic 4

Abstract: This report outlines the process of developing a website and a mobile application to manage a series of devices owned by GOSH DRIVE and lent out to external clients. GOSH DRIVE is a new unit of Great Ormond Street Hospital whose goal is to enhance technology in healthcare by digitalising and transforming existing systems to improve patient outcomes. It aims to bring together the ideas and expertise of those working with digital technologies both within DRIVE and the wider NHS and industry partners.

Our client tasked us with developing a digitalised solution for the easy and efficient management and tracking of a series of devices GOSH DRIVE owns. These devices were donated to our client by Samsung and included smartwatches, cameras, tablets and VR headsets. Samsung loan these devices to students and other external users for specific periods during academic projects. The pre-existing solution involved DRIVE staff tracking these devices manually using an Excel spreadsheet and a paper loan form to capture borrower details. This spreadsheet was ad hoc

and had to be updated manually whenever the checking in and out of a device took place, making the process unnecessarily time-consuming and prone to data inconsistencies and inaccurate tracking of devices.

As part of our proposed solution, we developed (1) a cross-platform mobile application enabling GOSH employees to quickly and easily check in and check out devices lent to external clients, both manually and using a QR code, and (2) a website with a flexible dashboard enabling employees to track, manage and edit the different devices easily. We built the app using Ionic and the AngularJS framework, Typescript, HTML and CSS, and PHP to access an SQL database hosted on Azure. We used a REST API to make HTTP requests to send and fetch data in JSON format. We built the website front end using HTML and CSS, and we used PHP to access and manipulate the SQL database. The theme of both the app and the website were according to guidelines provided by GOSH Drive.

Client feedback was extremely positive with the final versions of the website and mobile app. They believed we captured their requirements and the user experience was very smooth and enjoyable, and in particular, constant dialogue with our clients enabled us to refine our requirements regularly.

CRF Staff Activity App

Authors: Darren Ko, Jacob Carrant

Organisation: GOSH

Technologies used: MySQL, Azure, Django, HTML, CSS

Abstract: GOSH Clinical Trial employees employ outdated, basic Excel spreadsheets to log and analyse staff activity data over designated time intervals. The system suffers from inaccurate data collection and low user satisfaction stemming from repetitive and inefficient logging processes. Users of the current system are constrained to PC desktop-reliant data input.

The project improves and streamlines the process by moving data collection to mobile devices, supporting Android and iOS. We can reduce erroneous user input throughout this process, and activity logging is more efficient as minimal user interaction is necessary to input data.

Simultaneously, the project improves management staff workflows, with data handling and administrative management tasks delivered via a companion web page for administrators' and business managers' ease of use.

Delivery of both a full-fledged smartphone application and a multi-functional website by a two-person team was difficult to achieve within the project timeline due to the extensive functionality offered by each full-stack deliverable. We successfully hosted the website and MySQL database in Heroku and Azure, respectively. The smartphone application was completed and fully functioning on the front end as an input interface but only partially hosted and completed on the back end and database. Both the smartphone application and website would require further testing and approvals before deployment within GOSH.

Case study: the FHIRworks 2020 Hackathon



IXN for the NHS focuses on delivering Interoperability, Efficiency and Innovation (IEI) in the proofs of concept we devise with our healthcare partners.

Since 2017, many students have collaborated with the NHS to create pioneering prototypes with the latest FHIR (Fast Healthcare Interoperability Resources) standards. These FHIR standards make healthcare systems talk better to each other.

In 2020, we ran the UCL–GOSH FHIRworks hackathon. Students built 129 open-source demonstrators over two days. They used a synthetic patient record testbed. The testbed offered FHIR API access allowing connection to any developer environment and technology stack.

The exploratory prototypes ranged from smart letter generators to graphical data visualisations, smart watches to scanners, and chatbots to AR/VR demonstrators. Projects also included automated video conferencing over Skype and Microsoft Teams, filtered FHIR data aggregated on Google Maps to visualise patient demographics and immersive solutions that conceptualised patient FHIR records as holograms.

“Superb work by all of our students who have contributed ideas across their fields of interest. We are really grateful for their efforts and look forward to many of these being published as open source for GOSH and the NHS.”

Professor Dean Mohamedally, co-founder of IXN for the NHS





A guest team of technology specialists from IBM, NTT DATA, Intel, GOSH, Aridhia and EMIS, alongside NHS staff, mentored and then reviewed the student's ideas. We also held a 'Dragons Den' session for six selected students to explore the potential of their concepts.

The FHIR solutions are now hosted in a demonstrator suite at GOSH to introduce FHIR principles and capabilities to staff.

We've listed the FHIRworks hackathon projects among our abstracts. We hope you enjoy reading about them.

"Amazing projects in 48 hours. Can't wait to see the best ones taken forward by GOSH DRIVE and more widely. Hackathons are a huge amount of behind-the-scenes work, so many thanks."

Neil Sebire, Professor of Pathology and Chief Research Information Officer GOSH/UCL

2019-2020

Assessing Service Satisfaction Using Sentiment Analysis

Author: Chakradhar Koppula, Kar Lid Chan, Lian Wang

Academic: Dr Dean Mohamedally

Client: Sally Atkinson, Christopher Munyasya

Organisation: NHS, Microsoft

Technologies used: Azure Text Analytics, Azure Cloud Storage, TensorFlow, Keras, Python, Flask, Power

Keywords: Healthcare, Sentiment Analysis, Data Visualisation, Data Analytics, Patient Feedback

Abstract: The NHS Friends and Family Test was created to understand whether patients are happy with the service provided by the NHS. The form collects how likely patients are to recommend the NHS and any comments they have.

This project aims to provide a system that allows for the service feedback collected to be analysed using sentiment analysis and then visualised in Power BI to gain insights into what departments are performing well and where improvements can be made. In collaboration with the NHS and Microsoft, we have created an in-house API that gets patient feedback data from Azure cloud storage, carries out sentiment analysis on comments and writes the analysed data to a cloud-based database.

Overall, the system is intended to make the analysis of patient feedback simpler and more insightful so that the NHS can identify strong and weak points in the service it provides.

AutoWorld

Author: Lingzhi Xu, Eesha Irfan, Govind Balla

Academic: Dean Mohamedally

Client: John McNamara

Organisation: IBM

Technologies used: C#, Unity, Watson

Keywords: Game, Business

Abstract: Learning business theory has become mundane and laborious. Our objective is to create a game that will show learners how decisions made in the business world affect companies and apply theory to the real world through a simulation. The solution is AutoWorld. Our AI entrepreneur game focuses on the autonomous car industry to make learning business theory more fun and intuitive. The game will use real-world articles to generate realistic game events, making the game more immersive.

This will be done using Watson Discovery and Tone Analyser. The level-based game will challenge players to compete against each other and grow a successful company.

Chatbot for Education

Author: Daniel Lahlafi, Paul Xin, Yuer Qiu

Academic: Haroon Yousaf

Client: Joesph Connor RCGP

Organisation: GOSH

Technologies used: Django, BERT, HTML, CSS, Javascript, Python

Keywords: NLP

Abstract: A chatbot that performs question extraction on RCGP toolkits so that GPs can quickly ask questions and get answers from the toolkits.

Repository: <https://github.com/daniel-lahlafi/django-syseng-backend>

Augmented Reality Business Card System

Author: Ziheng Zhang, Zhiwei Zhang, Jiayi Chen

Academic: Dr Dean Mohamedally

Client: John McNamara

Organisation: IBM

Technologies used: Unity, Flutter, Node.js, Vue.js, MongoDB, C#, Azure, Vuforia, IBM Watson

Keywords: Business, AR, Augmented Reality, Chatbot, AI, TTS, Voice Recognition

Abstract: Business cards are common and popular in many kinds of situations. People receive and give business cards during networking events, for example. However, they are not easy to manage. People tend to lose physical cards, and they contain limited information.

We have designed a mobile and web multi-platform service, with an AI-powered interactive 3D AR avatar, for people to view and share virtual business cards. Powered by IBM Watson Assistant, users ask the avatar questions in natural language. These questions range from their education and business plan to their hobbies, simulating a natural conversation. The avatar uses advanced text to speech and voice recognition to boost the experience. Anyone can register and create their own 3D avatar business card to share publicly, and users can easily access specific cards by setting them as favourites.

Repository: <https://github.com/ibm-ar-card>

YouTube: https://www.YouTube.com/watch?v=pxXM_Y-umRs

Learning Advanced Semantic Text Representations for the Identification of Recipe Ingredients from Recipe Titles

Authors: Lorenzo Polidori

Academic: Dr. Dmitry Adamskyi

Client: ZOE Global LTD

Organisation: ZOE Global LTD

Technologies used: Python, Pytorch, Numpy, Pandas

Keywords: Data Science and Machine Learning

Abstract: The main goal of this industrial project was to achieve high-quality, semantically coherent, linear representations of unordered sequences of domain specific text. These vectorial encodings were computed using state-of-the-art automatic machine learning architectures commonly employed in large-scale natural language processing tasks. The set of available data belonged to the domain of knowledge of nutritional science. Therefore, high-dimensional representations of recipes (their lists of ingredients and corresponding titles) were found. The abstraction level of these representations was assessed through a practical retrieval experiment and several qualitative tests. Furthermore, a linear programming solver was utilised to implement a commercially viable meal decomposition pipeline. The final project's outcome is a complete complex process: given a recipe's title, its advanced representation is computed to retrieve relevant ingredients. Their individual quantities are also inferred.

X5GON-mobile

Author: Patrick Wu, Yinrui Hu

Academic: Phil Demetriou

Client: Sahan Bulathwela, Prof. John Shawe-Taylor

Organisation: University College London

Technologies used: Swift, Objective-C, Python, Flask

Keywords: Software Engineering, Mobile Application, Design

Abstract: X5GON is an industry-leading open education resource provider. In this project, we worked with the UCL X5GON research team to deliver a mobile application that provides users with an authentic and mobile-friendly X5GON experience and learning materials catered for their needs. With this project, the X5Learn system would be able to attract more users from the mobile platform and enable them to learn anything anywhere.

YouTube: <http://students.cs.ucl.ac.uk/2019/group4/#preview-video>

Speaker Recognition Prototype – RISE2

Author: Sabina-Maria Mitroi, Ruo Chen, Jingze Xu

Academic: Dr. Dean Mohamedally, Maliththa Sahan Sarojan Bulathwela

Client: Harris Partaourides (Researcher)

Organisation: Research Centre of Excellence in Cyprus (RISE Cyprus)

Technologies used: Python, Django, HMMLearn API

Keywords: Machine Learning

Abstract: A telecommunication provider company receives thousands of calls per day and needs to improve its customer service by verifying the customers in recorded calls. A part of the evaluation process is the verification of the customer which is difficult if this is not done by the call operator during the call. We came up with a speaker recognition prototype to help the call operator to identify the person faster, rather than asking the caller. Thus, the calls are recorded and saved for further evaluation by the quality control department of the company. The application will help the company to decrease the time needed for the evaluation process and improve its services, increase customers and revenue. The impact of this application will help both sides.

YouTube: A video which presents in more detail our project is here: <https://students.cs.ucl.ac.uk/2019/group47/starterTemplate.html>

Centralised Information System for Paediatric Trauma patients

Author: Ethan Fraenkel, Shitong Mi, Nathalie Carmona

Academic: Dr Yun Fu

Client: Dr. Shabnam Parkar

Organisation: NHS

Technologies used: Node Js, Microsoft Azure, HTML, CSS, Javascript, SQL

Keywords: Healthcare

Abstract: The four main trauma unit hospitals in London do not have a way of sharing, aggregating, and viewing all the data for the patients across their different hospitals. This is an issue, as sharing data among them could increase the efficiency and could help with establishing certain patterns with patients who have specific conditions. To this end, we will be creating a platform with a robust database for these four hospitals to allow them to better upload/share data among them. Only the four lead doctors, and one administrator, of those trauma units will be able to add, edit and view data of all the patients across these different trauma units.

Hear Me Out

Author: Max Bosch, Jason James, Lucy Rothwell

Academic: Yun Fu

Client: GOSH

Organisation: GOSH

Technologies used: Azure, JS, HTML, node.js

Keywords: Healthcare

Abstract: Problem Statement

Child patients in Great Ormond Street Hospital (GOSH) are given a great deal of time and support from the hospital. In the adult healthcare system, this is not always the case. When children move into the adult system at the age of 18, they struggle to navigate it, and a decline in health can be seen.

Solution:

A mobile app was built in Ionic using Angular and Typescript, which allows patients to store and track their appointments, find the location of their appointments, take notes in meetings, upload medical records and search for services they need. Patients can also access a 'news' section of the app, where they can be kept up to date with the latest information relevant to their condition. A website content management system was also created for clinical staff. This allows staff to upload articles into the 'news' section of the mobile app.

Universal Controller

Author: Zhiqing Wei, Xiaowen Li, Akkaraphonphan Tai

Academic: Dr Yun Fu

Client: Dr Barrie Mair, Mr Alan Fish

Organisation: Apperta

Technologies used: C#, WPF, MongoDB, Jaco SDK

Keywords: Internet of Things (IoT)

Abstract: Currently, there is no open-source way for people with disabilities to benefit from using IoT devices. This project aims to produce one universal controller desktop application capable of taking feeds from multiple input devices and output to various mainstream IoT devices. Specifically, we are working on adding a Jaco robotic arm, which only supports the joystick as its control source as the output device and would like to combine the Eye Gaze as an input device. Additional functionality to provide a live stream camera scene can give the user a perspective view, allowing them to see the parts occluded by the arm. The solution can help those who do not have a high level of manual dexterity to accomplish many typical tasks, such as drinking, picking up objects, opening doors, and making their lives easier as a result.

Craniofacial App

Author: Andy Brinkmeyer, Yasmin Abedin, Siobhan Hughes

Academic: Yun Fu

Client: Gemma Molyneux

Organisation: GOSH DRIVE

Technologies used: Angular, Django, Azure

Keywords: Healthcare

Abstract: Some children are born with misshapen heads, so-called craniofacial conditions. While in some cases the issue improves without intervention, others need professional treatment. But since those defects can be rare, GPs have difficulty identifying them, resulting in long referral times.

To improve the referral process to specialists at Great Ormond Street Hospital, we were tasked with developing a web application that helps GPs collect and share relevant data with the specialists.

When the GP suspects a craniofacial condition, they issue a questionnaire to the child's guardian via the web app. The collected data can then be used by the specialists to ask for additional information or to better prepare for the first consultation.

Uveitis Passport

Author: Mobin Sediqi, Asrath Rahman, Elizaveta Kretova

Academic: Dr Yun Fu

Client: Dr Lola Solebo, Gemma Molyneux

Organisation: GOSH DRIVE

Technologies used: Ionic, Angular, TypeScript, CSS, HTML, SQLite

Keywords: Healthcare

Abstract: This mobile app is aimed at helping children with uveitis, which is a group of chronic, relapsing-remitting, potentially blinding inflammatory eye disorders. Care for children with uveitis is multi-centre and multidisciplinary. The key care team may be in a geographically distant location, an obstacle to informing teams at local hospitals when children present with problems associated with their eye disease, systemic disease, or complications from therapy. It can be a challenge to educate young people about their childhood onset disease. This mobile app supports children and their parents to manage their treatments, eye history, medical teams, and general health.

Hospital Surveys – Collecting Patient Feedback

Author: Min Yen Lau, Shengtong Jiang, Bahdan Kapionkin

Academic: Dr Graham Roberts

Client: Gemma Molyneux, Daiana Bassi **Organisation:** GOSH DRIVE

Technologies used: Django, React, Python, JavaScript, Heroku, PostgreSQL, Redux.

Keywords: Progressive Web App, Software Development, Data Collection, Anonymised Patient Feedback

Abstract: We believe it is crucial for child patients of Great Ormond Street Hospital to be able to provide feedback based on their experiences. Whether it be hospital facilities, the way patients are treated, or just the overall experience, feedback not only allows children to share their experiences but can also help improve hospital services in the future. Thus, we have developed Hospital Surveys, an online survey tool that allows child patients to answer surveys to provide feedback anonymously. Surveys can be designed and managed by hospital staff using a web application and delivered to patients using a progressive web app. A database stores the anonymised patient feedback, which can be exported for further analysis. Graphical visualisation also helps analyse survey data and patient responses.

Repository: <https://github.com/michaellmy/hospital-surveys-dev.git>

Augmented Reality Avatar Receptionist

Author: Lilly Neubauer, Oliver Vickers, Dillon Lim

Academic: Yun Fu, Felix Thiel

Client: John McNamara

Organisation: IBM

Technologies used: Unity, C#, Azure, SQL, IBM Watson, Android

Keywords: Augmented Reality, voice recognition, chatbot, machine learning, avatar, Unity

Abstract: With advances in mobile graphics and machine learning, lifelike augmented reality avatars are becoming feasible as an alternative to a human presence in customer-facing interactions. Our project aims to create an AR receptionist, viewed through a smartphone or tablet, that can respond to standard reception tasks.

Social / Multiplayer AR Game

Author: Lu Han, Neha Ranade, Jingtian Yuan,

Academic: Dr Dean Mohamedally, Dr Graham Roberts, Dr Yun Fu, Dr Chris Evans

Client: Nadia Aziz

Organisation: NTT DATA

Technologies used: Unity, Photon Engine, AR Foundation, ARCore Cloud Anchors

Keywords: Multiplayer Game, Augmented Reality

Abstract: The project is to create a multiplayer game that uses augmented reality. The goal of the game is to help users socialise in an engaging way. Our finalised game concept involves users catching virtual popcorn within a time limit against contending players.

Augmented Reality (AR) Game Builder

Author: Jiaxin Lin

Academic: Dr Ghita Kouadri Mostefaoui

Partners: Daiana Bassi

Organisation: Great Ormond Street Hospital (GOSH)

Technologies used: Unity Project

Keywords: AR

Abstract: Children during their stay in hospitals are expected to follow certain routines, for example, washing their hands / sanitising. They might find these routines non-interesting and might forget at times. This project is to develop an AR application (Android) to gamify and encourage children to follow the routines during their stay in the hospital. This could be achieved through an AR pet or a game where they score points for following the routines.

Simulator Predicting Emergency Department Business Using AI

Author: Ethan Wood, Noan Le Renard, Wuhao Chen

Academic: Dr Dean Mohamedally

Client: Sally Atkinson

Organisation: NHS and Microsoft

Technologies used: Python3, TensorFlow, PostgreSQL, Flask, Node.JS, Azure

Keywords: Healthcare, Machine Learning

Abstract: A generalised system to allow the modelling of any emergency department within an evaluation framework. A model can be written in Python where, once uploaded, it will be run against historical patient data to gain a score for its particular metric. The system automatically manages and scales models while providing a simple Python object interface to patient data. One of the provided models is a machine learning algorithm of emergency department admissions, with improved accuracy over the current admission prediction system. The framework will include a graphical user interface for interacting with the models and a RESTful API to retrieve and request data.

Workplace Guru

Author: Valentin Gorbunov, Yuxuan Liao, Yusen Li

Academic: Dr Dean Mohamedally

Client: Fergus Kidd, Chris Lloyd-Jones

Organisation: Avanade

Technologies used: JavaScript, JQuery, HTML5, CSS3, Tizen Advanced UI Framework (TAU), Azure, Cosmos DB, MapBox, Leaflets, Quantum GIS(QGIS), Raspberry Pi 3

Keywords: internet of things (IoT), wearable, geographic information systems (GIS), spatial analysis', georeferencing

Abstract: The Emerging Technology team at Avanade pushes the limits of technologies to help clients obtain a competitive edge through applied research. To this end, Avanade have partnered with UCL to undertake a project investigating how wearables may be used to better manage employee fatigue. Fatigue resulting from over focusing on a task and excessive amounts of time spent searching through directories to find places leads to a decline in performance. Workplace Guru is a fatigue management app that integrates optimised indoor and outdoor directions to spaces in the workplace with time tracking software, that tracks how users allocate their time around the workplace and notifies them when excessive amounts of time have been spent in one place. Should the project be a success, it would facilitate increased employee productivity by reducing transit times, improving employee wellbeing as a result of better time management, and optimising the onboarding process.

YouTube: <https://youtu.be/V-JFEdGNH2Y>

Food Intelligence Services

Author: Samuel Emilolorun, Kaan Turan, Mukilan Bakeerathan

Academic: Dr Yun Fu, Dr Dean Mohamedally, Dr Graham Roberts

Client: Richard Watkins and James Smyth

Organisation: Ocado

Technologies used: Tensorflow, Keras, sklearn, NLTK, Gensim

Keywords: machine learning

Abstract: We were tasked with designing, testing, and evaluating models for producing recipe embeddings to predict and recommend ingredients the user may want in real-time, ultimately easing the user experience. It's a research project mainly aimed at finding the best methods for producing meaningful low-dimensional recipe embeddings that can be used in neural networks to create food recommender systems.

GetMyPolicy – Transforming Service Use In Hospital Interactions Using Chatbot

Author: Rakshita Kumar, Rafay Mahmood Siddiqui, Chris Tan

Academic: Dr Graham Roberts, Dr Yun Fu, Dr Dean Mohamedally

Client: Sally Atkinson

Organisation: NHS England, Microsoft

Technologies used: C#, Microsoft bot framework, Azure data bricks, Microsoft Azure Cognitive Services, Azure SQL database, LUIS, BERT, PolyAI

Keywords: Chatbot, Healthcare, Deep Learning, Natural Language Processing, NLP Transformers, L learnt Embeddings

Abstract: Searching through hospital policies for crucial information is a task health professionals carry out daily. With the help of the Microsoft bot framework and Azure Cognitive Services, we aim to create a chatbot that makes the process of searching these key documents effortless and efficient. After entering queries, our bot communicates with an SQL database to show users a preview of relevant sections in the documents, ensuring the user downloads only pertinent documents. Beyond the initial task of searching, we also provide additional features such as viewing the popular policies and a feedback system. In the case of supporting a larger number of documents (>10,000) we have also developed a second bot which carries out searches using Azure Databricks – a technology that handles large databases of documents more efficiently. Concurrently, we worked on an experimental fork of the project applying BERT and sentence embedding models to test the efficacy of deep learning to this task.

Repository: <https://github.com/Reton2/DocBotNHS.git>

YouTube: <https://youtu.be/6cOQ8NTu1nA>

Orthopaedic Patient-Record Outcome Measures (PROMS) Visualisation Based On openEHR Standards.

Author: Charlie Cowan, Haze Al-Johary, Menghang Hao

Academic: Robert White (for first term: Kehinde Owoye)

Client: Ian McNicoll

Organisation: Apperta Foundation

Technologies used: React, Node.js, MongoDB, openEHR standard

Keywords: Healthcare, Visualisation

Abstract: There is a lack of open-source, easy-to-use patient recorded outcome measures (PROMS) visualisation and collection software. Our project is an open platform web app that visualises patients' progress. This will aid doctors and public health professionals in understanding the recovery of patients and also aid patients in understanding their own recovery. The system is built as modules that can be adapted for other applications (e.g., the graphs, the survey pulled in from operational templates).

Repository: <https://github.com/ihaze111/orthoPROMS/>

Speech Emotion Recognition: Current Practices And Real-Time Applicability

Author: Bilal Ahmed Tariq, Wenhua Wei, Bang Ma

Academic: Dean Mohamedally

Client: George Kirkos, Dr Andreas Lanitis, Harris Partaourides

Organisation: Research Centre on Interactive Media, Smart Systems and Emerging Technologies, (RISE) - <http://www.rise.org.cy/en-gb/>

Technologies used: C#, Python, Django, REST, JavaScript, React, Redux, Postgres, Azure Functions, Azure Blob Storage, Azure Storage Queue, Azure Web Apps, TensorFlow, Keras

Keywords: Machine Learning and AI, Data Science, Speech Processing

Abstract: Our aim is to research the viability and the current state-of-the-art approaches to real-time speech emotion recognition. We are also tasked with using these approaches to create a service for call centre managers to evaluate and improve the performance of call centre agents.

We are developing a web platform that allows managers to upload call recordings to the system for analysis and aggregating the results of the analysis to provide insights into the performance of individuals in the call centre.

Public Led Health Intelligence – Carer Android Application

Author: Swechha Kansakar, Siwat Chairattananamokorn, Derrick Macakiage

Academic: Dr Graham Roberts, Dr Dean Mohamedally

Client: Joseph Connor

Organisation: HLP, CarefulAI

Technologies used: Android Studio - Java, Web App - Node.js, Express, MySQL,

Keywords: Healthcare

Abstract: We have created an Android application for carers which passively monitors pedometer data (number of steps taken) and telecommunication usage (calls and text messages made) to generate a weekly wellbeing score based on regional targets. Our app monitors two out of the five ways of wellbeing, Connect and Be Active, to understand the link between these steps and the wellbeing of a carer over a period of weeks. The data collected can be shared with trusted contacts as graphs and JSON. If a user's targets have not been met, the app will nudge them to schedule activities with a member of their care network. With permission, data in the form of local differential data is sent to persist in a nationwide database to inform public health advocates about user trends. This is visualised as an outbound postcode map visualisation.

Eyes First games for People Severely Affected by Disabling Conditions (e.g., ALS, Spinal Cord Injury)

Author: Nayana Dasgupta, Farhan Mahmood, Guide Limjumroonrat

Academic: Dr Dean Mohamedally

Client: Jarnail Chudge, Ann Paradiso

Organisation: Microsoft

Technologies used: Unity, C#

Keywords: Game Development, Accessibility, Eye Tracking

Abstract: Our aim was to produce a rich and unique eye-tracking game for individuals affected by severely disabling conditions. People with severely disabling conditions often retain good control of their eyes. However, there is a lack of applications and games that are designed for and fully support the use of eye tracking. Using Unity, we created 'Of Mice and Messages' – a fun and unique pipe-based puzzle game where users read messages in an overarching storyline by moving and rotating pipes to direct the flow of water from a starting mail pipe to a finishing mail pipe. The game was designed for use with an eye-tracker from the outset, with support for dwell-time based activation and follows best practices for eye-tracking interaction design. We have also created an eye-tracking 2D package, to assist future Unity developers in creating 2D eye-tracking games.

YouTube: <https://youtu.be/FtVaTgAGVho>

Chatbot For Medical Development

Author: Adnan Ahmad, Rajesh Goyal

Academic: Dr Dean Mohamedally

Client: Dr Pritesh Mistry

Organisation: RCGP

Technologies used: C#, Azure, Python, Microsoft Bot Framework, LUIS, Python

Keywords: Healthcare, chatbot, ML

Abstract: Every year, entrepreneurs in the UK are discouraged from investing in their ideas in the medical sector because of a lack of information available on projects already under development. This information, if it does exist, is hard to find and often the opportunity cost of searching for it puts off investors completely. Our solution is to collate all this information into a single database and provide an intuitive chatbot interface for investors to query it with, helping them to find a gap in the market or build upon an existing idea in development.

Repository: <https://github.com/addybongo/Projects-Chatbot>

ANCSSC Mapping Tool

Author: Afiq Bin Samsudin, Yangtao Ge, Ruairidh Williamson

Academic: Dr Dean Mohamedally

Client: Matthew Fallon

Organisation: ANCSSC

Technologies used: Java Spring Boot, MySQL, JavaScript, React, Chart JS, Azure, Mapbox

Keywords: Non-profit, Data Visualisations

Abstract: The project is designing a Visual Mapping Tool for the Alliance of NGOs and CSOs for South-South Cooperation (ANCSSC). The tool will use International Aid Transparency Initiative (IATI) data which could then be replaced later with the ANCSSC's members' data. When the tool uses IATI data it could be used by non-governmental organisations (NGOs) and civil society organisations (CSOs) to understand the types of projects, donors, and locations. They could use this tool to understand the data and create strategies to maximise their impact. CSOs and NGOs often do not have enough time or resources to do fundraising research. Data licensing also needs to be considered; most of the IATI data is open to use and modification, However, some is not, so the tool could keep track of this.

Repository: <https://github.com/UCL-COMP0016-Team37>

YouTube: <https://www.YouTube.com/watch?v=icMEV6lzz94>

Meaningful Conversation Tagging

Author: Vincent Leong, Ali Ghariani, Tiancheng Jiang

Academic: Dr Dean Mohamedally

Client: Joseph Conner

Organisation: CarefulAI

Technologies used: NodeJS, Electron, IBM Watson

Keywords: Healthcare, Speech to Text

Abstract: In many fields of healthcare, transferring conversations between individuals into data could be very useful. Looking at the resulting database record, we could analyse the conversation for different purposes such as saying if the conversation is good or bad. Speeding up the transfer from audio to data could make a huge impact on the health system.

Avant-Garde

Author: Eduardo Battistini, Choi Lam Wong, Nian Ran

Academic: Dr Dean Mohamedally

Client: Jarnail Chudge, Ann Paradiso

Organisation: Microsoft

Technologies used: UWP, C#, XAML, Tobii EyeTracker 4C

Keywords: Accessible Technology, Human Computer Interaction, Motor-Neuron Diseases, Eye Tracking

Abstract: Avant-Garde is a hands-free painting application that enables users to create free compositions or mandalas, utilising eye-tracking technology as the unique source of input. It aims to open new creative channels through uplifting, visual experiences for users with limited movement, such as patients with motor neurone diseases. Implementing an intuitive drawing mechanism and a UI carefully tailored for eye tracking, Avant-Garde allows for the smooth creation of designs that are intricate and exciting.

Repository: <https://github.com/astromarx/avantgarde>

Periodontal Diagnosis Tool

Author: Joshua David Pimm, Dantong Tu, Jinxiu Xiao

Academic: Dr Yun Fu

Client: Dr Federico Moreno, Anastasiya Orishko

Organisation: Eastman Dental Institute

Technologies used: HTML, JS

Keywords: Healthcare

Abstract: Periodontitis is a common condition affecting an estimated 45% of the UK adult population (Adult Dental Health Survey, 2009). Globally, periodontitis has a significant health, social-economic, and financial burden (Tonetti et al, 2017).

In 2018 a new classification was released by the American Academy of Periodontology and the European Federation of Periodontology. This classification involves many parameters and was implemented in the UK using a simplified staging definition.

The goal of this project is to provide an easy way for dental practitioners and periodontal specialists to obtain accurate diagnoses by creating a web application that will present the practitioner with a series of questions where clinical information can be entered. This questionnaire will present the practitioner with the correct diagnoses for the entered information using the new classification.

Intel HoloWindow

Author: Joel Morgan, Sibghah Khan

Academic: Dr Dean Mohammedally

Client: Great Ormond Street Hospital, Intel

Technologies used: C#, Unity, DICOM, CT-Scan

Keywords: Healthcare, Data Visualisation, 3D Modelling

Abstract: The aim is to develop a bedside over-thebody viewing window that renders 3D holograms as a holographic registration overlay to the patient. Traditional 2D imaging limits the ability to manipulate and interact with the imaging data. Review of this data usually takes place away from the patient's bedside.

IXN-DRIVE are looking to develop an early-stage prototype of a bedside 3D image generator to efficiently render DICOM imaging data into high quality holograms that can be used to educate and interact with patients and a wider healthcare team at the patient's bedside. The project will explore DICOM formats for CT, MRI, and Ultrasound, and examine both skeletal registrations as well as soft tissue muscle and internal organs registration.

Assisted Living Virtual Reality

Author: Eunice Chandra, Chi Xue, Se Jin Park

Academic: Dean Mohamedally

Client: John McNamara

Organisation: IBM

Technologies used: Oculus, IBM Watson, Unity, Photon

Keywords: VR

Abstract: This project aims to simulate soothing virtual reality scenes where users can connect to their family members and friends without having to physically move locations. This will aid with potential loneliness and isolation arising from separation.

Virtual Reality Meeting Environment

Author: Jieyou Xu, Yingming Luo, Wenxin Wang

Academic: Dr Graham Roberts

Client: John McNamara

Organisation: IBM

Technologies used: C#, Unity, Rust (actix-web, serde, PostgreSQL), JavaScript

Keywords: Virtual Reality

Abstract: Users are dissatisfied with existing virtual reality (VR) meeting platforms due to a lack of engagement, participation, and unreliable cameras. We devised a VR meeting platform emulating a physical meeting environment supporting real-time rendering and communication, allowing participants to see the presenter as well as each other. We're focus on inexpensive VR equipment to encourage inclusiveness.

Repository: <https://github.com/jieyouxu/VRME-Server-Rust>, <https://github.com/zcabwxw/loginPage>, https://github.com/1109LLL/Meeting_model

YouTube: <https://www.YouTube.com/watch?v=ZuGPT-KGMBQ>

A Cloud Solution For Analysing Patterns In NGO Projects

Author: Rachel Mattoo, Yansong Liu, Mark Anson

Academic: Dr Dean Mohamedally, Sheena Visram

Client: Dr Husna Ahmad, Dr Hana Al Banna, Ines Belliard

Organisation: ANCSSC

Technologies used: Python, Azure, Microsoft Cognitive Services, Computer Vision API, ALBERT

Keywords: United Nations, Sustainable Development Goals, ML, NLP

Abstract: The aim of our project is to build a database based on annual non- governmental organisation (NGO) reports. This involves data extraction from PDFs, which are in an image format, and storing this data in a database hosted on the Azure cloud. This project is a first step towards synthetic data generation in the future, to produce a general model which can be used to meet the UN's sustainable development goals.

As part of our project, we are also collaborating with a Master's year team, who are developing a web app for the ANCSSC by creating a back end in Azure to store their data. This database is a first step towards providing actionable data and predictions to the ANCSSC regarding the progress and efficiency of NGOs operating in the south.

Repository: <https://github.com/LiuYYSS/reportQuery.git>

Mobility, Hearing & Vision Impairments Assessment Tool

Author: Nadhirah Rafidz, Jingting Yan, Tianyi Wang

Academic: Dr Dean Mohamedally, Dr Graham Roberts, Dr Yun Fu, Dr Chris Evans

Client: Dr Cathy Holloway, Dorothy Boggs

Organisation: Global Disability Innovation Hub, London School of Hygiene and Tropical Medicine

Technologies used: Python, Java, Django, Android Studio, MySQL, SQLite, Azure

Keywords: Healthcare, Webs development, Android development, Databases, Data Analysis, User-centred design

Abstract: Our project consists of an Android mobile app and a website. Our mobile app allows medical officers to assess a participant's mobility, hearing and vision impairment and update the participant's assessment status in real time. It works offline and connects to our website server when the internet is available to upload and download participants' data. The participant responses are then visualised on our project's website. The website also has supporting features such as a questionnaire builder and a dashboard showing a registered participant's assessment status and administration. We utilised Django's Authentication System to control the access

rights. The system's MySQL database is served on an Azure server to securely store the collected data on the cloud. The goal of this project is to accelerate medical diagnoses and innovation by helping both the medical professionals and healthcare officials conduct their assessments and research in a more convenient, efficient, and automated way.

Repository: GitHub link for the website: <https://github.com/nadhirahrafidz/System-Engineering-Website.git>

GitHub link for the mobile app: <https://github.com/JingtingYan/Mobile-App.git>

CarerCare – Data Anonymisation with IOS

Author: Xiaofeng Paul Lin, Lishen Chen, Karunya Selvaratnam

Academic: Dr Dean Mohamedally, Dr Yun Fu, Dr Graham Roberts

Client: Joseph Connor

Organisation: CarefulAI

Technologies used: Swift (Xcode), Macs and iPhones, Linode Server

Keywords: Healthcare, Mobile App

Abstract: Currently in the UK, one in ten people are carers, a number that is on the rise. Three in five people will be carers at some point in their lives. Unfortunately, as carers, it is easy to neglect to spend the time and energy to connect with their core social network or engage in the minimum recommended physical activity to support their mental wellbeing. They need a support system that not only helps them but also provides an easy way to re-engage with their core social network and live an active life.

That's where CarerCare can help. This will actively encourage them to engage with two of the NHS's Five Ways to Mental Wellbeing. With the carer's permission, this app can also anonymise their wellbeing with local differential privacy and use the data to better inform the NHS about the general wellbeing of the different postcode map areas in UK.

Repository: <https://github.com/Paul11100/AlertApp>

YouTube: Quick App Demo – CarerCare: https://youtu.be/bdq44X_tMj0

Prototype 1 – client video: <https://youtu.be/vWhBNnULRtU>

AR/VR fitness rehabilitation gaming

Author: Hue Yap Nam, Lee Jae Yong, Demetris Kouppas

Academic: Dr Dean Mohamedally

Client: John McNamara

Organisation: IBM

Technologies used: C#, Unity, VIRZoom

Keywords: Healthcare

Abstract: A virtual reality tank battle game that aims towards rehabilitation and fitness. It can be controlled with a VIRZoom bike.

The player pedals to move forward and use the headset to turn the tank around. The player uses the buttons on the bike to shoot. The goal is to destroy all targets in the level. Different terrains affect pedalling difficulty.

YouTube: https://youtu.be/OWAgv7fK_Ok

IMG CARE

Author: Don Charles Lambert, Xiaoqi Tan, Bainuo Chen

Academic: Dr Dean Mohamedally

Client: Mr Ghassan Alusi

Organisation: GOSH Drive

Technologies used: JavaScript (React Native, Node.js), Java, Python, HTML, CSS, Javascript

Keywords: Healthcare, Machine Learning, Image Processing

Abstract: ImgCare is a medical drawing and image-processing web application. The application can render, convert and store DICOM images into more widely used file formats. DICOM is the standard for communication and management of medical imaging information. The standard is widely used by the NHS, being adopted by doctors and dentists in hospitals throughout the country. ImgCare's primary function, however, is medical drawings. The application provides the ability for medical professionals to draw tumours over templates of organs which are then classified into stages of cancer through machine learning. The Medic Draw mobile application goes together with ImgCare, allowing the user to create medical drawings which can be processed through ImgCare.

Repository: <https://github.com/DonCharlesLambert/DeanCare>

<https://github.com/DonCharlesLambert/Medic-Draw>

Intelligent Excursions

Author: Zahra Essa, Ping Liu, Jingyi Zhang

Academic: Dr Dean Mohamedally, Dr Yun Fu

Client: John McNamara

Organisation: IBM

Technologies used: Python, Flask, IBM Natural Language Processor API, IBM Tone Analyser API, HTML, CSS, JavaScript

Keywords: Travel, Software Engineering, Natural Language Processing, Web Development

Abstract: Intelligent Excursions is an application which generates personalised holiday recommendations based on a user's interests, requirements and five keywords. The user should be presented with a description of the location, links to hotels and flights within the user's budget as well as information about the location that's being suggested to them.

Repository: <https://github.com/zahraessa/QuickTrips-public>

YouTube: https://www.YouTube.com/channel/UCCMZFKMKe9E-2Pe4S2Yr-vw?view_as=subscriber

Open-sourcing Moodle with Virtual Reality

Author: Andrei Lazar, Emil Almazov, Yaoning Yang

Academic: Dr Dean Mohamedally

Client: Chris Lloyd-Jones, Fergus Kidd

Organisation: Avanade

Technologies used: C#, Unity, Azure, Oculus Quest, Javascript, HTML, CSS

Keywords: VR, Education

Abstract: We believe that the best way to learn any skill is through situational learning, but there are just not enough educational resources that use this technique. We wanted to make something that had situated learning at its core and could be used by anyone in the world.

We have, therefore, created an open-source platform where certain users can upload 360° videos that can be viewed by other users in virtual reality (VR) (using a VR headset). This will allow people to learn complicated topics such as brain surgery most effectively by being completely immersed in the environments where these topics would occur in real life, such as a surgery room.

Repository: <https://github.com/AndreiL26/360VideoPlayer.git>

YouTube: Prototype 1 Demo (https://www.YouTube.com/watch?v=YX7o_LGFwOE)

Meaningful Conversation Transfer

Author: Leong Vincent Wai U, Tiancheng Jiang, Ali Ghariani

Academic: Dean Mohamedally

Client: Joseph Connor

Organisation: CarefulAI

Technologies used: IBM Watson

Keywords: Text To Speech, Application Development, UI Design

Abstract: Separate desktop application to process conversation files where it would extract key information regarding the conversation. Extracted key information would be important in deciding whether recorded conversation consists of a meaningful conversation. Such conversation would also require its sensitive and confidential contents stripped, and the extracted information must not contain any trace of the original confidential contents spoken in the recording. It has to be able to handle large amounts of audio recording to produce large amount of information, which would be useful in deciding whether it consists of meaningful conversation in the first place. Utilises speech to text to extract the information. It also contains convenience features such as options tweaking of the extraction process and file confirmation.

Charlie The Smart Bear

Author: Karolina Skrivankova, Khwaja Muzib, Duncheng Wu

Academic: Dr Dean Mohamedally

Client: John McNamara

Organisation: IBM

Technologies used: Python, NLP, Speech to text, Text to speech, Vue, Nuxt

Keywords: Healthcare, ML, Data Science

Abstract: According to a University of Michigan survey, roughly half of all children are afraid of going to the doctors, with 'stranger phobia' being one of the most cited reasons. This leads to delayed or cancelled appointments and may be detrimental to the patient's health and wellbeing. The solution our IBM client suggested was replacing the object of fear (the doctor) by an object familiar to all children – a teddy bear.

The teddy bear can lead a generic conversation, enquire about patient's wellbeing and let them pinpoint the location of their ailment using an array of pressure sensors. A clinician can then access the gathered data in unison with the patient's profile and medical history.

We're hoping that using a smart teddy bear in practice could lead to better diagnostic capabilities and diminish the effect fear of doctors has on the wellbeing of patients.

Virtual Reality for the Clinical Skills Assessment

Author: Céleste Manenc, Sara Schitelea, Brandon Tan

Academic: Dr Dean Mohamedally

Organisation: Royal College of General Practitioners

Technologies used: Unity, C#, Blender

Keywords: Medicine, Medical Training, NLP, VR, AR

Abstract: Throughout this academic year, we have worked on a virtual reality (VR) simulation of the clinical skills assessment to help GPs in training prepare for this examination. As the Royal College of GPs in London is the only location where the exam may be taken throughout the UK, this makes it particularly important that we give as many doctors as possible the opportunity to eliminate exam day stress by introducing them to their examination environment as early as possible. We have managed to recreate a virtual replica of a clinical skills assessment (CSA) examination room and build a patient-like avatar for any candidate to practice with. This platform, we hope, can then be readapted for other purposes in the future such as job interview preparation or sales training. To accomplish this, we used Unity along with natural language processing and IBM Watson.

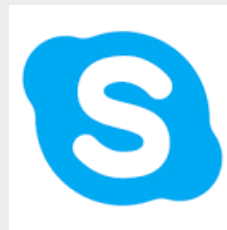
GOSH FHIRworks Hackathon 2020

GroupTherapyCalling

Author: Alex Niculae

Client: GOSH DRIVE

Abstract: GroupTherapyCalling is a platform that connects doctors and patients, improving the way they interact. Doctors will be able to easily set up group calls with patients that share common characteristics. For example, a physiotherapist can initiate a Skype conference call with patients that would require the same workout programme.



FHIR Patient Data Masker

Author: Patrick Wu

Client: GOSH DRIVE

Abstract: Provide data masker algorithms that transform original, sensitive patient data to masked, synthesised data for future research purposes and further implement advanced functionalities such as data filtering, and washing.

FHIR Docugen

Author: Joe Xu

Client: GOSH DRIVE

Abstract: Given FHIR records, upon user request, it can saturate predefined templates with the records and generate documents in predefined formats (Word, PDF).

Patient Data Feedback Form Generator

Author: Chak Koppula

Client: GOSH DRIVE

Abstract: It should be possible, given a patient ID, to produce a Word document that asks the patient to fill out a form for feedback on services they have received from hospitals in the NHS Friends and Family Test style. It will include the patient's name, address, and any specifics regarding the patient if applicable. More endpoints can generate Word documents for patients to update their info, but feedback forms are the main focus.

FHIR React Dashboard**Author:** Nayana Dasgupta**Client:** GOSH DRIVE**Abstract:** A React web dashboard fetches real-time data from the FHIR API and creates visualisations with interactive graphs using material design concepts.**Responsive Form to Push Data on to FHIR Server****Author:** Sibghah Khan**Client:** GOSH DRIVE**Abstract:** A responsive app used to fill out data and push it to the FHIR server and aiding healthcare professionals to store and update patient data themselves.**RecordConverter****Author:** Zhang Yifan**Client:** GOSH DRIVE**Abstract:** Converting FHIR records with Word/PDF format into letters, forms and documents.**FHIR Chatbot****Author:** Rikaz Rameez**Client:** GOSH DRIVE**Abstract:** A chatbot using IBM Watson to query patient records and patient observations. May include voice functionality or multilingual communication.**FHIR Scanner****Author:** Ethan Wood**Client:** GOSH DRIVE**Abstract:** A handheld portable scanner to display information about patients based on an RFID tag.**Vitalsigma Tizen Watch****Author:** Valentin Gorbunov**Client:** GOSH DRIVE**Abstract:** Wearable health devices (WHDs) are helping to better monitor patient health status at a medical level, providing more data to clinicians with the potential for the guidance of treatment. This FHIR works package demonstrates how a Tizen Advanced UI Framework (TAU) wearable application interfaces with sensing technologies on the Galaxy Watch Active2 (LTE): accelerometer, gyro, HR sensor and ECG, to capture and transmit synthetically generated patient health data to a FHIR record over a GOSH gateway. The technology will present vital signs acquired by the WHD to the user, and where there are concerns, the user receives notifications.**FHIR-Visualisations-Haze111****Author:** Haziq Shahrin Al-Johary**Client:** GOSH DRIVE**Abstract:** FHIR records would be parsed and visualised using either D3.js or Chart.js while operating on a Node.js environment. It will form live graphs to show trends and statistics. It is also possible to export it into CSV and XML.**DisplayFHIR****Author:** Jan Kolarik**Client:** GOSH DRIVE**Abstract:** The app will allow you to display FHIR records on an Apple Watch by typing in the patient ID, for example. It would display the essential information on the Apple Watch for the medical professional to see.**Displaying Data Using AR****Author:** Dillon Lim**Client:** GOSH DRIVE**Abstract:** I will be using augmented reality to display FHIR data by using Unity to build my project. Deployment is via a menu setting, possibly a drop-down menu, and then the user can navigate around it—perhaps with an avatar providing some guidance.**FHIRSmartVisualizer****Author:** Daniel Lahlafi**Client:** GOSH DRIVE**Abstract:** A tool that will allow you to visualise where different conditions are most prevalent and find trends in diseases. We will also have tools to query the data and retrieve the parts.**Data Graphing from FHIR****Author:** Wei Zhiqing**Client:** GOSH DRIVE**Abstract:** Creating graphs for processed data such as the age distribution of the patients or the distribution of patients' cities. Users should download the processed data calculated from the FHIR records for further reference.**FHIR Dashboard for Mobile****Author:** Yap, Hue**Client:** GOSH DRIVE**Abstract:** The software would be a dashboard that shows FHIR patient data, server version and other information in a human-readable way. Developed in Flutter and compatible with both Android and iOS, it would make use of graphs and tables to better visualise the data.

Letter Generator**Author:** Wang Wenxin**Client:** GOSH DRIVE**Abstract:** Users can automatically generate a letter, form or document by choosing a specific patient record, describing the information about that patient.**WeSearch****Author:** Hao Menghang**Client:** GOSH DRIVE**Abstract:** Recombine all patients and observations in the database. The search bar's design is on the table or page where users search for data, and the server connects the back end to search each composition. The original format displays the matching results, where users can search for fields and numbers.**PatientPE****Author:** Liao Liao**Client:** GOSH DRIVE**Abstract:** Allow users to search and view the patient's basic information and observation with interactive featured UI. It is based on Samsung's Active 2 wearable device.**FHIR Graphing Tool****Author:** Afiq Bin Samsudin**Client:** GOSH DRIVE**Abstract:** A graphing tool will display all the relevant data of patients, such as gender distribution, marital status, etc.**Datagraph2020 For FHIR****Author:** Ma Bang**Client:** GOSH DRIVE**Abstract:** Data visualisation to: show the data more clearly find more connections between different data make data analysis easier.**Document Generator****Author:** Samuel Emilolorun**Client:** GOSH DRIVE**Abstract:** Generate documents that show doctors a profile of their patients (symptoms, diagnostics etc.)**FHIR Data Visualiser****Author:** Ruairidh Williamson**Client:** GOSH DRIVE**Abstract:** A tool for visualising and analysing FHIR data and a responsive web tool that displays graphs based on FHIR data.**iOS FHIR****Author:** Yinrui Hu**Client:** GOSH DRIVE**Abstract:** An iOS app that could push data to the database and, if possible, pull data from the database and display it.**InformationSearch****Author:** Chen Bainuo**Client:** GOSH DRIVE**Abstract:** Allow users to get the information needed from a large amount of data. Users can type in words, as usual, then the words typed in will be converted to FHIR format and be searchable in the database.**H Base****Author:** Khwaja Muzib**Client:** GOSH DRIVE**Abstract:** This will contain the basic FHIR information as well as other information to be input by the doctors, such as the patient's weight, height, BMI, type of diet, region of residency, whether they smoke, drink, bad habits, as well as all types of symptoms, and health issues. An additional section includes patient prescriptions, after-effects, updates on their condition, any side effects, and further treatments. Implementation on a large scale, i.e., in all hospitals, shall make statistical data accessible to doctors worldwide on how effective a medicine, therapy or treatment is for a particular disease. Thus, allowing doctors to understand the effectiveness of a specific medicine and help rural places stock up with better medicine with limited expenses. Additionally, teaching medical students or researchers how a particular medication works in different circumstances and understanding more about how the medicine or the human body will help them research further.**AR Data Visualisation Tool for FHIR****Author:** Oliver Vickers**Client:** GOSH DRIVE**Abstract:** The tool will analyse the FHIR data we have access to and aim to present it to a user on a phone

or tablet in a readable fashion. Using augmented reality allows for various means of interacting with the information, i.e., physically moving and looking around and pressing buttons. Different information will be available depending on who the user is. Staff should also be able to easily find and verify the identity of patients using a search function.

FHIRSearchRequest

Author: Yuheng Wang

Client: GOSH DRIVE

Abstract: By sending requests to different links that include search criteria, users can display results that fully or partially meet the requirements. It might also allow fuzzy search, which returns results that could be relevant. This API could either return a webpage containing all the JSON info or return it as a HTTP request result for further data processing.

AR Data Visualisation Tool

Author: Lu Han

Client: GOSH DRIVE

Abstract: An augmented reality visualisation tool for data allows users to visualise data in 3D, which would provide users with a more interactive experience while visualising data.

KGs of FHIR

Author: Rafay Siddiqui

Client: GOSH DRIVE

Abstract: The objective of this package is to migrate FHIR records to Grakn. Grakn.AI has developed an effective and computationally efficient way to understand data by representing it as knowledge graphs. This package will help to build and query a Grakn server from FHIR records.

FHIRFetcher

Author: Zekun Yang

Client: GOSH DRIVE

Abstract: The project mainly focuses on helping users fetch data. Users can customise what data they need through the front end web page.

Speaker Verification

Author: Chen Ruo

Client: GOSH DRIVE

Abstract: It is a voiceprint verification to determine whether the individual has the authority to access the data.

FHIR Hackathon Records Vr

Author: Emil Almazov

Client: GOSH DRIVE

Abstract: Taking FHIR records and displaying them overlaid over a 360° video, so, for example, a patient would be able to see their surgery in 360° while having their details shown on the video too.

FHIR Record VR Displayer

Author: Cheng Xuyou

Client: GOSH DRIVE

Abstract: A virtual reality application run on Oculus Quest that utilises the new hand tracking feature to play around with FHIR records.

WPGenerator YQ

Author: Yuer Qiu

Client: GOSH DRIVE

Abstract: Generate documents in the form of PDF and Word from records.

HealthGraph

Author: Yangtao Ge

Client: GOSH DRIVE

Abstract: HealthGraph is a full-stack bundle package that includes the analysis APIs for retrieving data in different display formats, e.g. geographic layout, charts, thematic map, or even distribution. We can also embed it into a Javascript library such as Graph.gl with the same data format.

PX-IDK

Author: Xin Paul

Client: GOSH DRIVE

Abstract: Graphing statistical data from the records.

Jych.FHIR.Generatedoc

Author: Jiayi Chen

Client: GOSH DRIVE

Abstract: A package that takes FHIR records as input and returns a PDF or Word document containing forms. The fields in the document store the specific data from FHIR records. Users can choose the records they want to output by using a patient ID.

Display FHIR Record Data in AR**Author:** Yuan Jingtian**Client:** GOSH DRIVE**Abstract:** Display FHIR record data in augmented reality.**Samsung Galaxy FHIRWearks****Author:** Alex Tcherdakoff**Client:** GOSH DRIVE**Abstract:** Measures patient health and fitness data over a period and pushes it to the patient file on FHIR.**FHIRSQL****Author:** Rajesh Goyal**Client:** GOSH DRIVE**Abstract:** I will create SQL requests which collect information from FHIR records.**FHIR Record Dashboard****Author:** Henry Zhang**Client:** GOSH DRIVE**Abstract:** A progressive web application utilising responsive design, which displays and graphs the FHIR data in a clear and searchable way. The users can access the app through a website, mobile app, or even desktop apps.**FHIR Records Search System****Author:** Wenhua Wei**Client:** GOSH DRIVE**Abstract:** This system can read input search keywords, generate SQL requests, and convert them into FHIR queries to get information from FHIR records and display the search result. The purpose of an API can be to return the search result in JSON format based on the search keywords, which might be useful for other developers who would like to retrieve data from the FHIR records.**Swift Sending Form Data FHIR****Author:** Paul Lin**Client:** GOSH DRIVE**Abstract:** This package is about a swift app that collects relevant data from a patient and, with a click of a button, sends the data onto the API in a JSON format, under the FHIR specifications. We can then use this data to update an online FHIR record. In the API stage or the Swift code, the app converts collected data into a suitable FHIR format. If time permits, the

application will create a separate synthetic set of data, which will go into a separate API end point based on patient input.

Data Filling Application**Author:** Xiaoqi Tan**Client:** GOSH DRIVE**Abstract:** This application allows nurses and doctors to fill in patients' details and symptoms. The system will store data in a remote database. Data will send in JSON format and stored in JSON or SQL format in the FHIR record.**Data Entry Application****Author:** Yingming Luo**Client:** GOSH DRIVE**Abstract:** It allows nurses or hospital staff to use the digital form within the app to obtain basic information regarding the patient's background and medical history, storing the data on a remote database using FHIR standard.**Dashboard of FHIR Overview in Country****Author:** Zhang Jingyi**Client:** GOSH DRIVE**Abstract:** A dashboard showing an overview of patient information around a country. Including a map showing:

- categorised diseases in each city
- a daily, monthly, and the total number of patients healed or currently being treated
- links of a similar disease or symptom
- warning when appearances of a particular disease reach more than a specific number.

a human map indicating the total number of patients with disease in each of the nine body systems, with different colours representing their seriousness.

FHSearcher**Author:** Wang Kefan**Client:** GOSH DRIVE**Abstract:** FHSearcher will classify data by different types of attributes after it obtains a database. It will search for the specified information according to any record feature and convert the data obtained into FHIR queries.**Health Tracker****Author:** James Zhong**Client:** GOSH DRIVE**Abstract:** The package aims to provide a better way for hospital staff to find and record any important information

regarding their patient's health. Using a form to keep track of this information regularly could retain the patient's current status and store any previous entries in the database. The design will be efficient and straightforward since that is better for a busy environment like a hospital.

Document Generator from FHIR Files

Author: Eugene Tai

Client: GOSH DRIVE

Abstract: This program will take in a text file of FHIR syntax that will generate back a readable version of the file.

GraphFHIR

Author: Jingting Yan

Client: GOSH DRIVE

Abstract: My selected theme would contain two functionalities:

load FHIR records

graph data in FHIR records.

For loading FHIR records, my package would support data in both FHIR format and CSV format. The records would be uploaded both locally or via XML. For graphing the data in FHIR records, my package would support basic graphs, e.g., pie charts, line graphs, histograms.

FHIR Data Shown in VR/AR

Author: James Lee

Client: GOSH DRIVE

Abstract: This technology retrieves the patient data over FHIR and allows the user to view these data in a virtual or augmented reality environment.

FHIR EHR Converter

Author: Charles Cowan

Client: GOSH DRIVE

Abstract: The project will take a FHIR file and, as much as possible, convert the information into the openEHR standard and vice versa.

Datagraphing2020 FHIR

Author: Zhao Xinyao

Client: GOSH DRIVE

Abstract: This project aims to visualise data in a way that is much easier to understand. It could compare and summarise the relationship between different types of data.

GOSH FHIRworks 2020: AutomaticDoctorNotes

Author: Muna Aghamelu

Client: GOSH DRIVE

Abstract: A basic web application that allows you to enter your name and birthdate and generate a word document containing the patient information and current condition. The goal is to save GPs' time typing a doctor's note when one is requested. The system should only allow doctor notes when the patient has recently visited the hospital and has an ongoing medical condition that is accountable. The system should also only allow patients over a certain age to retrieve documents, e.g., over the UK-guided working age of 18; anyone below 18 should not receive a letter.

GOSH FHIRworks2020 Voice Assistant

Author: Bilal Tariq

Client: GOSH DRIVE

Abstract: Voice Assistant is an app that can help GPs and clinicians find information about a patient as naturally as possible by asking questions in their own words. We hope to reduce the amount of time spent searching for data points to improve doctor-patient interactions.

GOSH FHIRworks2020: HeartRateMonitoring

Author: Jan Kolarik

Client: GOSH DRIVE

Abstract: The heart rate from an activity recorded from the Apple Watch would be recorded and then sent to the FHIR server. This system would be beneficial for cardio rehabilitation patients. Placing these records on FHIR with their health records would provide an overview for the entire clinical team to view these data points in combination with others to track recovery after a cardiac event.

FHIRPlots

Author: Yalman Ahadi

Client: GOSH DRIVE

Abstract: This project aims to provide visual statistical data on patients. It will feature graphs and other types of plots that will help technicians and health analysts see patient data and spot trends or additional information based on event frequency and observation data. As it sits, FHIR data is verbose JSON data that humans do not find very visually pleasing. It will be much better for this data to be displayed graphically, and this project aims to do just that.

FHIRtoDoc**Author:** Wuhao Chen**Client:** GOSH DRIVE**Abstract:** Automatically generate publishable PDF and word docs from FHIR records.**Records Graph Platter****Author:** Yuan Jingtian**Client:** GOSH DRIVE**Abstract:** Draw graphs according to FHIR records.**NHS Assistant****Author:** Ryan Chuah**Client:** GOSH DRIVE**Abstract:** The chatbot will allow doctors to search patient data quickly. Healthcare professionals can use this system in various situations; for example, a patient comes in to the trauma centre. The doctor asks the chatbot, 'Give me the allergies of a patient named Ryan born on the 23 March, 1999, living in London'.

The doctor then administers medicine according to the patient's allergies.

Birthday Wish**Author:** Muna Aghamelu**Client:** GOSH DRIVE**Abstract:** Birthday Wish, a mobile application to help combat potential loneliness in a hospital environment. If someone is terminally ill and may not have a family to take care of them, they can use the app to receive and send nice birthday messages to patients. The message can be via email or a call to a patient directly. The application aims to encourage patient communication within the hospital environment, which may tend towards the elderly. I will use Python, Flask for the back end and Python, Tkinter for the front end application.**Patient Form Recogniser****Author:** Kar Chan**Client:** GOSH DRIVE**Abstract:** Extracting critical information, e.g., ID and age, from forms in different formats. Convert these to FHIR and then to another type of data.**FHIR Data Synthesis****Author:** Louis Phillips**Client:** GOSH DRIVE**Abstract:** The package uses statistical and machine learning to accurately synthesise new patient records while maintaining the original data's statistical properties.**Hygiene VR****Author:** Xue Chi**Client:** GOSH DRIVE**Abstract:** Technology to help users see the records in a virtual reality mode.**Targeted Message Sender****Author:** Paul Lin**Client:** GOSH DRIVE**Abstract:** Search through the patient's database to find relevant patients, then generate a message to email to patients to invite them to join our app. Relevant information includes patient name and email, filtered through a particular characteristic relevant to the carer (e.g., age). The message sent should consist of the sender's name, reference.**FHIR Data App****Author:** James Lee**Client:** GOSH DRIVE**Abstract:** The application retrieves the data the user requires from the FHIR records in JSON format and stores the data.**Documents Generator****Author:** Siwat Chairattanamanokorn**Client:** GOSH DRIVE**Abstract:** A software that generates letters, documents and forms prefilled with data from FHIR. This system will help users to send information faster and simpler.**Google Mapper****Author:** Joel Morgan**Client:** GOSH DRIVE**Abstract:** A primary mapping tool that acquires patients' addresses and displays them on a Google maps webpage for further use and giving a clear diagram of where patients are. We can impose filters on the plotter to plot patients fulfilling certain criteria, such as distance from a specific point, marital status, etc.

Watson Data Assistant

Author: Se Jin Park

Client: GOSH DRIVE

Abstract: My project is a smart chatbot or voice assistant capable of fetching and handling FHIR data on command. Since the current FHIR data is messy, the assistant will ensure that the FHIR data fetched from the API will be human-comprehensible. Furthermore, the assistant may feature functionalities like bundling data into a readable format. The assistant users can easily grab relevant data on the go just using a few voice or chat commands. This project hopes to ensure that data is effortlessly accessible by having an assistant capable of delivering data effectively.

FHIRDataVisuals

Author: Lib Pneh

Client: GOSH DRIVE

Abstract: Visualisation of patient data to reveal underlying insights of the patients.

InstaPaper

Author: Yi Luk Goh

Client: GOSH DRIVE

Abstract: Getting patient data from the API end points and putting it into a website to display it. Include the option to download the data into a Word document that has a standardised format.

PatientAnalyzer

Author: Michael Lau

Client: GOSH DRIVE

Abstract: A web app that formats FHIR records in a systematic and orderly way. We can develop a public API to send this formatted data and present this data more creatively and attractively.

Fitbit

Author: Dao Liu

Client: GOSH DRIVE

Abstract: This is a tool to dump FitBit data into patient observations. The device will consist of an interface to log into the FitBit dashboard and receive the open authorisation tokens required for API access transparently. It will output JSON schema that the SMART on FHIR tool suite can take, convert into FHIR schema, and ultimately upload to a patient record.

Patient Edit

Author: Leong, Vincent

Client: GOSH DRIVE

Abstract: A website with a user interface to edit current patients and add new patients into the FHIR records. Users can find patients using their ID names or actual names to find the content they want to edit. There may also be alternate methods of finding records, the consideration of using Felica, for example. The website would try to adhere to responsive design and work on many different browsers and screen sizes, hoping that it would also fit on mobile. Aesthetics is not a significant consideration here.

DocAndLetterFiller

Author: Guide Limjumroonrat

Client: GOSH DRIVE

Abstract: An API capable of reading FHIR records and auto-generating a PDF document or letter prefilled with all the fields and information retrieved from a FHIR record.

GOSH FHIRworks2020: predicting trends

Author: Govind Balla

Client: GOSH DRIVE

Abstract: I am using various quantitative and qualitative metrics to find trends between these features. I hope to uncover new patterns that could be useful for predicting future trends in patients.

Life Portal

Author: Ali Ghariani

Client: GOSH DRIVE

Abstract: A portal accessible by anyone who wants to manage all of its medical issues. From searching a GP to booking a consultation or seeing all of one's medical records, this tool can be advantageous for people seeking a healthier life.

GOSH FHIRworks2020 statistical

Author: Rachel Mattoo

Client: GOSH DRIVE

Abstract: Creating a front end displaying a statistical analysis of patient data in different forms, including age and gender distribution. By performing statistical analysis, the aim is to improve the efficiency of the healthcare system.

Form Generator SA**Author:** Sami Al Alawi**Client:** GOSH DRIVE

Abstract: Creating an API that can parse a FHIR record and create a standard patient page based on the record. The package should be able to create Word, PDF and CSV documents. I further aim to develop an API to send in a FHIR record and return a document.

SmartGraphs**Author:** Wang Tianyi**Client:** GOSH DRIVE

Abstract: In medical research, many different data fields in a patient's profile may contribute to the outcome and effect of a disease or a condition. They could have complex relationships that are difficult to analyse. Existing data visualisation techniques mostly revolve around a fixed set of relationships between a given number of variables, which are not very flexible. I want to build a data visualisation tool to enable researchers to perceive the data dynamically and be modified easily to help discover patterns inside the data more effectively.

Analytics and Visualisation of FHIR Records**Author:** Neha Ranade**Client:** GOSH DRIVE

Abstract: My proposal seeks to: Convert records to XML and CSV.

Generate a wide variety of graphs on the data. Provide statistical analysis tools.

EasyView**Author:** Andrei Lazar**Client:** GOSH DRIVE

Abstract: EasyView allows NHS professionals to visualise patient data in a straightforward and intuitive way. It will enable NHS staff to plot graphs based on multiple criteria and see other statistics-related functions such as the standard deviation or the mean of the data. Also, it provides a simple way to convert the FHIR records to CSV and XML.

Speaker Recognition for Patients**Author:** Sabina Mitroi**Client:** GOSH DRIVE

Abstract: The prototype that I am trying to create in two days (and also after in my leisure time) is a speech recognition application for patients to find their files faster, and be a good authentication process in the future. We will only add this for the patient if they know that we need voice samples first to make it more accurate. The

recordings provided by the patient will be used only for this process. I am trying to record the users saying their names and compare the live recordings with those already provided.

APDV**Author:** Joanne Wong**Client:** GOSH DRIVE

Abstract: Graphing observations from the ageing population (65+). Observations can be of any type, and the visualised data will be current.

GOSH FHIRworks2020 Dashboard**Author:** Noan Le Renard**Client:** GOSH DRIVE

Abstract: A dashboard of both FHIR service specifications and patient records. Planned features include:

- Server information.
- Bundle information.
- Logging capabilities.
- Patient record information.

FHIR Call Lists**Author:** Mark Anson**Client:** GOSH DRIVE

Abstract: A web app that allows the generation of 'call lists' from FHIR records through a query, allowing staff to build lists of patients that need to be called for various reasons, e.g., booking vaccinations.

FHIRapp**Author:** Liu Ping**Client:** GOSH DRIVE

Abstract: An application to implement the data from the records, some functions such as showing data in graphs and dividing data into a few categories if it's helpful for research.

Records in AR**Author:** Yuan Jingtian**Client:** GOSH DRIVE

Abstract: Pull down the FHIR records and show the information in the augmented reality environment.

Adaptive Card FHIR API**Author:** Adnan Ahmad**Client:** GOSH DRIVE

Abstract: An API that formats FHIR resources into the Microsoft Adaptive Card format, which we can use alongside the Microsoft Bot Framework in chatbots. Adaptive cards are highly portable and can display the same content to various platforms, from Microsoft's WebChat used by many chatbots to instant messaging platforms like Facebook Messenger. Providing an API that supports adaptive cards allows chatbot developers to quickly deploy information stored by FHIR, such as patient records or appointments. This API means developers can deploy chatbots quicker by taking care of card design for you. For more information, see: <https://adaptivecards.io/>

WellWellWell Letter**Author:** Swechha Kansakar**Client:** GOSH DRIVE

Abstract: The package will query FHIR patient records and auto-fill a recommendation letter to at-risk patients to download the WellWellWell application. GPs, carers or the patient can receive this letter.

CarefulAI Registration**Author:** Derrick Macakiage**Client:** GOSH DRIVE

Abstract: The main CarefulAI COMP0016 project uses an app to monitor a user's wellbeing every week by collecting their steps and calls per week and generating a wellbeing score out of 10 from a machine learning model. Based on this score, the app also nudges the user to contact the people closest to them and participate in their favourite activities. This project is a small web app that we can deploy to patients to preregister their immediate contacts and favourite activities. For use in the app on installation, search for their records using their name and date of birth and prompt them to fill a short form.

FHIR Health Dashboard**Author:** Raghav Mirza**Client:** GOSH DRIVE

Abstract: Enter your universal unique identifier, and it will generate a document displaying the patient's health information, such as fitness level and blood test results.

GOSH FHIR Advanced Data Visualisation**Author:** Abir Bhushan**Client:** GOSH DRIVE

Abstract: GOSH FHIR Advanced Data Visualisation is a web application and a data visualisation tool that visualises patient data within the GOSH FHIR database and links it to patient observations (like heart rate, respiratory rate, BMI, etc.).

FHIR Query with NLP**Author:** Liu Yansong**Client:** GOSH DRIVE

Abstract: The project aims to provide general medical staff with access to critical patient information without having complex computer database knowledge. Using machine learning techniques to transform natural language into complex database operations, the software can significantly reduce the knowledge barriers required to use a database.

NianRan**Author:** Nian Ran**Client:** GOSH DRIVE

Abstract: To record and show the data in a virtual reality environment to help users understand and make decisions more easily and effectively. And the animation of the changing of the data helps to understand tendency and ratio variation.

GOSH FHIRworks2020 SQL**Author:** Rajesh Goyal**Client:** GOSH DRIVE

Abstract: Asks the practitioner for pieces of information such as the user's name, surname, birth date, gender, spoken language and prefix. It uses this information to search for patients and list all their medication, including whether they are still taking it and when it was last updated.

FHIR By Voice**Author:** Sibghah Khan**Client:** GOSH DRIVE

Abstract: A simple application that allows users to search and filter the FHIR records. Users can use the buttons on the GUI, or they can use their voice to search or filter.

FHIRChatbot**Author:** Daniel Lahlafi**Client:** GOSH DRIVE

Abstract: A chatbot application that lets you view the history of different patients by typing questions in natural language.

GOSH FHIRworks2020 PatientWebApp**Author:** Yi Luk Goh**Client:** GOSH DRIVE**Abstract:** A web application to retrieve patient data, display patient data, graph relevant and vital information about the patient's observations, receive average age and general observation statistics and return them as a string or JSON object.**FHIR EHR Converter****Author:** Charles Cowan**Client:** GOSH DRIVE**Abstract:** Converts (parts of) FHIR records to electronic health records and vice versa. Initially built on just converting an individual patient's characteristics, and later looking at converting details about encounters if possible.**FHIR Record to MS Word****Author:** Eugene Tai**Client:** GOSH DRIVE**Abstract:** This program automatically fills in a MS Word document with a patient's details, e.g., name, address, date of birth. Users can format the document in any way if they include the macros required for the program to work.**Patient Graphs****Author:** Yalman Ahadi**Client:** GOSH DRIVE**Abstract:** A package that allows you to search for a patient from the FHIR records and display some data about their observations on graphs, e.g. heart rate and blood pressure.**FHIRHaze****Author:** Haziq Shahrin Al-Johary**Client:** GOSH DRIVE**Abstract:** FHIRHaze intends to pull data from FHIR records and display it using graphs. The graphs use the Chart.js library and show the overall statistics of the records.**FHIRDataApp****Author:** James Lee**Client:** GOSH DRIVE**Abstract:** The application pulls data from a series of FHIR records and allows the user to view patient information from the FHIR records and view a specific piece of patient information.**FHIR Patient Summary****Author:** Nicolas Ford**Client:** GOSH DRIVE**Abstract:** Python package that creates patient summary documents in DOCX or PDF from FHIR records.**Patient Demographics API****Author:** Se Jin Park**Client:** GOSH DRIVE**Abstract:** The Patient Demographics API is capable of parsing through the patient's data within the FHIR records and filtering necessary information such as country of origin, languages spoken, the decade of birth, marital status, and other information required to group patients. Furthermore, the API provides functionalities of graphing the gathered information onto a bar chart and combining the data onto a single-JSON format to easily convert to a CSV or XML format. The essential advantage of this API is its cross-platform nature: all data processed by the API is either in the base64-encoded image or JSON format.**Visualise Data****Author:** Choi Lam Wong**Client:** GOSH DRIVE**Abstract:** Visualising the synthetic records in the framework application.**GOSH FHIR Word2020****Author:** Sabina Mitroi**Client:** GOSH DRIVE**Abstract:** The challenge of this project was to use synthetically generated data retrieved over FHIR from a GOSH gateway to generate documents prefilled with records. I developed a web application in Flask which uses a Python API for creating and updating Microsoft Word. I also used FHIR Parser, which made it easier to access the information I needed from HL7 FHIR. The user can find any patient by using their unique identifier, forename, and surname. When the user presses 'Create a document,' the file will appear in the folder FHIR. To test the web application, you can use the files (Forename.txt, Surname.txt and Unique_identifier.txt) provided in the example folder.**Repository:** <https://github.com/MitroiSabina/GOSH-FHIR-Word2020>**PDF Generation of Basic Patient Information****Author:** Sara Schitelea**Client:** GOSH DRIVE**Abstract:** The program generates a PDF file with basic information about the patient, including name, gender, sex, age, race, marital status and contact details. Doctors

could use this PDF for first-time patients to gain a general knowledge of their new patients before the consultation.

BMI Tracker

Author: Karolina Skrivankova

Client: GOSH DRIVE

Abstract: With obesity in adults and children on the increase, this application allows practitioners to monitor the BMI history of their patients.

Carer Invite

Author: Paul Lin

Client: GOSH DRIVE

Abstract: An API to search through the patients database to find relevant patients, then generate a message to send to the patients through text message to invite them to join our app. Relevant information includes patient name and number, filtered through a particular characteristic relevant to the carer, in this case, age range. The message sent should consist of the sender's name, reference, app URL, and the patient's full name. The API will return the number and invite message separately in JSON format, with each patient consisting of a JSON object.

Displaying Patient Data in a Responsive Table

Author: Zahra Essa

Client: GOSH DRIVE

Abstract: My application displays patient data in a table that the user can resize (responsive). The table is paginated and sorted by the different fields. By clicking on a specific patient on the main page, you can see additional information about the patient and information about all their observations sorted by date. You can also filter between the three observation types: vital signs, laboratories, and surveys.

Form Recogniser

Author: Kar Chan

Client: GOSH DRIVE

Abstract: Take in any image of a different format, extract info and save it as FHIR data.

Patient Info VR

Author: Emil Almazov

Client: GOSH DRIVE

Abstract: VR/Unity/C# Project showing Patient Data from GOSH (Great Ormond Street Hospital) DRIVER'S FHIR server on top of a 360° playback inside a virtual reality environment.

Emergency Document Generation

Author: Kaan Turan

Client: GOSH DRIVE

Abstract: a simple solution for generating a single, extensive document regarding all relevant patient details. I developed a package designed to quickly provide an easily digestible information report for a patient (given their unique universal identifier) in emergencies where doctors and nurses require several different types of patient details without the time to sift through irrelevant details manually.

Getting Data

Author: Hao Menghang

Client: GOSH DRIVE

Abstract: By searching for the user's patient ID, the patient can query their personal information and some last observation data in two forms. Besides this, patients can choose to download the forms to their computer in PDF format.

FHSearcher

Author: Kefan Wang

Client: GOSH DRIVE

Abstract: Effectively generate a document for a specific patient, including personal details and all observations of that patient.

Graph Patient

Author: Eesha Irfan

Client: GOSH DRIVE

Abstract: Creating an API that, when called, returns data displayed on two graphs. One graph shows the proportional differences between six groups made from the following three attributes: gender, country, marital status. The second graph shows the ratio difference between the number of male and female speakers of different languages.

Patient Record Google Assistant

Author: Rakshita Kumar

Client: GOSH DRIVE

Abstract: My application is a Google Assistant chatbot that helps users extract patient records and analyse patient records using voice commands. It also displays data in graphs to allow users to observe trends visually. Doctors often need to extract patient records, and the chatbot is an easy and fast way to do this. Hospital administration staff can also use the data analysis aspect of the bot to view trends in the patients that visit the hospital.

Blood Report Generator**Author:** Raghbir Mirza**Client:** GOSH DRIVE**Abstract:** FHIR API uses a dummy FHIR database to retrieve patient data from their unique universal identifier and returns a JSON response with the patient's blood details and Word document with the patient's latest blood test report.**FHIR Patient Finder****Author:** Brandon Tan**Client:** GOSH DRIVE**Abstract:** Retrieve and display patient details based on criteria**Add Patient's Contact Information****Author:** Siwat Chairattananokorn**Client:** GOSH DRIVE**Abstract:** My web app fetches users' data from the database, allowing users to add contact information about that patient onto the server.**Data Mask Gen****Author:** Patrick Wu**Client:** GOSH DRIVE**Abstract:** A data synthesiser and masker takes in real FHIR patient data and generates data providing specific rules. I developed this tool with performance and customisation in mind.**Patient Filter and Letter Generator****Author:** Karunya Selvaratnam**Client:** GOSH DRIVE**Abstract:** My API allows a user to input a template letter and a set of criteria. This set of criteria will filter the patients down to those that fit the conditions. Measures include age, gender, and all the different observation components such as blood pressure, weight etc. The system generates a list of patients who fit the criteria, replaces their information into the template letter, and creates a personalised letter for each patient. There is also a simple UI where users can input the letter and conditions resulting in a page of download links of each generated letter.**NHS NLP Assistant****Author:** Ryan Chuah**Client:** GOSH DRIVE**Abstract:** This project aims to allow users to search for patient data stored in the FHIR format through speech-to-text and natural language processing. For example, 'Look for a male patient named Mr Abram Weimann born on the 12th of July 1965 who lives in Hanson, Massachusetts in the US and speaks English' will extract entities (information) from the sentence, search through patient data, and return Abram Weimanns record.**Document Generator****Author:** Eunice Chandra**Client:** GOSH DRIVE**Abstract:** Generates Word and PDF documents from FHIR records.**FHIR Dashboard****Author:** To Eun Kim**Client:** GOSH DRIVE**Abstract:** It graphs data from FHIR records, prepares data for transfer to XML and CSV, and allows users to download them. Then it creates a Flask-backed dashboard that presents a human-readable representation of the data.**FHIR Data Visualiser****Author:** Zi Lian Lim**Client:** GOSH DRIVE**Abstract:** This system will allow users to intuitively view patient observation data in a chart based on a time scale and view different demographic groups found on the FHIR database.**Observation Letter Generator****Author:** Swechha Kansakar**Client:** GOSH DRIVE**Abstract:** After inputting the patient unique universal identifier and selecting which observations are relevant, the system will generate a letter in Word and save it locally.**Patient Extract: Graphing Medical Data****Author:** Michael Lau**Client:** GOSH DRIVE**Abstract:** Using the FHIR.NET Azure Web API, we can use visualisations such as graphs and charts to plot patients' medical information. Users can use these graphs to analyse patient medical data and view general statistics of patient data.

PDF Generator**Author:** Mukilan Bakeerathan**Client:** GOSH DRIVE**Abstract:** Web app for doctors to view patient data and automatically generate letters based on observations on a specific date.**React Dashboard****Author:** Nayana Dasgupta**Client:** GOSH DRIVE**Abstract:** An interactive and real-time web dashboard aimed at hospital administrators pulls data from FHIR records and produces analytical visualisations using React, Recharts and Material-UI. I wrote the unit tests using Jest.**PDF Record Generator****Author:** Guide Limjumroonrat**Client:** GOSH DRIVE**Abstract:** A simple program with a simple user interface where users can enter the patient ID. The program will generate a PDF document prefilled with the information from the FHIR record.**Graph Patient to XML and CSV****Author:** Neha Ranade**Client:** GOSH DRIVE**Abstract:** The package does three things mainly: it converts patient data into XML (for both observations and properties); it converts patient properties into CSV; and it provides simple graphs on patient data.**FHIR Parser in Java****Author:** Khwaja Muzib**Client:** GOSH DRIVE**Abstract:** A developer tool, a parser for the FHIR database written in Java for Java developers. Users can use this to get the specific data that developers want for further development in any field, be it GUI or any web app.**Responsive Dashboard****Author:** Abir Bhushan**Client:** GOSH DRIVE**Abstract:** The app provides easy-to-use, responsive web and mobile dashboard interfaces for users to view, search and analyse FHIR datasets.**Repository:** <https://github.com/abircb/GOSH-FHIRworks2020-Responsive-Dashboard>**Patient Check-Up****Author:** James Zhong**Client:** GOSH DRIVE**Abstract:** This is intended to be a web app that allows nurses to submit a form into the FHIR server about a patient's health information such as blood pressure, heart rate, etc. The patients will need to be verified by their unique ID before logging any new information. This package aims to have a fast and easy-to-use form, so that hospital staff can save valuable time by not having to resort to paper records or other slower methods. An API will retrieve the patient's name with their ID and post form data to the server.**Patient Info and Up-to-Date Records Form Maker****Author:** Sami Baguneid**Client:** GOSH DRIVE**Abstract:** Makes PDF or Word documents with a brief overview of the patient's information and all the patients' up-to-date medical records; it goes through and checks if a patient's medical check has a newer version. If so, it discards it in favour of the new one.**Parsing and Combining Resources****Author:** Nadhirah Binti Mohammed Rafidz**Client:** GOSH DRIVE**Abstract:** This API parses the patient and observation resources and matches the resources based on a common attribute that can be specified. The API works with any resource API like the GOSH Drive. The API also has a search functionality for multiple resource attributes. The front end is responsive and has a clean and clear design.**Graphing Patient Data****Author:** Ben Ismaili**Client:** GOSH DRIVE**Abstract:** The API that I have developed uses two Python packages (FHIR-Parser and Flask) along with the provided FHIRworks_2020 app to allow users to graph patient data. We can generate different types of graphs for various types of data, allowing users to visualise the demographics of the patients they are dealing with and better understand the variety that exists among the patients.**Contact Information Document Generator****Author:** Celeste Manenc**Client:** GOSH DRIVE**Abstract:** My program takes any unique universal identifier from any patient and generates a word document containing any contact information available.

Analysis and Visualisation of Patient Gender Demographics

Author: Chris Tan

Client: GOSH DRIVE

Abstract: This software package is an example and starting point to the capabilities of using FHIR records to analyse and visualise patient data. In this case, we separate the patients by gender and visualise the differences in demographic factors such as age and marital status.

FHIR NLP MateBarbarics

Author: Mate Barbarics

Client: GOSH DRIVE

Abstract: It is a web application; on the home page, there are two options, either searching for a patient or viewing the list of all patients. The result on both pages is a table, with each row being clickable and leading to a patient view page with more information about the patient.

Dashboard to Show Patient Data

Author: Dillon Lim

Client: GOSH DRIVE

Abstract: A demonstrator that fetches data about the number of male and female patients along with the number of single and married patients. The data fetched will be displayed in a graph chart for easy viewing.

Vitality

Author: Valentin Gorbunov

Client: GOSH DRIVE

Abstract: Vitality is an open-source wearable web application for the Galaxy smartwatch. It uses the Galaxy smart watch's built-in heart rate monitor to measure the user's heart rate, stores its 'observations' on the watch and securely uploads them as FHIR records to the Gosh Azure FHIR server implementation. I built the application on top of the Tizen Advanced UI Framework (TAU), which facilitates the efficient creation and management of various UI components.

AR CLIPBOARD

Author: Lilly Neubauer

Client: GOSH DRIVE

Abstract: My project is an augmented reality clipboard. When a clinician points their phone at a clipboard with a trigger image on it, patient data is fetched from the FHIR API and displayed in real time.



Case study: Project Fizzyo



Project Fizzyo gamifies physiotherapy for children with Cystic Fibrosis (CF), transforming tedious daily exercises into play. UCL, Microsoft and GOSH adapted existing medical devices to function as joysticks for computer games and to send vital data to clinicians. IXN for the NHS students built games and data collection methods. Project Fizzyo, featured on the BBC and in the BMJ, won a Digital Health Tech4Good award and is supported by the Cystic Fibrosis Trust.

Background

“Imagine spending hours of your day, every day, battling with your teenage kids to do their physiotherapy. While others play video games, you are telling yours, ‘No you can’t go game with your friends – you have to come and do your physio’. For 15 years,” explained Vicky Coxhead, whose two sons have CF.

The life-limiting genetic condition mainly affects the lungs and digestive system. A build-up of mucus can cause breathing problems, and children with CF need to do treatments every day to keep well, including regular physical activity and airway clearance techniques (ACTs). These treatments are time-consuming and burdensome.

What is Project Fizzyo?

Project Fizzyo wanted to make ACTs easier to do and more fun so that children with CF can stay well for longer. It also wanted to investigate how these treatments, carried out at home, could make a difference to clinical status.

Wireless chipped electronic sensors were inserted inside airway clearance devices. The sensor detects breathing and converts each breath into an electronic signal, which in turn controls computer games on a tablet. The ACTs power the action in the game, which could be driving a car, collecting coins or playing mini golf!

Researchers and clinicians are using airway clearance sensors along with wearable activity trackers to capture and transmit data directly from patients’ homes. The data forms the basis for the largest study ever to measure which treatments most improve the health of young people with CF.

IXN for the NHS students worked with UCL teams covering physiotherapy, computer science, and electrical and electronic engineering (led by Professor Eleanor Main, Professor of Physiotherapy, UCL Great Ormond Street Institute of Child Health) and teams from Microsoft (led by Professor Lee Stott).

“Project Fizzyo needed a complex data infrastructure on a limited budget, facilitating secure movement of data from remote monitoring devices, such as activity trackers, and airway clearance sensors which were used by people with CF in their homes, via a secure data storage cloud into the GOSH DRE for reconciliation and analysis with clinical data.”

Professor Eleanor Main, Professor of Physiotherapy, UCL



What's next for Project Fizzyo?

After winning the Digital Health Tech4Good award in 2017, the pilot study led to a more extensive trial. The data analysis is exploring, among many things, the optimum frequency of treatment, whether gaming improves adherence and clinical outcomes, and the possibility of personalised treatment plans.

UCL has presented the Project Fizzyo data and methodology at a number of international conferences, most recently at the European CF conference in June 2023. Adults with CF have also shown an interest in the gaming-adapted physiotherapy devices.



“We worked with the students at every step of the project journey, from building the data infrastructure to designing apps for patients to use and developing games for children to play.

“This allowed students to learn essential transferable problem-solving skills and how to interact with clients in real-world scenarios. It allowed us to work with talented young people and explore possible solutions to our significant computer engineering problems.

“This is a fantastic model of collaboration, connecting education with practical and creative solutions for industry clients. Genius!

“Huge thanks to Dean Mohamedally, Lee Stott, Greg Saul and the rest of the Microsoft team, and the 80+ UCL computer science students including some properly exceptional individuals (Tim Kuzhagaliyev, Michael Woollard and Alan Bannon) who helped us run a very successful project.”

Professor Eleanor Main, Professor of Physiotherapy, UCL

2020-2021

Speeding up MHRA, NICE, and NHSD Software Compliance

Author: Ryan Wei Yue Chuah, To Eun Kim, Xinyao Zhao

Academic: Haaron Yousaf, Dr Yun Fu

Client: Joseph Connor

Organisation: RCGP / CarefulAI

Technologies used: Dialogflow, Python, Node.js, React.js

Keywords: Healthcare, Natural Language Processing

Abstract: One of the Royal College of GPs' interests lies in encouraging digital innovation. Currently, the Medicines and Healthcare Products Regulatory Agency (MHRA), the National Institute for Health and Care Excellence (NICE), and NHS Digital (NHSD) software compliance will add six to 18 months to the time to market of each innovation from May 2018, as all software will need to be Class II compliant (i.e., independently assessed).

In this project, it is hoped that a form of automated educational assistant can be devised to speed up compliance, as an 18-month delay in cash flow is a barrier to investment in digital health technology.

Repository: <https://github.com/ryanchuah/chatbot-builder-from-tree>, <https://github.com/ryanchuah/compliance-client>, <https://github.com/ryanchuah/compliance-backend>

YouTube: https://res.cloudinary.com/cyhiee123/video/upload/v1579782103/UCL/39_video_h1fluu.mp4

HoloLens app for cryoablation

Author: Mashkoor Ahmed, Othniel Adeosun, Danchen Lou

Organisation: UCL Hospital

Partners: Dr Navin Ramachandran

Abstract: Cryoablation is a process used to remove kidney tumours, involving the insertion of needles through the skin, towards the tumour, and destroying it. In this project, we built a HoloLens app used as a proof-of-concept simulation of cryoablation. We aim to see how accurately we can insert needles towards a target when basing the insertion on holographic cues and guidelines over the real target.

Key Features

- Allow a user to superimpose a holographic mesh on a given phantom box.
- Allow the user to locate the position of the tumour using the holographic mesh.
- Allow the user to insert needles into the tumour using the mesh and guidelines as a guide.

YouTube: <https://www.YouTube.com/watch?v=XCz0-VmEuW8>

Optimising the Diagnosis and Treatment of Age-related Macular Degeneration using Machine Learning

Author: Ruoqin Tang

Organisation: UCL

Abstract: Age-related macular degeneration (AMD) is the commonest cause of irreversible blindness in the UK. Every day, more than 200 people in the UK develop severe, blinding forms of the condition. Geographic atrophy (GA) is the advanced stage for the atrophic form of this disease, 'dry' AMD. This work developed a machine learning model capable of segmenting the boundaries of GA in optical coherence tomography (OCT) images. We can generate the anatomic measurements to establish classical machine learning models to predict disease progression and thus help identify novel therapies.

Attention-based Deep Multi-Instance Learning for Patient-specific COVID-19 Diagnosis from Computed Tomography Images

Author: Alexandre Weil

Organisation: Aladdin Healthcare Technologies

Abstract: The new COVID-19 coronavirus disease has been widespread worldwide since December 2019 (Chen et al., 2020; Shan et al., 2020). It is highly contagious, and severe cases can lead to acute respiratory distress or multiple organ failure (Li et al., 2020). The reverse transcription-polymerase chain reaction (RT-PCR) test (Xie et al., 2020) is currently widely used for diagnosis but has low recall and is time-consuming to perform (Ai et al., 2020; Fang et al., 2020).

Moreover, a shortage of RT-PCR testing resources during the pandemic has delayed clinical diagnosis and treatment, suggesting that computed tomography (CT) based diagnosis might be a more appropriate alternative. Initial CT scans for automated diagnosis have shown promising results, but the proposed models are almost always supervised learning based. Training those models requires a tremendous effort from the clinicians to manually label every image, which is highly impractical during a pandemic and prone to errors.

In this project, I attempted to address this issue by using a supervised learning approach to train on bags of patient-specific slices rather than individual images. I developed a range of models by combining the novel attention-based approach of Ilse et al. (2018) with the backbones of sophisticated computer vision models like ResNet or Inception (He et al., 2015; Milton-Barker, 2019). I also built automated visualisation tools to evaluate the performance of those models and help clinicians make faster and more accurate decisions. Some of the models obtained auspicious results, but they still need to be further refined and tested before being ready for large-scale deployment. My trained models can input many candidate slices, run

automated analyses, and return their selection of the most abnormal slices for clinicians to examine further. This model has much potential to help clinicians make faster and more accurate COVID-19 diagnoses.

A Comparison Study of Clinical IT Support Architectures with Knowledge Base Articles and Ranking

Author: Andrea Naudi, Xueting Wang, Wentao Yang, Jiahao Wang, Yuhui Lin, Boyan Kushlev

Organisation: EMIS Health

Abstract: To improve the user experience of EMIS Health's Now portal, we built several plug ins for their existing system along with an integrated mobile application. After encountering some limitations of the platform hosting their current system and getting user feedback, we decided to build Open Knowledge Rank (OKRA) – a solution for ranking articles and providing insights into what information meets users' interests. Using open-source architectural designs would be available to a broader range of companies and organisations with a database of knowledge-based articles. Additionally, we developed an independent Android application as a proof of concept to showcase how such clients can integrate and utilise OKRA. In this report, we compare both solutions and justify the need for building an open-source implementation..

Towards a Deep Learning Pipeline for Measuring Retinal Bloodflow

Author: Chadjiminias Chrysostomos

Abstract: Alterations to microvascular flow are responsible for several conditions, including diabetes, dementia and multiple sclerosis. We built a bespoke adaptive optics scanning laser ophthalmoscope. This technology has two spatially offset detection channels, with configurable offset aperture detection schemes to image microvascular flow. In this research, we sought to develop an automatic tool that detects and tracks erythrocytes. Classifying blood cell from non-blood cells in each frame, proposed via a deep learning convolutional neural network. The classification is coupled with a localisation process to detect the positions of the erythrocytes. We presented a capillary segmentation method to increase the efficiency and performance of the process. Finally, we implemented a technique to match corresponding cells between the two channels in the raster, allowing for a fully automatic blood flow velocity measurement.

User Interface in Autonomous Vehicles: Understanding the Trends and Challenges for Visually Impaired Drivers

Author: Su Yeon Oh

Abstract: Fully autonomous vehicles are an emerging technology that may become accessible to everyone.

However, the consumer vehicle industry has historically excluded people with visual impairments as independent drivers. Therefore, the project asks if vehicles in the future could have user-friendly interactive systems for users with visual impairments. We don't yet know the design strategies for autonomous vehicles and what progress has been made regarding users with visual impairments. This paper examines this progress and how different user interface design will be adapted to consider their vision limitation in automated vehicles, focusing on haptic feedback. We analysed a trend in self-driving vehicles through patent reviews and industry interviews regarding interaction methods and user interface aspects. The result suggests the level of focus on visually impaired people is different depending on the type of business and their aim for autonomous vehicle level.

Imaginethis: UI Prototype Design to Code Conversion Tool

Author: Vojtech Adam, Yutong Wang, Jeremy Chang, Yiding Xue, Chuyao Liu, Yiren Zhang

Organisation: NHS

Abstract: Developing mobile applications is a time-consuming and manual process. Our project explores the possibilities of using robotic process automation to automatically generate applications from their design sketches to shorten the development cycle. We propose the ImagineThis tool, which takes an annotated high-fidelity UI prototype designed in Figma and converts it into code that runs on both iOS and Android. We achieved this by developing a Figma file parser that iterates through all layers of the Figma file, identifies components and extracts data. Then we use this information to feed into our code generation algorithms, which output a complete React-Native project that we can compile and run on both mobile platforms. Our evaluation of three different Figma projects demonstrates that our tool can replicate the UI look and feel and achieve excellent visual accuracy, quality of generated source code, and code generation speed.

Intel Sight++: an Assistive Device for the Visually Impaired

Author: Sven Struan Finlay, Gísli Georgsson, Yanru Chen, Songping Lin, and Xingda Cen

Organisation: Intel

Abstract: Intel RealSense is a series of depth and light detection and ranging (LIDAR) cameras that aim to reshape the future through computer vision. Today, there is significant research on medical devices using computer vision. This project seeks to create a system for a new opportunity within this field utilising RealSense.

Novel Hybrid Models with Asymmetric Training for Malaria Prevalence Prediction in West Sub-Saharan Africa

Author: Thomas Peter Fish

Abstract: Every two minutes, a child dies of malaria. Predicting malarial prevalence has been studied for over a century and is one of the critical strategies of the Global Technical Strategy for Malaria for 2016 to 2030. Current systems do not provide short-term predictions at accuracy high enough for clinical practice or to inform government decision-making. In this thesis, we study a regional dataset with 20 years of child malaria data from the malaria holoendemic city of Ibadan in southwest Nigeria. We compare the performance of a variety of classical time-series forecasting and machine learning methods on the dataset. We then investigate novel linear-nonlinear hybrid models that have previously not been used in this study area by combining SARIMAX with newly proposed asymmetrically trained LSTM methods. We demonstrate that this approach decreases test set MSE by over 50% and increases the percentage of predictions falling within a tolerance interval of the true value by 20% compared with the previous best performance on this same dataset. We compare our method to the stacked meta-learning approach of [Wan+19], which is currently the most advanced malaria prevalence prediction method. We show that our hybrid model gives improved performance compared to our implementation of the [Wan+19] model on this dataset. We also investigate the influence of antimalarial interventions on the prevalence. This process shows statistically significantly reduced child malarial prevalence when insecticide-treated bed nets are used in conjunction with intermittent preventive treatments during pregnancy compared to having no interventions in place or just insecticide-treated bed nets alone.

Inferring Genetic Pathways Associated with Schizophrenia using Bayesian Structure Learning

Author: Daniel de Vassimon Manela

Organisation: UCL

Abstract: Understanding the behaviour of genetic pathways involves modelling a graph of interactions between sets of genes. Such graphs are of immense value to the bioinformatic and pharmaceutical industries as they provide a mapping of key genetic regulatory pathways that are central to the development of diseases. In this thesis, we use Bayesian structure learning algorithms to infer local networks around genetic loci associated with the development of schizophrenia. We also present an experimental review of traditional and state-of-the-art techniques and investigate the impact of performance when working with non-linear, non-Gaussian data. Finally, we investigate the impact of node omission in structure learning and demonstrate that for linear-Gaussian systems, the probability of a node detected depends on both the linear weighting and the number of omitted pathways hidden given a reduced feature set.

Web Application to Air Quality Analysis

Author: Jinxiu Xiao

Abstract: With the development of society, human activities are increasing. The impact of social movements on air quality continues to rise, causing more and more air pollution. To protect the air environment, we need to clearly understand the air pollution levels in different regions, find ways to display air pollution data, analyse and compare air pollution data, and obtain air pollution levels and quality changes. This project aims to create a web application for people. Bootstrap is the primary framework for frontend implementation, a collection of HTML, CSS, and Javascript. Regarding back end implementation, we built the application on a Python-based framework like Flask. Admin can download air pollution datasets for many areas in CSV format and manage data upload and storage in a database. MySQL is one of the most common general-purpose relational databases, so we use MySQL for the database. Users can find ways of displaying the data. Simultaneously, the web app provides a dashboard to view the data in tables or charts and search. The web app can show analysis functions, such as comparing air pollution quality in two months and finding averages at different times of the year.

The ANCSSC Web App: Knowledge Sharing And Capacity Building

Author: Kamile Sakelyte

Organisation: ANCSSC

Abstract: This systems integration project followed on from the work of the previous Alliance of NGOs and CSOs for South-South Cooperation (ANCSSC) development teams. It aimed to create a web application to allow organisations to share knowledge and resources efficiently and connect and form partnerships. The project involved product handling and delivery through the software development stages. We inspected, enhanced and rearchitected codebase projects to fit the new project goals. Using Agile project management, we were able to gather, analyse and implement new client requirements. We deployed the integrated system to the client server. As a result, we deployed the legacy prototype components to a live server where the ANCSSC and its members can use them. The web app provides enhanced features from foundation projects and several new features, such as geolocation mapping, enhanced member and project searching and project-related report generation for the NGOs' data based on ANCSSC models.

Food Stock Entry using Computer Vision

Author: Harry F. Bullough

Organisation: UCL

Abstract: The management of food stock in supermarkets can be achieved through demand forecasting, minimising spoilage. This management is more complex in scenarios

such as food banks due to the variation in brand, product type, and extensive distribution of expiration dates. This project aimed to review state-of-the-art computer vision algorithms for object recognition and expiration detection and implement a tool for use in a stock management system. We compiled a new food image dataset and trained a Mask R-CNN model using the Detectron2 toolbox. The model was augmented using text detection with Google's Vision API and a keyword dictionary, achieving an accuracy of 91.75%. We achieved expiration date recognition using text detection, performed two data search methods, and made a final proposal. We measured accuracy of 75%. The object recognition and expiry detection modules were rolled up into an API and deployed on an Azure VM.

Diagnotify Application

Author: Yifan Lou

Organisation: GOSH DRIVE

Abstract: Currently, the records of Great Ormond Street Hospital patients are kept offline in papers, which need a significant amount of time and effort to manage, and it is difficult for clinicians to find these records when diagnosing illness. This project aims to develop a system to store the data on a cloud server and enable clinicians to access this information by mobile phone.

A Comparative Study of Data Augmentation for Diffusion-Weighted MRI to Train CNNs for Prostate Cancer Classification

Author: Oliver Dean

Abstract: There is interest in using CNNs to aid in diagnosing prostate cancer from mpMRI exams. However, there is currently limited research into the optimal augmentation policy for such models. We used rotations, translations, shears, and scales to statically augment a training set of DW-MRI exams of 274 prostate lesions. I applied each transformation to the training set across a range of magnitudes. Thirty-nine different data augmentation policies were trialled and compared to a baseline model trained with non-augmented data. Each model was tested on a validation set of 51 lesions and evaluated using AUROC. In addition, each model was trained multiple times with a range of random seeds to estimate confidence intervals. A mean AUROC of 0.69 was the highest result, obtained by scaling the data by a 1.4x magnitude and scoring +0.07 higher than the baseline.

Epilepsy Diary

Author: Shitong Mi

Organisation: GOSH

Abstract: Traditionally, child epilepsy patients are required to record their episodes with their caregivers

logging them on paper-based records. This process is not the most efficient method, and paper-based records are challenging to store. This project aims to develop an application to digitalise this process for their caregivers. Caregivers can add, store, delete and update patients' records on their mobile phones. They can print these records and show them to their GP. Throughout this project, I had weekly meetings with Dr Fu, my supervisor, to discuss various problems, including database, UI design, and set goals to complete tasks. I used the Ionic framework and Angular for the front end and back end for the mobile development. I chose SQLite for the local database deployment. As a result, this application can record, store, update, and delete epilepsy records and ketones/blood glucose records. Users can also export the data into a PDF file to show to doctors. In addition, they can back up their data in a SQL file. Users can import the backup file data if they switch to a different device.

Sacrocolpopexy Surgical Workflow Analysis

Author: Yitong Zhang

Abstract: Laparoscopic sacrocolpopexy is the gold standard procedure for the management of vaginal vault prolapse. Statistical evidence proves a learning curve for an experienced surgeon where the operation time drops significantly after the first 30 operations and reaches a steady state after 90 cases. Due to the rarity of this procedure, training the surgeons requires a considerable amount of time and a professional trainer. The surgical workflow analysis provides a method to solve this problem. By applying artificial intelligence techniques, the phases of the procedures can be automatically detected and hence the progress can be traced. This research implemented a 3D convolution neural network with a sequential model for workflow analysis on our laparoscopic sacrocolpopexy dataset. Besides the LSTM network, we first tested the feasibility of the transformer network in the surgical workflow analysis field. In addition, we implemented the sequence-to-sequence architecture with surgical workflow analysis and explored its advanced usages. We used various training strategies in parallel for searching the appropriate one for each network.

Open Collective Heartbeat: Inclusive Technology to Amplify Social Connectedness Through Collective Cultural Experience During Social Isolation in the COVID-19 Pandemic

Author: Meg Obata

Abstract: The COVID-19 pandemic has had a colossal impact on all aspects of daily life. To reduce the impact and deaths, governments have closed public life from cinemas to theatres to restaurants and prevented ways in which people would typically interact with others. Such a stark change has caused an unprecedented number of socially isolated people to need alternatives to physical social gatherings. To investigate the possibility of replicating the same physiological and psychological feelings people

elicit when they attend social and cultural gatherings like attending a performance, we present a technology that visualises audience members' heart rates to encourage feelings of connectedness in online performances. By recruiting participants to an online performance of a singer and a poet, we were able to find promising evidence that these visualisations can provide a method for feeling connected to others in a time of social isolation.

Learning Transferable Neuroimaging Representations for Robust Early Dementia Detection

Author: Boris van Breugel

Organisation: Aladdin Healthcare Technologies

Abstract: In recent years, healthcare professionals have proposed numerous deep learning approaches for the automated classification of Alzheimer's disease (AD) from neuroimaging scans. These methods usually consist of a 3D convolutional neural network (CNN) architecture trained on MRI or PET scans. Unfortunately, AD neuroimaging datasets are small for deep learning standards; thus, existing models need to be severely limited in incapacity to avoid overfitting the training data. To effectively increase the amount of training data, this research has explored the use of transfer learning across tasks and modalities. The results indicate that transfer learning benefits performance significantly when little training data is available for the target task or modality. The methods are described in this thesis, and we expect that their benefits will be transferable to other (medical) imaging problems that suffer from data scarcity. We hope further research will improve and extend this work.

Identifying Progression-based Subtypes of Huntington's Disease: Unsupervised Learning with Clinical Data

Author: Lucy M. Rothwell, Dr Peter Wijeratne

Partners: Dr Peter Wijeratne

Organisation: UCL

Abstract: Objective: The main objective of this study was to determine whether data-driven subtypes of Huntington's Disease (HD) exist based on motor, cognitive and psychiatric clinical symptoms. A secondary objective was to test whether symptomatic variance existed independently of the biomarker, CAG repeat length.

Methods: A data subset of 5947 patients and controls across 9 features (3 motors, 3 cognitive and 3 psychiatric test scores) from the Enroll-HD data set were used. Analysis of the data included subtyping and stage inference (using the SuStaln model), MCMC uncertainty estimation, 10 fold crossvalidation and t-tests between subtypes.

Results: Three subtypes with distinct progression patterns were found: Motor-led HD (Subtype 1), Cognitive-led

HD (Subtype 2) and Psychiatric-led HD (Subtype 3). The proportions of subtypes in each group were 0.37, 0.33 and 0.3 respectively. Statistically significant differences were found between Subtype 1 and Subtype 2 and between Subtype 2 and Subtype 3, both with p-values of < 0.01 . Statistically significant differences were not found between the CAG distributions of the subtypes (p-values > 0.3).

Discussion: This is the first time progression-based subtypes of HD have been found using clinical test data. The subtypes discovered could have large implications on HD treatment scheduling, drug discovery design and our general understanding of the disease (for example the Motor-led HD subtype contradicts a key existing clinical definition of HD which states that motor symptoms usually come later). Additionally, it was shown that the distinct progression patterns (subtypes) existed independently of CAG repeat length, fortifying the argument that CAG repeat length is not a suitable biomarker for predicting disease progression.

Repository: <https://github.com/LucyRothwell/Clustering-Huntingtons-Disease>

Collaborative VR with Expressive Avatars

Author: Yun Fang

Abstract: This project aims to determine how social interaction, in terms of body language, between expressive avatars can affect the efficiency of completing collaborative tasks and if there is a relationship between the efficiency and user preferences to the level of ability to make the interaction. For this purpose, We developed a two-players virtual reality balance beam game encouraging collaboration and offering different avatars. We carried out a study with volunteers and recorded the game data, including the time spent to complete the task and the camera views, then analysed the data afterwards.

Experimental Health and Care Records Platform

Author: Suyash Kabra

Organisation: GOSH

Abstract: FHIR (Fast Healthcare Interoperability Resources) is a healthcare system that is starting to be used by many hospitals. It makes it easy for external applications to integrate with the hospital's system and move data between two hospitals' FHIR servers. However, the way FHIR stores medical data can be very complicated for developers with a non-medical background. The project creates a pipeline for developers to integrate their applications with FHIR without learning a lot about the FHIR schema. The pipeline takes in primary medical data like a heart rate value. It creates a FHIR template (and the other way round), allowing developers to create medical applications that send and get data from a hospital's FHIR server. The project has a sample mobile app as a developer app and a webserver to convert medical data to FHIR (and vice versa).

AR App (iOS) for Teaching Younger Students Computational Thinking

Author: Yiota Krashia

Abstract: This project is about implementing a mobile application that, through the use of augmented reality (AR), will contribute to the teaching of computational thinking to younger students. Computational thinking is the process of how to solve a problem and create a solution. Teaching students computational thinking equips them with crucial skills necessary to solve real-world problems and see them differently. However, computational thinking has only recently become part of compulsory education in some countries, while others are still behind. This mobile application will include a variety of features.

Estimating Biases in Facial Analysis Tools

Author: Samuil Stoychev

Abstract: Face recognition is a branch of computer science with growing importance in medicine, security, and social media. However, agreement between facial analysis tools is often low, especially when extracting demographic features like race, age, and gender. This project aims to address this problem by analysing and estimating the bias of popular image recognition tools (Face++, Amazon Rekognition, Clarifai, Azure Cognitive Services).

Innovation Feed

Author: Harry Bullough

Organisation: GOSH DRIVE

Abstract: The Great Ormond Street Children's Charity has recently set up an innovative team to drive the development of new products. A vital part of the innovative strategy is empowering staff to develop new ideas and pilot them. The goal of our project was to build a responsive web application to aid the proliferation of innovative ideas. Our solution is a website that allows staff to post their ideas and vote on ideas from staff at the hospital and charity. Each user has a dashboard that displays a list of suggested ideas generated using an algorithm based on their previous likes.

HoloPipelines V2 IntelOptimiser

Author: Immanuel Baskaran

Organisation: GOSH

Abstract: HoloPipelines version 2 is a proof-of-concept iteration to optimise the generation of 3D models from CT imaging. As part of the 2018-2019 MSc project solution, HoloRepository, HoloPipelines was created. This technology is currently a cloud-based service that performs the automatic generation of 3D models from 2D image stacks using several pipelines for neural network libraries and other image processing with

Machine Learning to apply to medical data visualisation. Optimising operations include offline local processing, multithreaded architecture scalability, GPU acceleration and applying design patterns to the core module units. Offloading and directing Python code for Intel specific processes, such as from the Neural Stick was also investigated.

An Improved Educational Model for Management of Musculoskeletal Conditions by NHS Primary Care Staff

Author: Bharghavi Damodharan

Abstract: Musculoskeletal conditions (MSK) lack a good education model for primary care staff training. This outcome has several implications for patients, primary and secondary care. Firstly, mismanagement of MSK leads to a loss of patients' confidence in GP services. Secondly, if the staff are not confident or competent to manage effectively, patients are referred to secondary care, even for trivial issues. This project aims to increase and improve the management of MSK conditions by staff. We will produce an improved educational model to render primary care more confident and competent in managing MSK.

Rapid Prototyping Concepts In Transportation Infrastructure Using Augmented Reality (HoloSketch)

Author: Anthony Cheng

Abstract: Rapid prototyping is a widely used technique to conceptualise, visualise and interact with novel ideas without investing vast amounts of time or resources, reducing the risk of project failure. Augmented reality (AR) is a rapidly growing technology that we could potentially use to enhance the rapid prototyping workflow as it brings a user's ideas further into reality. It allows users to interact with their ideas in ways that would be impossible if they were static objects. One can envision that the prototypes created in AR shall only be limited to one's imagination and the feasibility of implementing it in the real world. This project aims to demonstrate how AR could be applied to rapid prototyping within the transportation industry to encourage the uptake of such technologies, hoping other sectors see the potential benefits and integrate it into their rapid prototyping workflows.

Applications and Analysis of a Decentralised Digital Identity Architecture

Author: Oscar King

Abstract: People make multiple assertions about themselves every day. An increasing number of these assertions are made electronically, such as proof of identity or good credit. These assertions may not mean much individually but aggregated can create a detailed profile of a person. This is an issue because the original data holder may use and abuse this information, but a more malignant

party may eventually become privy to it; in four essential UK services, this work analyses a privacy-preserving digital identity management system (IDMS). It proposes several novel extensions to the IDMS that we can use for more specific use cases. It then builds upon the original design to adapt it to the particular use case of Transport for London (TfL). This extended IDMS is then analysed and evaluated against the current TfL system.

Exploring the Optimal Way to Help Engineering Students to Learn and Practice Data Science

Author: Sotirios Vavaroutas

Organisation: UCL

Abstract: This project aims to support engineering students to learn and practice data science in a user-friendly, modern and effective way. We focused on performing research and developing the educational tools required to teach the most crucial aspects of data science to university students with some basic knowledge of programming but no data science skills to achieve this. Its fundamental goals are to develop an interactive and user-friendly mobile application to teach the core data science skills that an engineer should have, on the go, along with some walk-through coding examples. To accompany the mobile app, another aim of the project is the design of a 'desktop companion' plug in for a code editor that facilitates the data analysis coding procedure for learners. The whole project results are an easy-to-use, on-the-go teaching tool, which is more than suitable for distance learning, especially after the recent coronavirus outbreak.

ANCSSC Mapping Tool

Authors: Ruairidh Williamson

Organisation: ANCSSC

Abstract: The project is designing a visual mapping tool for the Alliance of NGOs and CSOs for South-South Cooperation (ANCSSC). The tool will use IATI data, which we could replace later with the ANCSSC's member's data. When the tool uses IATI data, non-governmental organisations (NGOs) and civil society organisations (CSOs) could understand the types of projects, donors, and locations. They could use this tool to understand the data and create strategies to maximise their impact. CSOs and NGOs often do not have enough time or resources to do fundraising research. We also need to consider data licensing; most IATI data is open to use and modification. However, some do not, so the tool could keep track of this.

Using Deep Learning to Solve Inverse Problems in Medical Imaging

Author: Adam Peace

Abstract: Increasingly in medical imaging, an issue has emerged surrounding the reconstruction of noisy images from raw scan data. The forward problem is generating

raw measurement data from a ground truth image; the inverse problem is reconstructing those images from that data. In most cases with medical imaging, classical mathematical transforms work well for recovering images from clean measurement data. Unfortunately, this causes an increase in the exposure of patients to radioactive substances and makes medical imaging prohibitively expensive for developing countries. Our project aims to show that, by using a cascade of deep neural networks, it is possible to reconstruct usable images from noisy and under-sampled scan data to introduce cheaper and safer scan technology.

Blue – A Virtual Lab Assistant

Authors: Joanne Wong, Rikaz Rameez

Organisation: NTT DATA UK

Abstract: Our project is to build a lab assistant for visitors and lab users. The assistant should be able to carry out a natural conversation with users, communicate with internet of things (IoT) devices and display information about the company in the form of speech or video. The assistant should have a 3D avatar with natural animations and a face-tracking feature to constantly face the user. We use Amazon's Alexa, which has advanced natural language processing capabilities and IoT device connectivity as our back end. Our solution was to build on top of Alexa's existing functionalities by adding customised skills using Alexa Skills. Front end wise, we have a 3D-humanoid model with realistic animations and face-tracking functionalities using a camera. The back end utilises the Alexa voice service SDK to run Alexa (along with Skills) locally on a machine and operates a custom keyword detection engine. We establish real-time communication between the front end and the back end using a web socket.

Understanding Public Perceptions and Attitudes on Disability and Disabled People on Twitter

Author: Kyla Aguillo

Abstract: Negative attitudes towards disability are the most significant barriers to participation and inclusion that prevents disabled people from living a full life. Hence, this project aims to investigate society's current views on disability by exploring the terms 'disability' and 'disabled' on social media – particularly Twitter. By comparing the attitudes present in developed and developing countries, this project also determines how social-economic factors affect public perceptions. In this work, we developed a software tool for collecting and analysing Twitter data. The data collected was then analysed and used to suggest reasons for prominent trends and propose actions that we can take.

Case study: UCL HoloRepository

HoloRepository renders scans of the brain, lungs, chest, abdomen and kidneys as 3D holograms. The project is a collaboration between UCL, GOSH, Intel and Microsoft and has been running for several years.

What is HoloRepository?

It can be difficult for an untrained person to understand a medical diagnosis by looking at a CT or MRI scan. However, technical advancements in augmented reality (AR) mean there is the opportunity to use AR for medical imaging.

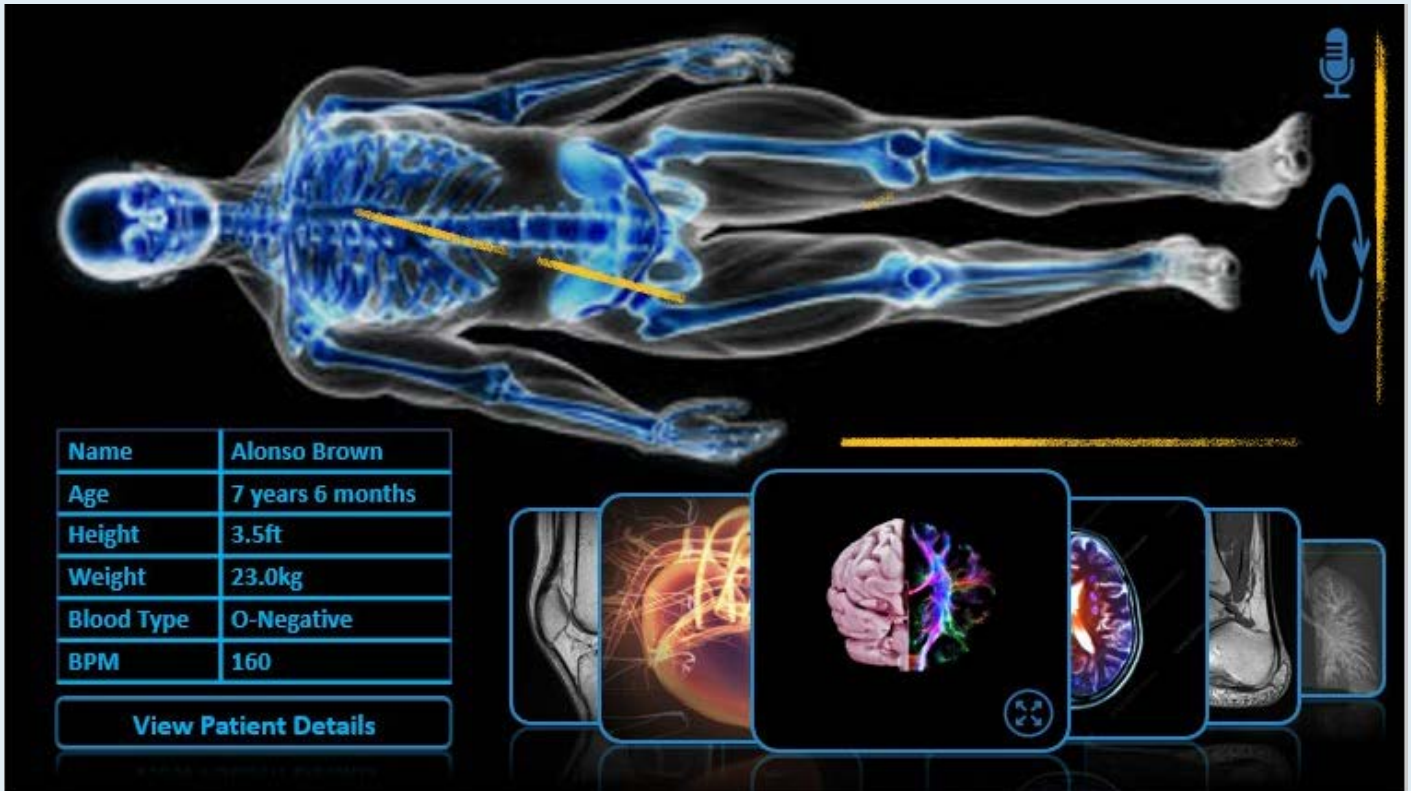
HoloRepository takes CT or MRI scans and makes them three-dimensional, using a pre-trained machine learning model and the latest techniques for organ segmentation.

IXN projects work with openly available imaging data in place of patient data. However, thanks to Fast Healthcare Interoperability Resources (FHIR), the 3D models can be connected with existing patient health records.

“This programme has been an excellent way to get a hands-on learning experience in working with clients and industry to produce a product which can feasibly have a future. Thank you to Intel and GOSH for allowing us to work with you on this exciting piece of technology.”

Joel Morgan and Sibghah Khan, worked on the project in 2019.





Versions of HoloRepository

HoloRepository 2020 Viewer

A Python tool incorporating a barebone version of HoloPipelines to segment and generate 3D models of various anatomical structures. These include the lungs, brain, kidneys, abdominals and bones. It works on your laptop/PC as a 3D viewer rendering images straight from CT/MRI DICOM scan files locally, with its HoloPipelines segmentation component. This is intended for clinicians to present and teach with.

HoloRepository 2020 for NUCs

This is an optimised build for clinical Intel NUCs that can show 3D views and simulate a local FHIR-enabled database for researchers looking to explore experimental results. This is intended for clinical research settings.

HoloRepository 2020 for Azure and HoloLens 2

This is an Azure Cloud solution that works with the newly released HoloLens 2 (AR headset) and facilitates cloud storage of 3D models.

“GOSH DRIVE has been delighted to work with the excellent team of UCL computer science students on the HoloRepository, who have done amazing work. The potential applications for holographic representation of medical information are only in their infancy, and the HoloRepository can act as a catalyst and platform for how this develops.”

Neil Sebire, Professor of Pathology and Chief Research Information Officer GOSH/UCL

What's next for HoloRepository

HoloRepository 2023 is being developed with Project MONAI to look at the state-of-the-art in CT organ segmentation. This will allow a patient to view their scans in 3D using AI and computer vision on their own computer. We're developing HoloRepository to be available in Microsoft Teams, as used by the whole of the NHS, so that clinicians are not burdened with separate software.

2021-2022

Web Service for 3D Printing Facilities in the NHS

Authors: Tega Natufe, Tudor Axinte, Maria Ciocan

Client: Dr Philip Webb (NHS), Prof Joseph Connor (NHS), Alan Fish (Apperta), Prof John McNamara (IBM)

Organisation: NHS

Technologies used: Flutter, Node.js

Keywords: Healthcare

Abstract: Our team set out to build a first-generation web service for 3D printing facilities in the NHS.

We built the solution as a web portal accessible online by logging in with an authorised UCL or NHS account. We used Flutter for the front end and Node.js for the back end. We also used the Google Maps API to create custom maps in our web portal.

Our web app successfully achieved many of the goals we set out, such as allowing users to search for nearby 3D printing facilities. Users can search for models online and manipulate the view of 3D models. Users can upload models and provide a description and thumbnail. We designed the UI such that users can easily find what they're looking to do. We also considered a security feature by using Microsoft single sign-on to permit only authorised users to use the web service.

Repository: <https://github.com/TudorAxinte/nhs>

YouTube: <https://streamable.com/9p3b74>

NudgeMe

Authors: Chris Tomy, Saachi Pahwa

Client: Prof Joseph Connor

Organisation: CarefulAI, NHS England

Technologies used: Flutter, Dart, Go

Keywords: Mental Health, Mobile Development

Abstract: According to a survey in the UK that took place nine months into the COVID pandemic, a quarter of adults reported they had felt lonely in the last two weeks. A year of isolation and a considerable decrease in movement has evidently harmed the mental health of the UK public.

We have created a cross-platform mobile application that allows users to keep a weekly record of their wellbeing and steps, which they can share with others. It also allows users to optionally contribute to a map visualisation that the NHS can use to monitor wellbeing across regions of the UK.

NudgeMe has delivered 100% of the MoSCoW requirements, and testers of the application have

reported that NudgeMe has improved their wellbeing by encouraging them to walk more. Additionally, we hope to help the NHS better understand the effect of isolation on mental health using our back end data visualisation.

Repository: https://github.com/UCLComputerScience/COMP0016_2020_21_Team26

<https://github.com/thevirtuoso1973/team26-nudgeme-backend>

YouTube: <https://youtu.be/xPsXeuL4j-4>

<https://youtu.be/wT2BrCRfX58>

Dashboard for Visualising Infusion Pump Data

Authors: Daulet Batayev, Henry Ching, Tianang Chen

Client: Gemma Renshaw

Organisation: GOSH

Technologies used: React.js, Material-UI, Redux, Node.js, PostgreSQL, Docker, Nginx, Digital Ocean, Jest, Istanbul(NYC) and Cypress

Keywords: Healthcare, Data Visualisation

Abstract: Infusion pumps deliver nutrients and medications into a patient's body in controlled amounts. So far, clinicians at GOSH have been manually collecting information from patients to record the feed data. Moreover, GOSH had no system to monitor the feed data and present it in a concise, user-friendly manner. This problem is crucial as it is often unclear whether a patient is achieving the prescribed amounts of feed, resulting in false positives about the efficiency of the treatment. Our project focuses on building a smart dashboard that receives real-time feed information from the infusion pump avoiding intermediaries and visualises the feed data with many configurable features. The dashboard is accessible for both clinicians and patients. Patients can seamlessly view their treatment history and give feedback about how they feel when clinicians monitor and change the current treatment plan to a more tailored one.

Repository: <https://github.com/COMP0016-Team6/NHS-Patient-Dashboard>

YouTube: <https://www.YouTube.com/watch?v=uFFqcel0S2g>

Lab Virtual Assistant v2

Authors: Tingmao Wang, Kaloyan Rusev, Victoria Xiao

Client: Praveen Selvaraj

Organisation: NTT DATA

Technologies used: Unity, C#, Alexa Skill, Alexa Voice Service (AVS), Python, Flask, Azure

Keywords: Virtual Assistant

Abstract: Our project improves on a previous project

that allows users to talk to an animated avatar backed by Alexa. The main focus of our project is to make the assistant UI more engaging, simplify the installation and configuration of the project and add some more functionalities to the assistant, such as allowing users to ask about company information, directions to rooms in the building, to play a video, etc.

Repository: <https://github.com/btxl192/VirtualAssistant>

YouTube: <https://students.cs.ucl.ac.uk/2020/group24/video.html>

Medicube - an X5GON Medical Prototype

Authors: Yong Hoon Shin, Zelong Ou, Wenjie Chen

Client: Dr Rawa Lina Jawad, Sahan Bulathwela

Organisation: X5GON

Technologies used: React, Spring Framework (Java), Redis, MongoDB, PostgreSQL, Kubernetes, Docker, Elasticsearch, X5GON

Keywords: Healthcare

Abstract: Prior to most medical treatments, a clinician has to obtain informed consent from the patient. This process is still largely un-automated and generally troublesome for clinicians. They have to ensure that the patient has reached a satisfactory level of understanding and voluntarily given consent and document the process as evidence. Anything short of this may present a legal liability to the clinician, as the patient can file a medical negligence claim should anything go wrong during the treatment.

This project delivers a proof of concept for a web application that centralises and automates the process of obtaining medical consent and makes the clinician's job of educating patients easier by integrating X5GON's open-source tools to fetch relevant video recommendations for a particular treatment. It additionally seeks to demonstrate how we can integrate the technology behind the Open Educational Resources aggregation/recommendation platform X5GON into a project that provides value in clinical settings.

Repository: https://github.com/UCLComputerScience/COMP0016_2020_21_Team15

YouTube: https://youtu.be/VZ_SvJwpq7c
<https://youtu.be/hGO9OFL0FYQ>

NHS5 Repository of Compliance

Authors: Shubham Jain, Mateusz Zielinski, Matthew Schulz

Client: Prof Joseph Connor

Organisation: NHS

Technologies used: JavaScript, React JS, Next JS, Node.js, Prisma, PostgreSQL, Keycloak, Docker

Keywords: Healthcare, Data Analytics, Web Development

Abstract: The Welsh Government's Health and Care Standards provide a consistent framework for healthcare staff to provide high-quality care. Unfortunately, there is a severe lack of data on how clinicians meet these standards, which we need to make more meaningful whilst reducing the significant pressure. It is challenging for them to judge, improve, or enter conversations about their performance.

This platform enables healthcare staff to enter conversations about their performance and communicate about the Standards in a meaningful way. It is an adaptable, user-centred, and intuitive online platform for staff to perform honest self-reports through a series of short questions on their own devices in their own time. The data is accessible by individuals, managers, hospitals, or health boards and is anonymised to promote honesty and privacy.

Our client and users believe the platform solves their problems and would help them to have these crucial conversations.

Repository: https://github.com/UCLComputerScience/COMP0016_2020_21_Team20

YouTube: <https://www.YouTube.com/watch?v=u1quMFeWIWQ&feature=youtu.be>

Ask Bob

Authors: Jeremy Lo Ying Ping, Ak Ihoeghinlan

Client: Prof John McNamara, Prof Joseph Connor

Organisation: IBM, NHS

Technologies used: Python, Mozilla DeepSpeech, Rasa, SpaCy, Pytsx3, JavaScript, React, Material-UI

Keywords: Voice assistant, Natural language processing, ML, Healthcare, Combatting social isolation

Abstract: Ask Bob is a customisable, open-source framework for developing federated, privacy-safe voice assistants operable both: within IBM's FISE ecosystem aiming to combat social isolation; and interactively standalone on compatible low-power Windows and Linux desktop devices, such as the Intel NUC, on which we performed all speech and data processing locally to help safeguard users' privacy.

It has a modular skills architecture to extend the voice assistant's skill set via additional componentised plugins installed at build time that, for example, interface with external services. Moreover, we added a progressive React-based configuration generator web app to help non-experts design new Ask Bob plugins and a progressive 'skills viewer' web app to inspect the skills available on Ask Bob servers visually.

Repository: <https://github.com/UCL-COMP0016-2020-Team-39/AskBob>

AutoFAQ**Authors:** Aashvin Relwani, Jade Hartley, Youmna Srour**Client:** Prof Joseph Connor (NHS), Dr Atia Rafiq (NHS), Dr Elizabeth Krymalowski (RCGP), Dr Stephanie Coughlin (RCGP)**Organisation:** NHS, RCGP**Technologies used:** Django, IBM Watson, Python**Keywords:** Healthcare

Abstract: Since the start of lockdown, GP practices have seen a drastic increase in the number of calls, many of which cannot be dealt with directly by the surgery and require redirection. Despite official advice to employ a digital triaging system to relieve these pressures, there is a lack of analysis and concrete data to do this effectively.

AutoFAQ is a web application that gives GP practices the power to perform data analysis on their call recordings. After the system converts the calls to text, the user can assign tags by searching their transcripts for keywords, generating word clouds to identify probable topics, and viewing a cluster diagram to determine similar calls. A graphical breakdown of these tags will help general practice managers precisely understand why patients are calling in. In this way, they can create tailored solutions for more effective triaging and demand planning.

Repository: https://github.com/UCLComputerScience/COMP0016_2020_21_Team36**YouTube:** <https://www.YouTube.com/watch?v=p9-jPVaf9so>**Avanade COVID19 Changes****Authors:** Zihan Zhu, Davit Mirzoyan, Qiuer Zhu**Client:** Fergus Kidd**Organisation:** Avanade**Technologies used:** Azure, Node.js, Python, Elasticsearch, Sumy, Haystack, virtual machine**Keywords:** Software development, machine learning

Abstract: Due to the COVID-19 epidemic, most companies have switched to remote working, and Avanade is one of them. The new working style brings new challenges; in particular, productivity and communication take a hit when employees are new to working from home.

We, therefore, created AvaBot to ease the pain; it holds a rich knowledge base to answer employees' questions about the company's newly induced tools and policies for remote working. It is also endowed with AI functionalities, including natural language processing and image recognition, to help employees read, analyse, and understand documents for them and thus enhance their productivity.

Repository: https://github.com/UCLComputerScience/COMP0016_2020_21_Team8**YouTube:** <https://YouTube/RtaOL-G6mAM>**Sight++****Authors:** Vlad Udrescu, Xing Su, Chenyao Li**Client:** Costas Stylianou, Sheena Visram, Dean Mohamedally, Graham Roberts**Organisation:** Intel, UCL, GOSH**Technologies used:** Flutter, Dart, NodeJS, WebSockets, Firebase, SQLite, C++**Keywords:** Healthcare, Image Processing, ML

Abstract: The primary purpose of this project is to create a new assistive device for visually impaired people using ML and image processing technologies alongside the Realsense camera and NUC computer from Intel. The user would get a wearable camera and the NUC computer with them either when moving through the house or outside, receiving speech information about the environment. COVID-19 has meant even more isolation for blind users, especially when shielding, so a system like this would be beneficial. The final goal of this project is to create an app store ecosystem for Sight++ and to have static Realsense cameras installed in specific locations (e.g. a bank), so the users will be able to connect to the local system of a location (building/zone) and receive information from around that place.

Repository: <https://github.com/SightPlusPlus>**Q-Vu for the NHS****Authors:** Shaheer Ahmed, Joshua Mukherjee, Tangsheng Geng**Client:** Dr Atia Rafiq (NHS), Dr Stephanie Coughlin (NHS), Prof John McNamara (IBM), Dr Elizabeth Krymalowski (RCGP)**Organisation:** NHS England**Technologies used:** Azure, Django, Java, Python, Javascript, HTML, CSS**Keywords:** Healthcare

Abstract: A complete web service enables a GP or NHS clinic to host a virtual queue waiting system. The activation is by a Twilio SMS message and forwards you to a virtual queue. Receptionists can view everyone in the queue at once and see descriptions of the patient's problems given while waiting in the queue. The receptionist can then forward them on with links to resources or links to talk to other staff members. The patient can see how many people are in the queue ahead of them, hopefully reducing their frustration at waiting.

Repository: https://uclcomputerscience.github.io/COMP0016_Team34.github.io/

YouTube: <https://www.YouTube.com/watch?v=GA8WpM8Fxm4>

NHS 3D Printing Hub

Authors: Tudor Axinte, Maria Ciocan, Tega Natufe

Client: Philip P Webb

Organisation: NHS

Technologies used: Node.js, Dart, Flutter, Azure, MSAL

Keywords: Healthcare, 3D

Abstract: Our team set out to build a first-generation web service for 3D printing facilities in the NHS. Our clients indicated the solution should have local GLB files loading from HoloRepository and other clinical 3D modelling formats. Our solution should also export to necessary 3D printing formats using open specifications. It should have a polished web portal access with the ability for hospitals to search for records over FHIR, local 3D GLB generated models, and then send them to destination printers in necessary formats.

Repository: <https://github.com/TudorAxinte/nhs/tree/release>

YouTube: <https://streamable.com/9p3b74>

IBM FISE v2 Concierge 2021

Authors: Calin Hadarean, Ernest Nkansah-Badu, Mohammad Syed

Client: John McNamara

Organisation: IBM

Technologies used: Vue.js, Android, Rasa, Spacy, IBM DB2, Maven, SpringBoot, Firebase, TensorFlow, Docker, Docker compose

Keywords: Natural Language Processing, Voice assistant, Web App

Abstract: Concierge is a scalable, modular and infinitely extensible voice assistant providing a helping hand to older people through speech, abstracting away the complexities of account management. The application works as part of the IBM FISE v2 portfolio of social isolation projects to make life easier in these turbulent times.

Repository: https://github.com/UCLComputerScience/COMP0016_2020_21_Team25

VizAI: Visualising Explainable AI

Authors: Julian Popovski-Jones, James Chang, Dylan Hoi

Client: Fergus Kidd

Organisation: Avanade

Technologies used: Interpret Community SDK, Django, Bootstrap, Joblib, Keras, TensorFlow, Pandas, Numpy,

PostgreSQL, Python, Jupyter Notebook

Keywords: Explainable AI, Machine Learning, Data Science

Abstract: Explainability has always been a problem surrounding AI-based technologies, such as in the area of machine learning. While data scientists may understand algorithms and training models thoroughly, the result is often unclear or confusing. It then becomes imperative for them to understand why and how a model outputs such results.

The VizAI project aims to create an application where users can use to explain their machine learning models and datasets. The explanation will include graphs so people can use this tool regardless of their technical abilities.

The achievement, impact, and potential of this project are promising. The simple and intuitive application takes only a few clicks to have a machine learning model explained with graphs. This solution can help anyone to understand complex models and datasets.

Repository: <https://github.com/deCourier/vizAI.git>

YouTube: https://www.YouTube.com/watch?v=v_AbAeR35rc

IBM FISE v2 Lounge - Social Isolation Assistance With Simplified Calling

Authors: Daniel Javadinejad, Radu Echim, Adam Piwowarczyk

Client: John McNamara

Organisation: IBM

Technologies used: Main: NodeJS, React, NextJs, MongoDB, Jitsi

Keywords: Web-app, healthcare, multi-device ecosystem, open-source, video-calling

Abstract: COVID-19 has highlighted society's need to help people in social isolation, particularly amongst our most vulnerable: the elderly. This project aims to help mitigate the potential health consequences for those in shielding by providing an interactive and privacy-safe video calling platform, proof of concept, made with the elderly in mind.

By following guidelines and principles from gerontological studies, we have designed a privacy safe and customisable online simulated lounge as a multi-device front end ecosystem. It features open-source video calling and social interactivity applications that make it easier for those in shielding to maintain contact with their dearest.

Repository: <https://github.com/UCL-COMP0016-Team-38/FISE-Lounge>

UCL MieMie v3 - NLP and Data Mining Web Scraping Engine

Authors: Kareem Kermad, Albert Mukhametov, Varun Wignarajah

Client: Ann Blandford, Neel Desai, Marilyn Aviles, Simon Knowles

Organisation: UCL

Technologies used: Python, Django, Tableau, MongoDB, Microsoft Azure

Keywords: ML, NLP, Data Scraping, Data Visualisation

Abstract: The 2030 Agenda for Sustainable Development provides a blueprint for peace and prosperity for people and the planet. The 17 Sustainable Development Goals (SDGs) are an urgent call for action by countries in a global partnership. They recognise that ending deprivations go hand-in-hand with strategies to improve health and education, reduce inequality and spur economic growth. The SDGs build upon decades of work by countries and the United Nations. A critical step is mapping how existing university activities align with the SDGs, including research expertise and course listings. One approach uses SDG-specific keywords to search through sets of university-related data, including research publications or course listings. This approach was inaccurate, causing wrong SDG mappings. We investigated the uses of machine learning to correct these false positives, learn more about each SDG and provide a validation similarity index to compare our model's predictions to string search.

YouTube: <https://drive.google.com/file/d/14crwnkdjEvfFZK9qhy0cGskQ5r9qZQSI/view>

<https://drive.google.com/file/d/1M7VYcqIUOXHhVzrg9cNbq3X-3L44G4/view?usp=sharing>

<https://web.microsoftstream.com/video/0b56cc03-d4fa-4a02-8322-e0914d22cacd>

AT-Watch

Authors: Shirui Lyu, Shilong Deng, Chukun Wang

Client: Prof Catherine Holloway

Organisation: UCL-HCI centre

Technologies used: Django, Echarts, ElasticSearch, Bootstrap, SQLite, Haystack

Keywords: Data science, software engineering

Abstract: The research in assistive technology, we believe, will lead to a better future by providing greater inclusion to our society. However, there are difficulties, such as working with data collected from various sources and formats and managing data in a low resource setting, which cost researchers time in trivial data management tasks.

In this project, partnering with Prof Catherine Holloway from UCL HCI centre, we want to address those common

difficulties working with assistive technology. From this perspective, we want to build a multi-functional data engine that supports users to access, upload and visualise the data they need in a single platform. Also, we hope our work lays a foundation for users from all backgrounds to share their stories and user experiences to facilitate assistive technology research.

Repository: https://github.com/UCLComputerScience/COMP0016_2020_21_Team1

YouTube: <https://www.YouTube.com/watch?v=DQArGTis7js>

3D Hologram Pyramid Rendering

Authors: Yong Hyun Cho, Andrei Bubutanu, Xinyi Liu

Client: John McNamara

Organisation: IBM

Technologies used: Python, OpenCV, Numpy, pyvirtualcam, Autodesk Maya, OBS Studio

Keywords: Video processing

Abstract: Our project is to create a media editor that produces a synchronised video stream that we can project in 3D onto a holographic pyramid. It can take live input from webcams or recorded video files and output the rendered visuals into a video file or to OBS Studio. We can consequently channel it into video conferencing/streaming apps.

Repository: https://github.com/UCLComputerScience/COMP0016_2020_21_Team3

YouTube: <https://www.YouTube.com/watch?v=8wbbofXPWDE>

Situated Cognition 360 Editor 2021

Authors: Zixuan Ding, Min Wang, Szu-Han Chen

Client: Sheena Visram, Prof Dean Mohamedally, Fergus Kidd, Chris Lloyd-Jones

Organisation: Avanade, GOSH, NHS, UCL

Technologies used: C#, Unity

Keywords: Virtual reality, 360-video, Clinical Training

Abstract: The interruptions to medical training during the COVID-19 pandemic have encouraged educators and trainers to try new and different technical tools to facilitate remote learning. As a novel and immersive method, Virtual Reality (VR) could offer an engaging learner experience for simulated learning scenarios in healthcare. Similarly, 360°-video can capture real-world environments and provide the learner with an immersive experience. Our project worked on the development of a proof of concept prototype of a 360°-video editor. This system serves to augment 360° video with media to create an interactive mixed reality experience. The Situated Cognition 360°

Editor 2021 comprises an editor that allows trainers to annotate any 360°-video and a corresponding player feature to extract that content for scaled deployment to learners.

Repository: <https://github.com/Apperta-IXN-for-the-NHS/SC360Editor2021/>

YouTube: <http://students.cs.ucl.ac.uk/2020/group11/img/ShortVideo.mp4>

Inclusive Hiring Pipelines

Authors: Wu Zekun, Han Sung-Hyun, Wu Jingfan

Client: Chris Lloyd-Jones, Fergus Kidd

Organisation: Avanade

Technologies used: Word Embedding, Tesseract, React JS, Django, Gensim, sklearn

Keywords: ML, Bias Elimination, Job Hiring, NLP, Word Embedding

Abstract: The Resume or CV review during hiring processing leads to significantly unconscious bias against gender, age, and race. The project aims to remove implicit human bias caused by the semantics of words within the hiring pipelines. The solution mainly focuses on detect and reduce implicit bias caused by the semantics of the unigram. We implemented an NLP technique named Word Embeddings, which turns a word into a vector and uses it to train AI algorithms. We found that the word embeddings could learn biases from the text we trained on it. The detection part, using PCA between the biased word, pairs to find the biased vector. The bias will be determined and ranked as different bias levels. For the front end, we use React.Js, which is a JavaScript library to construct our user interface. We chose the Django framework for the back end, an open-source web framework written with Python.

Repository: https://github.com/UCLComputerScience/COMP0016_2020_21_Team9

IXN3 Virtual Lecturing Environments with Unity and OBS with UCL and IBM

Authors: Adnan Benachar, Sinead Villanova Tattan, Misha Kozlov

Client: John McNamara

Organisation: UCL, IBM

Technologies used: Unity, OBS, Express.JS, Socket.IO, WebRTC, PeerJS, Tensorflow.js, BodyPix

Keywords: 3D environments, Graphics

Abstract: The transition from in-person to online interactions has been challenging during the COVID-19 pandemic. Suddenly, we're all required to carry out social gatherings, lectures, meetings, and conferencing apps, and sitting at our computers all day is becoming

increasingly dull. With VPE, we've mitigated the negative impacts by creating a more engaging live medium for presenting information to replace the current simple webcam and screen share standard. VPE has various 3D virtual environments such as lecture halls and conference rooms, allowing one or more people to be seamlessly rendered into the scene, depicting them in a physical space. You can also configure the scene you choose, including the option to display a desktop behind you. No more dull, monotonous video calls!

Repository: <https://github.com/AdnanBen/vpe>

YouTube: <https://www.YouTube.com/watch?v=Qb1h6kHVCSY>

<https://www.YouTube.com/watch?v=zrTZKXH3Bkw>

GP IVR

Authors: Chris Dai, Max Wilson-Hebben, Catalina Agachi

Client: Prof Joseph Connor

Organisation: NHS England, RCGP

Technologies used: Python, Asterisk, Twilio, Docker, PocketSphinx

Keywords: Interactive Voice Response (IVR), Automated Call, Healthcare, Emergency system

Abstract: Calls to GP surgeries have increased by 200% due to COVID19. The GP IVR is an innovative solution aiming to improve GP call queues. We redirect a user to a relevant clinician rather than all patients going through a GP receptionist. We deliver a better experience for patients by taking them through an initial triage of questions before redirecting them to the right clinician, depending on their answers. Our system gathers yes/no answers from a caller, using open-source speech to text run locally. For this reason, our solution is fully compliant with GDPR.

Apart from improving patients' experience, the solution also provides a user-friendly interface that allows back end users (e.g. receptionists) to create IVR call systems and easily handle calls. The GP IVR tool also clarifies incoming call data, allowing further analysis and changes to GP staff structures.

Repository: https://github.com/UCLComputerScience/COMP0016_2020_21_Team35

YouTube: https://www.YouTube.com/watch?v=L_aTdaRX8Mw&t=2s

Consultation+

Author: James Kinsler-Lubienski, Anirudh Lakra, Dian Kalaydzhiev

Client: Elisabeth Krymalowski (RCGP), Joseph Connor (NHS Wales), Atia Rafiq (NHS)

Organisation: RCGP, NHS

Technologies used: C#, .NET, Python, Django

Keywords: Healthcare, Data Science, NLP

Abstract: Currently, GPs do not have a way to search trusted medical information sources online quickly. We seek to change this. Consultation+ is a search app that searches sources of information that GPs themselves have elected as trusted sources, along with a myriad of other tools to streamline a GP's workflow and ensure that they spend as much time as possible diagnosing patients. We collated data from the app into a comprehensive dashboard to draw trends based on the GP's country. This app has been making small waves in the medical community. We have contacted organisations such as Health Education England and Great Ormond Street Hospital to discuss further plans for this project.

Repository: <https://github.com/jklubienski/SysEng-Team-33/>

YouTube: <https://vimeo.com/530743688>

TEND-VR for Unity

Authors: Mohamad Jamil, Rowan Kiam, Konstantine Siokos

Client: Matthew Hoad-Robson

Organisation: TEND-VR

Technologies used: Unity, Google Cloud, Newtonsoft

Keywords: Virtual Reality, Psychology, Meditation, Healthcare

Abstract: Tend-VR is a company focused on delivering new meditation and mindfulness content in virtual reality to improve users' mental health and wellbeing. In this project, we worked with the project partners over at Tend-VR to implement an assortment of features as requested by their team to provide the application's users with more user-friendly and engaging content.

Repository: https://github.com/UCLComputerScience/COMP0016_2020_21_Team17

YouTube: <http://students.cs.ucl.ac.uk/2020/group17/index.html>

AR App for Patient Education and Awareness Prior to the MRI Scan

Authors: Li Yean Chew, Zeyu Zhou, Arib Islam

Client: Tom Winstanley, Praveen Selveraj, Daniel Brickwood

Organisation: NTT DATA

Technologies used: Unity, C#, IBM Watson, Firebase

Keywords: Data Science, AR

Abstract: MRI exams, commonly used to monitor patients' health, are performed on an adult, but it is not

unusual for a child to undergo the scan if their condition requires it. However, the majority of the existing resources on the MRI process are for adults. As such, a child undergoing an MRI may feel anxious as they may not fully understand the process.

For this project, we worked with NTT DATA to create an augmented reality proof of concept to educate and raise the awareness of younger patients before the scan. They should observe the scan process and communicate with a virtual practitioner to answer any queries.

Through this app, they will better understand the scan, enhance their knowledge, and hopefully reduce their anxiety before they undergo an MRI exam for the first time.

Repository: https://github.com/UCLComputerScience/COMP0016_2020_21_Team21.git

HoloRepository Portable 2021

Authors: Bryn Llewelyn-Jones, Shuai Yuan, Daniel Rempel

Client: Costas Stylianou

Organisation: UCL, GOSH, Intel

Technologies used: Unity, C#, HLSL

Keywords: Healthcare, computer graphics

Abstract: The HoloRepository Portable 2021 is a windows-based, 3D medical model viewer application. It aims to provide a convenient way for clinicians and educators to view, manipulate and store information about medical 3D models.

Repository: https://github.com/UCLComputerScience/COMP0016_2020_21_Team32

YouTube: <https://youtu.be/pnxuC5mFitQ>

SMS It: Chatbots for Everyone

Authors: Zvezdin Besarabov, Thowhid Ahmed, Michael Khot

Client: Prof Joseph Connor

Organisation: NHS

Technologies used: React, Electron, Twilio, Voiceflow, Node.js, Mobx, JavaScript, TypeScript, Gatsby

Keywords: SMS, Voiceflow, Twilio, UBF, File Format, Conversion, Chatbot, NHS

Abstract: Amidst the pandemic, NHS doctors are overwhelmed by queries from patients with generic problems that one can resolve with generic advice. This process is not an efficient use of NHS resources.

To solve this issue, the NHS seek to design automated medical advice chatbots. These chatbots should be accessible over SMS to reach as many patients as possible. Many chatbot design platforms exist, with Voiceflow being the NHS's preferred choice. However,

none of these platforms supports exporting chatbot designs over SMS.

This project creates an ecosystem for designing and deploying SMS chatbots. We provide a standalone desktop application allowing anyone to use a Voiceflow design and publish it as an SMS chatbot behind an actual phone number in 3 clicks. Immediately, this chatbot becomes accessible to anyone in the UK.

This project can help the NHS provide the automated chatbots it needs and make more efficient use of its human resources. In addition, the larger community can benefit from our project in the following ways:

- We design a set of standard formats and APIs that make it easy to expand our solution with more types of input designs and SMS back end services.
- We provide two published, documented and tested open-source software libraries as implementations of these standards.
- With these packages, anyone can create their global SMS bots in 3 lines of code
- We incorporate three types of automated testing: Unit, Integration, End-to-End.

Repository: <http://code.sms-it.io/>

<https://github.com/tahmed4/vf-to-ubf>

<https://github.com/tahmed4/ubf-to-twilio>

YouTube: <https://www.YouTube.com/watch?v=afAb8GFxpG0>

<https://www.YouTube.com/watch?v=Oyl6lOue6fk>

AAP/EFP Classification

Authors: Jawahar Tunuguntla, Sercihan Kulak, Aleksei Sukhov

Client: Dr Anastasiya Orishko, Dr Federico Moreno Sancho

Organisation: UCL Eastman Dental Institute

Technologies used: MongoDB, Express.js, React.js, Node.js, Azure

Keywords: Healthcare, Dentistry

Abstract: A website to help the UK implement the new AAP/EFP and classify periodontal and peri-implant diseases and conditions.

Repository: https://github.com/UCLComputerScience/COMP0067_2021_Team14

Virtual Assistant with Low Latency Lipsync

Authors: Brandon Tan, Xiu Loon

Client: NTT DATA

Technologies used: Unity, C#, Azure

Keywords: Media

Abstract: The project aims to create a Virtual Assistant using a Unity front end and an Amazon Alexa back end. We had an existing codebase containing a minimum viable product to start – this needed to be polished and developed further. Key further developments include implementing low latency lipsync to the virtual assistant and making the overall project more scalable and configurable.

Repository: <https://github.com/btxl192/VirtualAssistant>

Predicting Brain Age from MRI Scans of Healthy Brains

Author: Raghib Mirza

Technologies used: SynthSeg, TensorFlow

Keywords: Medical Imaging

Abstract: The primary goal of this project was to explore a novel brain scan segmentation tool called SynthSeg, and to utilise it on an array of brains to train a supervised model that can predict the brain age of healthy T1 weighted MRI scans with minimal loss. This project aims to compare the segmentations produced by SynthSeg to the segmentations produced by existing technology, SPM.

One of the most significant challenges in meeting these goals was achieving adequate quality control and ensuring that brains from different data sets were consistently segmented to confirm no biases in the statistical data.

We achieved the project's primary goal using UCL's High-Performance Clusters, which allowed around 5000 brains to be segmented quickly using GPU power. We used Python to transform the segmented data into viable machine learning models. We used R for the secondary aim, allowing a relatively unbiased comparison between SPM and SynthSeg.

The project successfully evaluated five different supervised machine learning models as predictors of brain age. We chose the best one to create a Python program that can take a brain scan as input and return a prediction for brain age. As well as this, we performed a thorough comparison between SPM and SynthSeg.

NHS FHIR Data sync (Grace Chatbot)

Authors: Alex Hein, Shea Magennis, Jakub Mularski

Client: John Booth

Organisation: GOSH

Technologies used: NodeJS, Neo4J, LUIS, Azure

Keywords: Healthcare, Data Engineering

Abstract: Due to recent developments in graph technologies, there has been a rise in exploring their functionalities during recent years. While most use relational databases to store data for any general case,

graph databases present an opportunity to improve the process of data organisation due to their flexible nature. A growing challenge within the health data community is the tedious process of retrieving patient data due to a lack of user-friendly UIs and the continued use of inefficient data organisation techniques, such as that of a relational database. This system demonstrates a proof of concept of the usefulness of graph databases towards patient healthcare, specifically through patient data retrieval to aid clinicians in navigating through more significant amounts of health-related data. Our solution offers to 1) build and integrate a chatbot to the graph database, 2) provide a user-friendly, precise visualisation and representation of data, and 3) have responsive and efficient data retrieval.

Repository: https://github.com/UCLComputerScience/COMP0016_2020_21_Team18

YouTube: https://www.YouTube.com/watch?v=haUGWvS_KKw

<https://youtu.be/BeowpwDkTDY>

LDEncoder: Reference Deep Learning-Based Feature Detector for Transfer Learning in the Field of Epigenomics

Author: Warren (Gun Woo) Park

Technologies used: PyTorch, Python

Keywords: Bioinformatics, Epigenomics, Transcriptomics, Transfer learning

Abstract: I propose a reference feature extractor that we can use for the epigenomics domain to solve trans/inter-omics classification and regression problems using DNA methylation data as an input. DNA methylation data is part of epigenomics data that external factors alter, including the change in environment. It has multiple roles, including the regulation of gene expression. The goal of the reference feature extractor is to provide a generalised model that can encode the features from the input data in a particular -omics domain. Then, the model can be used to solve alternative problems while using problem-specific knowledge, trained with significantly more training data.

Furthermore, a multilayer perceptron used in this approach has the encoding dimension of 512. We use this perceptron to represent the high dimensional DNA methylation data in a significantly lower-dimensional feature space. So, if the new classification/regression problem needs to be solved, we can use the input dimension of 512 for further model training. This approach significantly reduces the amount of time and computational resources required for solving problems. In effect, transforming the DNA methylation data to gene expression data (RNA-seq) while having a bottleneck (significantly smaller encoding dimension) enables the lower dimensional encoding of the data. We evaluate the generalisability of the model through cancer/non-cancer prediction and breast cancer molecular subtype prediction

results, and we showed the accuracy from experiments to be comparable or better than other state-of-the-art approaches.

Newborn Baby App

Authors: Giuseppe Baldini, Caroline Crandell, Chenuka Ratwatte

Client: Dr Iya Whiteley

Organisation: Cosmic Baby Books

Technologies used: Ionic, Capacitor, Cordova, React.js, Node.js, Express, MySQL, HTML, CSS, Sass, Typescript, jQuery, Axios

Keywords: Baby Development

Abstract: Cosmic Baby Books is a growing collection of books and learning materials for babies of all ages. Their stimulating black and white images aid infants' brain and eye development whilst also engaging their attention and calming them when distressed. Parents who are desperate for a break while caring for their children and want to ensure that they engage with materials that support healthy cognitive and visual development particularly value these images. Dr Iya Whiteley (space psychologist, cognitive engineer, and founder of Cosmic Baby Books) offers a new medium of accessibility through a mobile application, featuring the images first presented in her Cosmic Baby Books collection. The objective of this mobile app is to showcase animated black and white development cards to babies in a slideshow with audio narration describing each image. These slideshows aim to benefit cognitive and physiological development and keep babies engaged, entertained, and calm. The front end of this mobile App is coded in Typescript/React.js, using the Ionic framework with Capacitor plug-ins to offer cross-platform functionality (Android and iOS). The back end of this mobile app was created with Node.js, using an Express server and MySQL database. We hosted the back end using Microsoft Azure, and the client front end coded in HTML, CSS, and JavaScript. Our final product offers an intuitive, educational and enjoyable experience for users.

Repository: https://github.com/UCLComputerScience/COMP0067_2021_Team16

YouTube: <https://youtu.be/CjLGu5Rn3ms>

GOSH CRF Staff Activity Tracker

Authors: Hao Cheng, Matthew Jones, Benedikt Kau

Client: Gemma Molyneux

Organisation: GOSH DRIVE

Technologies used: Flask, MySQL, Ionic, Angular, Capacitor, HTML, CSS, JavaScript

Keywords: Project Management, Time Tracking, Healthcare

Abstract: GOSH runs numerous clinical trials each year with private sector commercial partners. Labour costs can

make up a significant fraction of the expenses incurred by GOSH in these trials. It is currently tracking time spent on trials using a system of shared spreadsheets.

However, the spreadsheet system suffers from data accuracy, consistency and integrity issues. DRIVE, therefore, tasked us with creating a fully functional prototype of a new system, combining a web portal for administrators to manage the system (and extract data) and a cross-platform mobile application for staff to track their time.

Our solution 'TRACK' combines a browser-based web portal, a cross-platform app built with Ionic, and a shared Flask back end.

Repository: https://github.com/UCLComputerScience/COMP0067_2021_Team15

YouTube: https://youtu.be/8OrgAMvBe_0

GOSH Twitter Feed

Authors: Théo Reignier, Thomas Smith, Ruoyu Shi

Client: Gemma Molyneux

Organisation: GOSH DRIVE

Technologies used: React.js, Node.js, Socket.io, MySQL, Twitter API, Azure

Keywords: Healthcare

Abstract: GOSH DRIVE require an application to help them display real-time tweets during conferences to increase the level of interaction in the audience. However, there is no suitable commercial software to achieve this goal.

We spent some time researching and designing a suitable solution. With the help of our teaching assistant, we found a solution using a combination of React.js for the front end, Node.js HTTP module for the back end, Socket.io for bidirectional and event-based communication between front and back end, MySQL for the database and obviously, the Twitter API (v.2). Being unfamiliar with all technologies listed above, we had to learn using official documentation.

VisualTweet is our final product. It allows users to customise a preview of their presentation and set their tweet filters. Users can also save the current state of the presentation as a public or private template to access it in the future and save time. Finally, there is an admin user able to manage user accounts in the system.

Repository: https://github.com/UCLComputerScience/COMP0067_2021_Team18

QuotaFit App

Authors: Gabriel Freedman, Yang Zou, Yuxin Guo

Client: Akeel Noordally

Organisation: QuotaFit

Technologies used: Ionic, Angular, Firebase, SQLite, html5, CSS, TypeScript

Keywords: Fitness, Mobile App, Motion Diary

Abstract: Quota Fit is an organisation focused on developing weight loss solutions that are accessible, effective and convenient. Currently, they base these around one-to-one or one-to-many trainer-client interactions through a digital medium. This process dramatically limits the bandwidth of each trainer, and thus the number of clients who they can train. As delivered by this project, the solution to this problem is to create a fully automatic digital training plan that can offer a comprehensive training experience without requiring any human input from a trainer. This system allows a far greater number of people to train and maintain their fitness than would be possible without a fully digital solution.

Repository: https://github.com/UCLComputerScience/COMP0067_2021_Team23

YouTube: <https://youtu.be/xvFlwA0mnbj>

Health Education England: Q&A Database Generator

Authors: Ashild Kummen, Frederic Johnson, Richa Lad

Client: Richard Price, Richard Brunton

Organisation: Health Education England

Technologies used: HTML, CSS, JavaScript, Bootstrap, NodeJS, Express, MySQL, EJS

Keywords: Healthcare, Web Development

Abstract: The Q&A Database Generator is a project under The NHS Learning Hub developed by Health Education England, a website providing the national health and care workforce with the opportunity to share and access a wide range of education and training resources. This system ensures that healthcare professionals are equipped with the necessary skills and values to deliver excellent healthcare. Users are currently not able to create and share assessments on such resources. Adding this functionality would mean an enhanced learning experience for those who take the assessment, with the opportunity for immediate feedback and allowing teachers to track their students' progress. Our goal was to develop an assessment editor that allows Learning Hub users to create and manage such assessments, comprising a collection of questions and answers that one could publish as part of an education or training resource. Users would also be able to create banks of questions stored for later use. The project was developed as a web application, using primarily HTML, CSS, Javascript, jQuery, Bootstrap on the front end, and NodeJS, Express, EJS and MySQL

on the back end. We deployed the application to the cloud through Microsoft Azure App Services and stored the database through Azure Database for MySQL. After carefully considering the HCI principles, the final application provides a simplistic and elegant interface designed with the user in mind. The application is fast and durable, with few known bugs. Through excellent teamwork and frequent communication with the client, we delivered a project that met 99.14% of the essential functional requirements and 85.70% of the client's optional functionality requirements. Users can create quizzes from scratch, develop quizzes as a combination of different question banks, and create question banks. They can add, edit, reorder and delete questions in quizzes and question banks, preview what their quiz will look like to others and generate a link to their quiz that users can share with others. The website will allow the busy national healthcare workforce to develop their skills remotely and engagingly.

YouTube: https://github.com/UCLComputerScience/COMP0067_2021_Team07

Tracheostomy Passport

Author: Xin Chen, Lai-Pong Chung

Client: Gemma Molyneux, Andrew Hoey

Organisation: GOSH

Technologies used: ionic, Angular, capacitor, HTML, CSS, Typescript

Keywords: Healthcare

Abstract: We built the tracheostomy passport app to provide community hospitals with easily accessible information. Such information includes the patient's tracheostomy tube details, background pathology and previous surgeries. It gives parents greater autonomy and control of tracheostomy information and easy access to clinic letters and future appointments.

Repository: https://github.com/UCLComputerScience/COMP0067_2021_Team10.git

Neuro-GAN: Generative Adversarial Networks for Neuron Generation

Author: Yi Zhong

Technologies used: TensorFlow

Keywords: GAN, Neuroscience

Abstract: There is significant use of morphological features of neurons in neuroscience research. However, the measurement and reconstruction of real neurons' microstructure are difficult. In this project, we attempted two generative adversarial networks (GAN) to generate the nerve fibres of neurons with more realistic features. The first network contains Deep Neural Networks (DNN) based generator and discriminator to transform a 2-D

random noise into the coordinates of nerve fibres' nodes. The generator and discriminator are trained with each other's outputs to achieve the gradient descent. To generate smoother and orderer samples, we modified the generator and the discriminator in the second network to Recurrent Neural Networks (RNN), which regard the nodes of nerve fibres as time sequences to extract and learn the sequential information between each node. Compared with the generation algorithms only based on mathematical statistics, the neurons generated by the GAN-enhanced algorithm have more realistic microstructures. Besides, these works also inspired a possible solution to develop the whole neurons only based on GAN models

Repository: <https://colab.research.google.com/>

Webcam-Based Hand Gestures To Control Existing User Interfaces And Its Value In A Clinical Environment

Author: Åshild Kummen

Client: Sheena Visram, Joseph Connor, Lee Stott, Prof Dean Mohamedally, Prof Graham Roberts and Dr Atia Rafiq

Organisation: Great Ormond Street Hospital, Microsoft, NHS England

Technologies used: Python, C#

Keywords: Healthcare, Touchless Technology, Software Engineering, Computer Vision, Machine Learning

Abstract: There is no doubt that touchless technology will play a vital role in the new workplace post COVID-19, allowing users to interact with their computers without needing a mouse, keyboard, or any form of physical input. Yet, despite substantial progress in machine learning and computer vision that allows for advanced gesture recognition, an affordable solution for touchless computer interaction is still missing. This project presents MotionInput, an application that uses existing open-source technologies to recognise four modules on input: hand gestures, eye tracking, head movement, and full-body gestures. Specifically, this project reports on the hand gesture module developed with NHS clinicians to allow for touchless control of existing user interfaces, including 2D image navigation and manipulation.

YouTube: <https://youtu.be/AI6mX5W7knk>

MS Learn Module To Teach Programming Using An Azure Sphere

Author: Jawahar Tunuguntla

Client: Dave Glover and Mike Hall

Organisation: Microsoft

Technologies used: C, Azure, Git, Github, Azure Sphere

Keywords: Azure Sphere, Azure, Programming, C

Abstract: The internet of things (IoT) is quickly becoming one of the most common digital services that people are installing inside their homes with innovation and convenience in mind. Microsoft has developed a new secure platform for IoT devices called Azure Sphere. This new system has very few learning materials available. This project aims to solve this problem by creating an MS Learn Module to showcase best practices to guide developers onto this platform. Best practices are tips and tricks for C Language and other Azure Sphere basics. MS Learn Modules are training courses developed to refine the skills of developers at any learning stage. This MS Learn Module showcases best practices for C development on the Azure Sphere AVNET MT3620 Starter Kit. The primary purpose of these exercises is to understand how IoT can vary from desktop applications and learn Azure Sphere programming.

Repository: <https://github.com/JawaharT/Best-Practices-On-Azure-Sphere>

<https://github.com/JawaharT/Best-Practices-On-Azure-Sphere/wiki>

A Platform To Organise And Schedule Working From Home And The Office For Teams

Author: Manuel Buri

Client: UCL Internal

Organisation: UCL Internal

Technologies used: Django, HTML, AWS, JavaScript, CSS, Slack API

Keywords: Future of Work, Hybrid Work, Collaboration, Startup

Abstract: This thesis investigates the application of a user-centric software-as-a-service platform to efficiently organise and schedule work from home and the office for teams. I conducted this research in collaboration with the author's startup called Floq. This thesis investigates the software development process of the software-as-a-service platform called Floq. Floq is a startup developing a web and Slack application that serves as a platform to easily organise and schedule work from home and the office for teams. The developed software-as-a-service platform is an alternative to traditional spreadsheets or calendar entries many organisations still use to organise and plan to work from home and the office.

Virtual Reality Stroke Rehabilitation

Author: Richa Lad

Client: David Fried

Organisation: Evolv

Technologies used: C#, Unity, Visual Studio Code

Keywords: Healthcare, Rehabilitation, stroke, Virtual Reality, Cognitive VR, VR, VRT, physical therapy

Abstract: Strokes are a leading cause of disability in the UK, with over 100,000 happening annually. This project aims to create a Virtual Reality Therapy experience that aids stroke patients during their recovery.

The solution has been developed in C# and Unity and targets three core areas of a patient's recovery – upper limb motor function, cognitive ability, and mood. It does so by placing a patient in an extra-terrestrial environment, offering a distraction from reality. Patients must complete two mini-games, the difficulty level of which can be adjusted by their therapist. Patient data is saved to the device, enabling therapists to track their patient's progress.

The game challenges patients physically and cognitively and allows therapists to track their patient's progress more easily. Its compatibility with multiple devices creates a future-proof solution, although more investigation is necessary for the future as to how effective this specific system is.

YouTube: https://youtu.be/-F_wy1xGFe0

A Single Point Of Access (SPA) Application For Access To Mental Health Services

Author: Caroline Crandell

Client: Prof Joseph Connor

Organisation: NHS

Technologies used: Django, SQLite, Python, jQuery, Twilio

Keywords: Mental Health

Abstract: In the UK, people face several challenges when seeking mental health treatment through the NHS, such as completing lengthy online questionnaires, waiting for several weeks or months to be contacted, and being turned away based on the severity of their circumstances or their proximity to services. This user experience can be particularly distressing for those experiencing a mental health crisis or presenting a high risk of harm, and a prompt response is vital. The principal aim of this application is to provide solutions to these challenges by creating a simple and effective user experience for those seeking help.

The Single Point of Access application includes the following goals: split the lengthy online self-referral questionnaire into parts prioritise urgent cases by scanning for high-risk phrases send an email to the designated clinician indicating the patient's risk level enable clinicians to export patient data to alternative services.

YouTube: <https://youtu.be/prh2AIRaXaY>

MotionInput v2.0: Eye-tracking Module For Creativity

Author: Guanlin Li

Client: Jarnail Chudge

Organisation: Microsoft UK

Technologies used: Python, OpenCV, OpenVINO, MediaPipe, DirectX, WinForm

Keywords: Eye-tracking, gaze estimation, human pose estimation, deep learning, computer vision

Abstract: Eye-tracking is a technology that tracks the user's eye gaze and captures the location where the user looks. In this project, we propose a new webcam-based eye-tracking method for mouse navigation, and it uses hand gestures or a keyboard to trigger mouse clicks.

This eye-tracking method needs three different steps:

- We need to obtain the gaze estimation.
- We need the user's position information concerning the camera.
- We compute the location on the screen.

Ideally, users do not need to calibrate each time they use. But it depends on the accuracy of gaze estimation and depth capture.

We test the eye-tracking with some existing software in Windows 10, such as PowerPoint and Adobe PDF Reader. For example, the user can scroll up/down a PDF and highlight text with their eyes and hand gestures without touching the computer.

YouTube: <https://youtu.be/BZjdXJMfeg>

Azure Sphere IoT And AI Developer Project For Detecting Room Capability

Author: Yuxin Guo

Client: Mike Hall and Dave Glover

Organisation: Microsoft

Technologies used: C, Python, Azure Sphere, Azure Machine Learning, Azure Function, Scikit-Learn

Keywords: embedded system, IoT, ML

Abstract: When COVID-19 is spreading worldwide, social distancing is one of the most important approaches for saving lives and alleviating further virus transmission. While social distancing for outdoor spaces needs people to obey the rules, social distancing for indoor environments also limits the number of people in the room, allowing people to have enough space to keep their distance. So, it is crucial to monitor the room capability for keeping indoor social distance dynamically. Based on this, the project aims to develop an automatic, error-free, energy-efficient, and remote-controllable Room Capability Monitor based on Azure Sphere, involving: hardware device for detecting the

number of people in rooms cloud service allowing remote user interaction machine learning model on the cloud that predicts the future number of people in rooms.

Repository: https://github.com/intheRain07/UCL_IXN_Project-Azure_Sphere_IoT-ML

YouTube: <https://youtu.be/HGSBgAjKHD0>

Tennis Sense

Author: Jacob Lapkin

Client: Fergus Kidd

Organisation: Avanade

Technologies used: Microsoft Azure, Visual Studio Code, Microsoft Excel, MySQL Workbench, Python, JavaScript, CSS, Custom Vision, OpenCV, MediaPipe, Chart JS, Matplotlib, Pandas, NumPy, Bootstrap, Font Awesome

Keywords: ML and HCI

Abstract: The project's primary goal was to create an open-sourced web application and analytics tool that would allow tennis players from low-income households to improve their stroke technique. The application seeks to address the difficulties many tennis players inherent through the sport, such as the inability to receive low-cost recommendations concerning their strokes for improvement. I created the application using Python's Flask framework and utilised computer vision methods such as pose estimation and image classification. I predominantly focused on allowing users to upload videos of their tennis serves to receive statistics, scores, and recommendations for improvement.

The library MediaPipe was chosen to deliver 3D pose estimation that could track different joints on the human body. I applied Microsoft Azure's Custom Vision and pose estimation data to classify various aspects of the player's stroke.

Repository: https://github.com/Jacob-Lapkin/UCL_Thesis.git

Theory In The Overview Effect – Using A Complex Theory Of The Earth To Enhance The Overview Effect In Virtual Reality

Author: Narcis Marincat

Client: UCL Internal

Organisation: UCL Internal

Technologies used: C#, Unity, Photoshop, FL Studio, SPSS

Keywords: Virtual Reality

Abstract: As an increasing number of people will travel into space via commercial space travel, a notable psychological phenomenon that will be made more accessible is the 'overview effect'. The psychological

effect that astronauts report when they travel into space and gaze at Earth. This phenomenon, marked by a cognitive shift, includes a sense of awe, recognising the interconnectedness of life on Earth and a renewed sense of social responsibility. This project involved designing a virtual reality (VR) experience that aimed to reproduce the overview effect and examine whether introducing a complex theory of what the participants see while Earthgazing will enhance this effect. Overall, the VR experience induced the overview effect successfully. Still, there was no significant difference between participants introduced to a complex theory of life on Earth while engaged in the experience and those who did not.

Facilitating Brainstorming Through Augmented Reality Technology

Author: Benedikt Erasmus Kau

Client: John McNamara

Organisation: IBM

Technologies used: Unity, C#, AR Foundation, IBM Watson, IBM Cloudant, Node-RED

Keywords: Augmented Reality, Artificial Intelligence, Design Thinking

Abstract: Recent transitions to working from home exposed the challenges surrounding remote collaborative brainstorming. Existing ideation tools have concentrated predominantly on variants of digital whiteboard designs. Despite research suggesting that brainstorming in open settings with three-dimensional objects may yield more creative results, the role of augmented reality (AR) in ideation tools has remained largely unexplored.

This project aims to investigate the extent to which AR can facilitate the design thinking process. A prototype realised a three-dimensional interpretation of core design thinking concepts based on AR design principles. thinkAR is an Android and iOS mobile application based on Unity's hybrid ARFoundation framework with a Node-RED, IBM Cloudant back end including IBM's Watson service

The result demonstrates the feasibility of designing usable AR brainstorming and design thinking applications. The prototype may lay the groundwork for subsequent user acceptance research examining the relationship between AR and creativity.

Repository: <https://github.com/benediktkauf/thinkAR>

PACE: A Wearable-based Approach To Long COVID-19 Recovery

Author: Ko Sakuma

Client: Melissa Heightman (UCLH), Sam Duncan (Apple)

Organisation: UCLH, Apple

Technologies used: Swift

Keywords: Long COVID, Wearables

Abstract: This project was set up with University College London Hospital to create an application (named 'Pace') to support Long COVID patients. Apple supported any technical queries that the author had during the project.

Pace helps patients to self-manage their recovery process with an iPhone and Apple Watch app. Pace is distinctly different from the existing Long COVID applications in 2 key regards:

- Pace is the first attempt to leverage wearable data in the Long COVID recovery app space.
- Instead of symptom-tracking, Pace focuses on motivating patients to find and accomplish appropriate daily activity goals.

From a technical standpoint, Pace is a native iOS and watchOS application. I built the application with Swift 5 and frameworks such as SwiftUI, HealthKit, and Watch Connectivity. I set up the code design to allow maximum flexibility for future builds, and Human Interface Guidelines informed the UI-related decisions. Pace is also a self-contained application, respecting patients' privacy.

Knowledge Distillation For Lattice Free Maximum Mutual Trained Acoustic Models

Author: William Tudor

Client: Sam Ringer

Organisation: Speechmatics

Technologies used: Pytorch (Python), Tensorboard, Deep Neural Networks

Keywords: Machine Learning within Automatic Speech Recognition

Abstract: This thesis investigates knowledge distillation for Lattice Free Maximum Mutual Information trained acoustic models used in automatic speech recognition. The acoustic models studied use deep neural networks (DNN) to map from a temporal series of acoustic features to the emission probabilities of each state of a Hidden Markov Model. I researched Speechmatics, Cambridge UK. In recent years DNNs have provided state-of-the-art performance in acoustic models but at a great computational cost due to their large size. This project evaluates knowledge distillation to realise the performance of these prominent (teacher) models in much smaller (student) models. The project compares the following distillation criteria: mean squared error, frame-wise Kullback-Leibler loss and the recently implemented sequence-level Kullback-Leibler loss. I trailed extensive training with sequence-level Kullback-Leibler loss to effectively transfer the teacher's knowledge. Finally, I evaluated feature-based distillation using mean squared error between corresponding feature layers in each model.

YouTube: <https://www.YouTube.com/watch?v=7VTNjUDFsJw>

Augmented Reality Application On Supporting Reducing Anxiety With Music

Author: Yujia Zhai

Client: John McNamara

Organisation: IBM

Technologies used: Unity, IBM Watson

Keywords: AI, AR

Abstract: Due to the spread of COVID-19, more and more people have to stay at home to keep themselves safe from Coronavirus, but long-term isolation may negatively impact people's mental health.

This application has two main functions. Firstly, users can communicate with a chatbot built by artificial intelligence technology, and the chatbot will recommend suitable music according to its current mood. Users can use the built-in music player to listen to it. Secondly, users can play an augmented reality music game. They can turn on the device's camera, and then different musical instruments will appear on the device's screen. They can act as a conductor and select the appropriate musical instruments according to the rhythm to get a score.

I developed this application using Unity and IBM Watson technologies, and the programming language is C#.

Repository: https://github.com/YujiaZhai2020/COMP0073_2021_Yujia_Zhai.git

YouTube: <https://www.YouTube.com/watch?v=gnM5MG9J9bs>

GADSA Application – Combating Antimicrobial Resistance Through Antibiotic Stewardship, Gamification, And Persuasive Techniques

Author: Frederic Johnson

Client: Prof Patty Kostkova and PhD candidate Aisha Aldosery

Organisation: UCL dPHE Team

Technologies used: Ionic, React, Node, Express, MongoDB

Keywords: Mobile Healthcare

Abstract: Antimicrobial Resistance (AMR) represents an immense and growing threat to global public health. To help reduce AMR, in 2019, the UCL Centre for Digital Public Health in Emergencies (dPHE) Team created the GADSA mobile application, which uses persuasive techniques and gamification to influence the prescription behaviour of healthcare professionals and reduce antibiotic overuse. This project updated the GADSA mobile application by redesigning and rewriting the front-end using React, a modern Javascript framework, and moving certain key features from the front-end to the back end. This process improved both the longevity and deployability of the GADSA app, allowing easy modification for use

in different healthcare systems around the world and ultimately help change behaviours and combat AMR.

System Integration Of MotionInput v2.0 In Kinect Compatible Games

Author: Yang Zou

Client: Prof Graham Roberts and Prof Lee Stott

Organisation: UCL, Microsoft

Technologies used: C#, Unity, Python

Keywords: VR Rehabilitation

Abstract: Full body games usually require a depth camera like Kinect to sense users in 3D space. Based on the achievement of MotionInput v1.0, this project aims at exploring the potential of RGB camera and pose estimation frameworks in capturing the location of key skeletal joints. It is also crucial to provide my client, EvolvRehab, with an approach to integrate MotionInput v2.0 into their existing Unity games.

After three iterations, the final prototype satisfied all the essential requirements. The motion capturing functionality, packed into a module, is selectable in the MotionInput v2.0 application. This module ran the MediaPipe model and then used Socket to send coordinates of skeletal joints to Unity games. In Unity games, the coordinates were received and used to update the key skeletal joints. I also implemented two demos to demonstrate the use of this prototype in Kinect compatible games.

Developing An Augmented Reality AI Business Card

Author: Syed Qasim Razvi

Client: John McNamara

Organisation: IBM

Technologies used: IBM Watson, Unity, C#, Node.js, Express, JavaScript, React Native

Keywords: ML, Applied AI, Software Engineering, Augmented Reality, Mobile Development

Abstract: This project explores applying recent advancements in augmented reality (AR) and artificial intelligence (AI) to re-invent the business card experience.

The project proposes a novel approach to create an experience that is immersive, engaging, and interactive for the user. The vision focuses on creating an experience whereby users interact with an AR character rendered in their own space, which they can communicate with via spoken natural language.

I developed a mobile application for iOS and Android using Unity to build the graphics and augmented reality features while leveraging IBM Watson tools for artificial intelligence tasks. This report discusses the steps taken to achieve this vision and key planning, design, and implementation decisions.

Repository: <https://github.com/IBMIXN/AR-Business-Card>

CARE4CF: Daily Logging App

Author: Jordan Smith

Client: Eleanor Main, Lee Stott

Organisation: Great Ormond Street Institute of Child Health, Microsoft

Technologies used: Node JS, Express, PWA, SQL, WorkBox, Web-Push, Azure

Keywords: Healthcare, Logging, PWA

Abstract: People with cystic fibrosis (CF) often spend around two hours each day on treatments to try and stay well. The most time-consuming of these treatments are airway clearance treatments, a form of chest physiotherapy. Many people with CF choose to replace airway clearance with exercise, and the CARE4CF trial aims to study whether people with CF can do so without getting sicker as a result. The CARE4CF App will be used by ~1,000 people with CF to log what airway clearance activities they do each day – whether they've done their routine, something different (and if so, what) or no actions. It is a progressive web app, using recent technologies to create an installable web app with offline functionality and push notifications.

Study Of Online Human Behaviour Change Post-Pandemic Using OpenStreetMap

Author: Xing-Chan Lin

Client: UCL Internal

Organisation: UCL Internal

Technologies used: Python, Osmium, Google Colaboratory

Keywords: Data Science, Computational social science, Crowd-sourcing

Abstract: Since 2020, the coronavirus pandemic has brought a significant impact on our lives, changing our social behaviours physically and virtually. One of the key types of online human behaviour is crowdsourcing, a collaborative work to source information from a group of online users.

OpenStreetMap is one of the most successful crowdsourcing paradigms, focusing on individual contributors' geographical maps. This project aimed to quantitatively study maintenance dynamics between pre-pandemic and post-pandemic periods concerning who was engaged in maintenance, how users contributed, what types of information they maintained, and how pre-pandemic contributors changed their engagement in post-pandemic.

One of the results reveals that post-pandemic crowd-mappers became more concerned about facilities (e.g.

postbox) rather than restaurants. This result might be a knock-on effect by the lockdown, where users could not dine in a restaurant and gradually lost their interest in editing the information on restaurants.

Repository: <https://github.com/CSpharm/Thesis>

Model Deployment System Of SoundLab v2

Author: Weicong Hu

Client: Joseph Anthony Connor

Organisation: NHS England

Technologies used: Python, Django, scikit-learn, bootstrap, JavaScript, Java, Android, Maven, Swift, Docker, Kubernetes

Keywords: Healthcare, ML, Model Deployment

Abstract: The project SoundLab v2 is a machine learning (ML) project proposed by the NHS, aiming to build an all-in-one platform where users with or without a background in ML to visualise processed sound files, build classifiers on the fly, validate their accuracies and deploy the model onto their own devices in a matter of minutes. The author's work is to develop a model deployment system of SoundLab v2 to realise the model deployment on target platforms.

SoundLab v2 model deployment system aims to provide the essential deployment files that the deployment needs for users. As for specific deployment functions, we realised the deployments for four target platforms. There are two of the most common target platforms, Docker and Kubernetes, and two system platforms with the most users, Android and iOS, were also developed by using Java and Swift respectively with the help of integrated development environments of IntelliJ IDEA and Xcode.

Repository: <https://github.com/Jade-Wang-729/soundlab2>

WaterAid News Search Portal

Author: Arianna Bourke

Client: Stuart Wilson at WaterAid and John McNamara at IBM

Organisation: WaterAid and IBM

Technologies used: Flask, MongoDB, IBM Watson Discovery, IBM Watson Natural Language Understanding, JavaScript, HTML and CSS

Keywords: Charity, NLP, text analysis

Abstract: WaterAid is a non-governmental organisation with a strategy to provide access to clean water, hygiene and sanitation worldwide. To drive change, WaterAid continuously analyses political and social issues to make strategic decisions. Currently, staff perform manual web searches and literary reviews to identify relevant documentation, a time-consuming process that the client wishes to optimise.

This project has produced the WaterAid News Search Portal, a web application to speed up finding, prioritising and reviewing relevant articles, intending to improve workflow. Built using Flask and MongoDB, the application harnesses IBM Watson to provide cognitive search and text analytics. Functionality includes searching news articles, enhanced by filtering to identify and save relevant literature quickly. Watson technologies utilise natural language processing to output insights including sentiment, concepts and entities to speed up the literature review. The application also features data visualisations and trends analysis through maps and charts.

Repository: <https://github.com/AriannaBourke/WaterAidNewsSearch>

YouTube: <https://youtu.be/O6LVrP42-hQ>

Tabulating Clinical Trial Results: A Joint Entity And Relation Extraction Approach With Transformer-Based Language Representations

Author: Jetsun Whitton

Client: UCL Internal

Organisation: UCL Internal

Technologies used: Python, spaCy 3.1, Bidirectional Encoder Representations from Transformers (BERT)

Keywords: Healthcare, NLP, ML, transformers, transfer learning, information extraction, systematic review, bioinformatics, deep learning, named entity recognition, relation extraction

Abstract: Evidence-based medicine, where healthcare professionals refer to the best available evidence when making decisions, forms the foundation of modern healthcare. However, it relies on highly labour-intensive systematic reviews, where domain specialists must aggregate and extract information from thousands of publications into evidence tables.

This work investigates automating evidence table generation by decomposing the problem across two language processing tasks: named entity recognition, which identifies key entities within the text, such as drug names, and relation extraction, which maps their relationships for separating them into ordered tuples. Two neural net models were developed for this joint extraction system, using transfer learning principles and transformer-based language representations.

This approach demonstrated significant advantages, performing well across tasks and multiple disease areas, including unseen areas during training. The final system is proof that generating evidence tables can be semi-automated, representing a step towards fully automating systematic reviews.

Repository: <https://github.com/jetsunwhitton/RCT-ART.git>

ML training And Predicting System Development Of SoundLab-2

Author: Yiwen Chen

Client: Prof Joseph Connor

Organisation: NHS England

Technologies used: Python, Django

Keywords: ML

Abstract: The NHS focuses on voice analysis, and we will use the result to predict diseases. Machine learning technology provides the opportunity to understand the relationship between diseases and the features of potential patients.

SoundLab is a machine learning() hub for comparative evaluation of speech models. Users can upload datasets to SoundLab. Then SoundLab can let the user visualise the data distributions and implement ML algorithms on those datasets. Eventually, the generated classifiers can be used to predict diseases.

SoundLab-1 meets this application's basic needs, but some shortages will be optimised in SoundLab-2. This project is a subproject of the development SoundLab-2, and it is focused on machine learning training and predicting part. In this project, the ML learning process will be promoted in data preprocessing, training models and predicting.

Repository: <https://github.com/Jade-Wang-729/soundlab2/>

GAGCN: Generative Adversarial Graph Convolutional Network for 3D Point Cloud Semantic Segmentation

Author: Seunghoi Kim

Keywords: 3D Point Cloud, Semantic Segmentation, ML

Abstract: With emerging 3D applications in many fields, there has been a surge in attention to deep learning on the point cloud. The existing deep learning networks successfully work on image data. It is much more difficult to directly apply onto raw point cloud because it is scattered and unordered while the image is regular and ordered. Although the proposal of much work recently is to achieve effective feature learning directly from raw point cloud by tackling the distinct properties, they suffer from problems such as poor segmentation or high complexity and size of a network, slowing the inference speed. This research proposes a new graph convolutional network with an adversarial learning scheme for 3D point cloud segmentation. The segmentation network captures local geometric information through graph convolution on features through the K-Nearest Neighbour graph. We trained it through adversarial learning, which minimises an embedding loss, defined as the difference between

features from ground truth and predicted label maps. The network comprises an encoder that sub-sample points to reduce the number of parameters and the decoder to up-sample points to preserve resolution. Additionally, we employ dilated convolution to have a large receptive field without an extra load of memory. To demonstrate the effectiveness of our approach, we present comparative results on publicly available data, ShapeNet Part segmentation. The results show that the proposed network achieves a state-of-the-art performance with fewer parameters than the existing SOTA networks.

HEE Personalised Learning Portal

Author: Ebuka Agbanyim, Dimitar Atanasov, Edward Lee

Organisation: Health Education England

Keywords: Healthcare, Education

Abstract: Digitally augment learning resources and experiences for students and healthcare professionals within the NHS. We are aiming to create a personalised learning portal that can aggregate various internal and external resources and allow individual users and teams to personalise and share these resources through annotations and highlights.

Interpreting Deep Learning Models used in Protein Structure Prediction

Author: Benedict Chan

Keywords: Bioinformatics

Abstract: Proteins are chains of amino acids that fold into unique 3D structures that ultimately determine their function. Using experimental methods, capturing a protein's structure is a lengthy and expensive process, so there has been growing interest in predicting these structures using computational methods. We can attribute much of the recent success in protein structure prediction to deep neural networks. In this paper, we set out a framework to analyse the decision process of these networks using the integrated gradients explanatory method. We applied this approach to a specific protein structure prediction model (DMPfold2), using a multiple sequence alignment (MSA) with just unknown residues as the baseline. The results showed that the learned embedding implementation led to heavy inductive biases towards specific sections of the input MSA. Our approach can help make informed changes to future model architectures and identify trends in the model's decision process.

Cuttlefish: Flexible Protocol Framework for Low Power IoT Devices

Author: Karolina Skrivankova

Keywords: IoT, LPWAN

Abstract: With the Internet of Things (IoT) technologies increasing in popularity, it is becoming a foundation for diverse applications. However, this diversity is often not reflected in the tools and protocols built for IoT applications and devices. The project's goal was to remedy the issue by building a protocol framework to address the need for flexibility and customisability in IoT, achieved by a combination of interface-based architecture. It focuses on flexibility and customisability in most design decisions and thorough supporting documentation.

Creating a Pipeline for Protein Structure Prediction using AlphaFold

Author: Daniel Lahlafi

Organisation: UCL

Keywords: Machine Learning

Abstract: Proteins are essential for a wide range of biological processes. A protein is known to fold into 3D structures; these structures can determine the protein's function. This process leads to the 'protein folding problem', which asks if we can use an algorithm to predict a protein's folded structure from the amino acid sequence.

Over 50 years since we first posed the protein folding problem, Google DeepMind published a paper titled 'improved protein structure prediction using potentials from deep learning'. Here, they outlined a new neural network system, called AlphaFold which showed a substantial increase in the accuracy of protein structure prediction. The open-source implementation that DeepMind published has several limitations; we can only use the algorithm on the CASP13 dataset, and the optimisation code required to take the neural network outputs and produce a protein structure is not included. Other open-source projects have addressed the first point of un-restricting the input from the CASP13 dataset, but the final optimisation step still hasn't been handled. Therefore, with the help of supervisor Professor David T. Jones, this project implements the missing gradient descent optimisation. This process will allow a state-of-the-art protein prediction for any sequence of amino acids.

An Analysis of Time-Series Forecasting Methods Applied to COVID-19 Case Counts at a Sub-National Level

Author: Dilan Patel

Keywords: Data Science, Healthcare, Neural Networks

Abstract: The ability to forecast the spread of the COVID-19 disease is essential for public health

organisations, providing vital information when planning intervention strategies. This project aims to evaluate the performance of various time-series forecasting methods used to predict the spread of COVID-19 throughout a population, specifically examining their ability to accurately forecast the daily number of new COVID-19 cases in each state within the USA. Five different time-series forecasting methods were identified (ARIMA, linear regression, multilayer perceptron networks, LSTM networks, and deep causal convolution networks). These were adapted to predict COVID-19 case counts in two manners.

Utilising Deep Learning for Cancer Diagnostics

Author: Nithin Anand

Keywords: Bioinformatics

Abstract: This project uses gene expression data from the TCGA, fed through a recurrent neural network using gated recurrent units (GRU), to answer several research questions about two types of cancer. The results show that although it is difficult to predict the tumour stage of breast cancer from gene expression data alone, there are potential genetic markers that could be driving the growth of the tumour. Furthermore, the GRU model performs strongly at predicting the molecular subtype of invasive breast carcinoma from gene expression data, even outperforming previous research using a deep neural network approach, albeit with a convolutional neural network. We conducted further experiments on a dataset of lower-grade glioma (LGG) tumour samples. The old subtyping system for LGG tumours resulted in an ambiguous, indistinct subtype; the new molecular system divides lower-grade gliomas into three classes that their gene expression profiles can easily distinguish.

Genetic Analysis of Prostate Cancer with Computer Science Methods

Author: Yuxuan Li

Client: Wei Yuan

Organisation: Institute of Cancer Research, London

Technologies used: Python, Gephi

Keywords: Healthcare, ML, Data Science, Cancer, Gene Analysis, Complex Network

Abstract: Metastatic prostate cancer is one of the most common cancers in men. In the advanced stages of prostate cancer, tumours can metastasise to other tissues in the body, which is fatal. In this thesis, we performed a genetic analysis of prostate cancer tumours at different metastatic sites using data science, machine learning and topological network analysis methods. We presented a general procedure for pre-processing gene expression datasets and pre-filtering significant genes by analytical methods. We then used machine learning models for further key gene filtering and secondary site tumour

classification. Finally, we performed gene co-expression network analysis and community detection on samples from different prostate cancer secondary site types. 13 of the 14,379 genes were selected as the most metastatic prostate cancer-related genes in this work, achieving approximately 92% accuracy under cross-validation. In addition, we provide preliminary insights into the co-expression patterns of genes in gene co-expression networks.

Repository: https://github.com/zcablii/cancer_project

Laboratory Assay Reagent Audits

Authors: Achilleas Mitrotasios, Ho Yi Li, Hongkang Tian

Client: Gemma Molyneux, Lisa Mennie

Organisation: GOSH DRIVE

Technologies used: React, Ionic, Angular, Node.js, Express.js, MongoDB, Azure

Keywords: Healthcare

Abstract: Laboratory tests at GOSH DRIVE are currently audited manually in an unstandardised manner. Staff document test results on a paper-based worksheet; they track the available chemicals or reagents in stock on an Excel spreadsheet. As a result, the documentation takes up a significant amount of time in the laboratory testing procedure and is additionally prone to error due to its manual character. LabAssist aims to fully digitalise the current auditing process by providing a set of functionalities to the lab staff at GOSH, enabling them to seamlessly conduct the documentation of their tests and automatically keep track of the inventory status. Over the past months, we created a multi-platform application with state-of-the-art web technologies to tackle the client's issues with the current processes.

Repository: https://github.com/derekhoyi/-COMP0067_2021_Team19_App

<https://github.com/mitrotasios/goshServer>

<https://github.com/mitrotasios/gosh-client>

An Empirical Study of the Usability of Chatbot Systems

Author: Shirin Harandi

Technologies used: Jupyter Notebook, Azure, Rasa, DeepPavlov, Google's DialogFlow

Keywords: Chatbots

Abstract: More frameworks help developers create chatbots with greater ease due to the increased use of chatbots in recent years. These frameworks differ in the amount of control they give the developer when training the dialogue model. Chatbot usability is one of the primary metrics when evaluating chatbots, as the central focus of any chatbot is to communicate efficiently with its users.

While there has been a large influx of new chatbot training frameworks in the market, there is little research on these automated frameworks' effects on user experience. The report aims to understand the impact of training automation on chatbot usability. Specifically, the report examines evaluation methods to evaluate the usability of chatbots.

The report examines the usability of dialogue systems by creating and comparing three different chatbots. The observed chatbots were trained on the same dataset, using three different frameworks with varying levels of control during training. We asked participants in the study to interact with the bots and fill out a questionnaire.

We conducted a qualitative and quantitative review based on questionnaire results. The analysis found that users preferred interacting with chatbots that we trained using automated or semi-automated methods rather than manually trained ones. The analysis also showed that users' previous experiences with chatbots affected their interaction with the systems. The more background experience a user possessed, the better they interacted with the manually trained chatbot. The report also created a new evaluation metric to help quantify chatbot usability.

MotionInput v1.0 Exercises Module

Author: Lu Han

Client: Prof Dean Mohamedally,

Technologies used: Python, PyTorch, OpenCV

Keywords: ML, Computer Vision

Abstract: During the COVID-19 outbreak, lockdowns were implemented in many countries to stop the spread of the virus. It became difficult for people to replicate their previous fitness routine without going to the gym because they lacked amenities and motivation. One of the biggest obstacles against at-home workouts is boredom. Although there is already a wide range of products that aim to keep users physically active while playing with embedded gesture recognition technologies, they are not accessible to everyone due to price. They only work with specific games.

This project aims to develop an open-source application that turns existing DirectX Windows games on the market into fitness games by allowing users to play games by exercising. We built this work as a catalogue of the application MotionInput, which aims to support touchless control of Windows software.

YouTube: <https://youtu.be/IEOPtmvknM>

Your Virtual Optician: Using Smart Devices and a Virtual Environment to identify (AMD) Age-related Macular Degeneration

Author: Prashan Karunakaran

Client: Clayton Blake and Alan Fish

Organisation: ToukanLabs Ltd (Lead) support by The Apperta Foundation CIC

Technologies used: Unity, C#, Google VR SDK, Android Plugins

Keywords: Healthcare, Ophthalmology, Virtual Reality, Virtual Environments

Abstract: Age-related Macular Degeneration (AMD) is the leading cause of blindness in people over 60. It is an age-related disease that wears down the macula (a portion of the retina), leading to vision loss. The project aims to use a virtual environment and (mobile-based) virtual reality (VR) to overcome the key issues of taking the test for AMD in person.

'Our Virtual Optician' can be used by anyone who feels they are experiencing a loss of vision that reflects the symptoms of AMD. Using Unity, C# and feature-specific plug-ins, the application rigorously tests AMD using various test formats. Algorithmic scoring of the user's vision assists the application in providing medical guidance to the user based on their tests.

MotionInput for Desk-based Hand Gestures – An Open-Source Low-Latency Coloured Object and Multi-Point Recognition Input on Existing DirectX Accelerated Interactive Software Using off-the-shelf RGB Web Cameras and Computer Vision Libraries

Author: Emil Almazov

Client: Dr Dean Mohamedally, Sheena Visram

Technologies used: Python, OpenCV

Keywords: Gesture Recognition, Human-Computer Interaction, Computer Vision

Abstract: This report describes a solution that uses off-the-shelf RGB web cameras and open-source computer vision to deliver low-latency gesture recognition on existing DirectX-accelerated interactive software and Windows 10 applications. The final product – Desk Gestures Module – has become part of UCL's MotionInput – a modular framework that brings together gesture input catalogues for Windows-based interactions.

COVID-19 has led to many workers working from home, which has made it increasingly more challenging for the general public to maintain their health and wellbeing by staying active. This issue has especially been the case for presenters like university lecturers who sit in their chairs while presenting. As a result, we now interact with our home computer interfaces far more frequently.

GUIs (Graphical User Interfaces) are currently the most familiar methods of interaction; there is further research on NUIs (Natural User Interfaces) involving the recognition of, as the name suggests, natural and intuitive actions (or gestures) using everyday human behaviour.

Our solution has explored the use of existing equipment to facilitate actions with touchless interactivity regarding a user sitting at a desk or standing stationary and using their hands and instruments in their hands to control existing software.

We start this solution by designing and demonstrating a “virtual Rectangle” system that allows the use of pen navigation while sitting or standing to control existing interactive software and Windows 10 applications such as Microsoft PowerPoint, Paint, and Teams. Virtual Rectangle is a mode for subdividing your screen into quadrants for enabling hit-entry points.

We end this solution by designing an improvement to Guiard’s bimanual action (Guiard, 1987) by demonstrating Virtual Circle navigation to handle two-handed responses in an RGB web camera event handler stream. Virtual Circle is a mode for tracking a moving point like a cursor attached to a finger or moving object and enabling clicks by entering the virtual circle with a set distance from its centre.

YouTube: <https://YouTube.com/playlist?list=PLRbGNLLuGLx-6NaRfxTEJEaZFZpZ4vplj>

GOSH Food Diary App for Management of Paediatric Dysphagia

Authors: Teodora Ganeva, Xing-Chan Lin

Client: Rhiannon Halfpenny, Gemma Molyneux

Organisation: GOSH Drive

Technologies used: Ionic Framework, Angular, HTML, SASS, TypeScript, Node.js, SQLite

Keywords: Mobile App, Healthcare

Abstract: Clinicians currently ask patients with swallowing disorders to keep a paper-format food diary in-between consultations with their language & speech therapist from GOSH Drive. The provision of dysphagia info leaflets is to help patients choose the proper food and drink to manage their condition better.

The problem is that both data are often lost as it is currently paper-based—this project aimed to provide a child-friendly app encompassing the functionalities of a food diary and supporting information. With the GOSH Food Diary app, users can generate and store food diary records on their mobile devices and export the data in different formats (PDF or CSV). The exported data can be downloaded on the device or sent, for example, via email.

YouTube: https://liveuclac-my.sharepoint.com/:v:/g/personal/zcjtga_ucl_ac_uk/EYFU7fLq741Hqpf2bCiH_WoBW-zN_ibRY-6D3HahSRm-yw?e=4yiJsd

GOSH Patient Entry Form and Dashboard

Authors: Zhongjie Ma, Hsin-Chin Shen, Ling Qin

Client: Natalie Yerlett

Organisation: GOSH

Technologies used: Azure, Java(Spring Boot), MySQL, Redis, Angular

Keywords: Children Healthcare, Mobile Application

Abstract: Discovering a patient’s fundamental needs for specialised diseases at Great Ormond Hospital is difficult. It is because patients are mainly children who are not able to express their feelings correctly. Furthermore, there are lots of different healthcare specialists involved when patients come for an appointment. Patients might miss out on asking questions that may be important for them.

Our application OctiPAT provides a solution for this problem. It provides a way of asking questions and enables patients to communicate with medical professionals directly. Patients could express their questions before appointments, and medical professionals could give answers in advance. Knowing the patients’ questions, medical professionals can prioritise them on the appointment day and give more instructive advice. Additionally, this application offers an animated theme to attract children’s attention.

The team followed the v-model of software development to improve the application’s quality of code and usability. Most of the requirements from the clients (GOSH) have been met to a high level, and we added extra functions, such as data analysis, to enhance usability for medical professionals. The feedback from clients is positive, and the application has been proven to be easy to use.

Repository: https://github.com/UCLComputerScience/COMP0067_2021_Team22

YouTube: https://liveuclac-my.sharepoint.com/:f:/g/personal/zczlhcs_ucl_ac_uk/EgvMitFeHVtNtc957iaqc0EBL6TzJzsnYIILMIUqYnCbQA?e=1TDB0i

NHS at Home Pictures Index

Authors: Ali Hassan, Guanlin Li, Yujia Zhai

Client: Dr Atia Rafiq

Organisation: NHS

Technologies used: Ionic, Angular, Tkinter

Keywords: Healthcare

Abstract: Some patients find it hard to efficiently report their health conditions to a medical practice, especially during the COVID-19 pandemic. Besides, doctors in medical practices also worry about patients that cannot correctly read the medical device and report to the doctor.

ROAM includes mobile and desktop apps to provide a solution for both the patient and doctor. The patients can take a picture of a medical device and send it to the doctor using the mobile app. Patients can also input the medical reading by following

the instructions in the app and tagging it to the picture. The mobile app can also do optical character recognition (OCR) on some of the medical device's pictures, automatically recognising the required reading. The ROAM setting desktop app can receive the pictures sent by the patients and manage them automatically. Doctors can review the picture and monitor the medical reading efficiently.

We developed the mobile app using the Ionic and Angular framework with Capacitor plugins. The desktop app is based on Python 3 and Tkinter. The communication between the mobile app and desktop app can be made using email. All the key requirements from the clients were implemented and we received positive feedback.

Repository: https://github.com/UCLComputerScience/COMP0067_2021_Team13

YouTube: https://www.YouTube.com/watch?v=PNLxfg4mfDg&ab_channel=Group13AppEngineering

HEE Podcasts Portal

Authors: Iskander Fakhritdinov, Weijia Zhang, Rui Tong

Client: Victoria Winlow, Richard Price

Organisation: Health Education England

Technologies used: HTML, CSS, Javascript, Node.js, Vue.js, MySQL

Keywords: App Engineering

Abstract: We focused on creating an app that delivers an efficient audio learning and exploration experience. The requested features included all the basic functionality of the typical podcast app plus some additional functionality, such as getting back to the minute where a user has left the podcast. We created a CRUD web app based on the Vue.js, Node.js, Express and MySQL tech stack to fulfil these requirements. Furthermore, we designed the front end following the prototype developed in the Human-Computer Interaction part of the AppEngineering design course.

Repository: https://github.com/UCLComputerScience/COMP0067_2021_Team08

The HoloRepository Raytracing 2021

Author: Yaoning Yang

Client: Sheena Visram

Organisation: GOSH

Technologies used: C#, Unity, NVIDIA RTX

Keywords: Healthcare

Abstract: The project is structured to separate the user interface of modelling and ray tracing ability. The model loading and analysis system was developed as a stand-

alone in Unity 3D (3 Dimensions) C# and provided the foundation for the ray-tracing inside Unity HDRP (High Definition Rendered Pipeline) engine. Moreover, the project features functionalities including:

- changing the transparency of the rendered models by selecting specific geometries within,
- shifting the colour of the rendered models by selecting specific geometries within,
- rotating the X, Y and Z axes of the rendered models,
- zooming the rendered models,
- deleting selected geometries inside the models,
- detecting extra layers of the models,
- setting lighting points for hologram performance,
- the ability to apply texture maps to layers with local picture searching engine,
- and constructing ray-tracing to segmented layers by using Nvidia RTX in Unity High Definition Rendered Pipeline.

Removal of Artifacts in Digitised Medical Optical Microscopy

Author: Jingyi Zhang

Technologies used: TensorFlow, Keras, OpenCV, CycleGAN, Numpy, Python, Matplotlib, Split-folders

Keywords: Healthcare

Abstract: Malaria remains a global health challenge causing half a million deaths annually. With imaging processing and deep learning, there is a significant opportunity to analyse microscopic blood films automatically; however, the presence of artefacts increases the difficulties of digital pathology. This project mainly focuses on stain artefacts in Giemsa stained thin blood smears. We aim to verify the feasibility of the image processing method and machine learning models that could help remove artefacts in appointed images. The critical challenges of this project are lacking cell-level labels, a corresponding supervised dataset, and the difficulty of separating parasites and artefacts which look similar.

The proposed image processing algorithm concerns both colour difference and area difference of artefacts and cells. The algorithm divides the artefacts into two sets (inside and outside the cells) and removes them under similar ideas by selecting all artefacts, making masks for the chosen area, and then painting the mask. However, due to the random feature of artefacts, it is impossible to find a suitable threshold for all types of artefacts. There are too many of them, so we concluded this algorithm to be inefficient. We have applied the CycleGAN framework to our dataset and fine-tuned it to be suitable for our problem. We find this method is effective in removing small artefacts but may perform weaker on larger ones.

COVID Data Analysis and Extrapolation

Author: Zekun Yang

Client: John McNamara

Organisation: IBM

Technologies used: TensorFlow, ReactJS, JavaScript, Python

Keywords: ML

Abstract: The aims of this project are:

1. Visualise COVID-related data in the public domain
2. Predict the trend of COVID using machine learning techniques.

This project involves the development of a web application that consists of both the front end and back end. The front end focuses on providing users with a user-friendly, highly flexible way to visualise the data. Users can also see the future trends of COVID predicted by pre-trained machine models through the front end. The critical technologies adopted in the implementation of the front end include JavaScript, ReactJS and Redux. The back end manages the database, maintains API endpoints, and trains the machine learning models to make predictions. The implementation of the back end includes Python, FastAPI, Postgres and Keras.

The machine learning part of this project involves the research, application and testing of machine learning models to predict future trends of COVID. The workflow contains data set construction, feature engineering, model training, and evaluation. We should highlight three novel parts. Firstly, the project considered two new features often neglected, weather and level of restrictions, to enhance the model performance. Second, to better handle time-series data, the sliding window algorithm is adopted. Thirdly, this project adopts a variant of the recurrent neural network, lone short-term memory.

Open Eyes & HoloRepository for Eye Segmentation 2020

Author: Noan Le Renard

Client: Clayton Blake

Organisation: ToukanLabs

Technologies used: Python, PyTorch, Conda, OpenCV, scikit-learn

Keywords: Healthcare, ML, 3D graphics, image processing, software engineering, organ segmentation, NHS, open-source

Abstract: The project's goal is to add the eye as a supported organ to the HoloRepository. A UCL-led proof of concept research demonstrator project allows practitioners to generate 3D models from imaging studies accessible in an augmented reality setting with as little manual involvement as possible. The project's industry

partners are ToukanLabs and the Apperta Foundation, which promote open systems and hospital interoperability, thus becoming the work's focal points.

We carried out the project's research and development with an iterative approach of prototyping and evaluation whilst integrating feedback from the end user (clinicians) as frequently as possible to improve and validate our choice of methods. The project's main technical parts were:

- the retinal layer segmentation of OCT images.
- creating 3D models.
- integrating this work into the HoloRepository.

Despite a change in scope due to circumstantial limitations, the project was successful in its goals. It created a new, extremely efficient eye pipeline that uses state-of-the-art machine learning segmentation and clinician-validated innovative methods for 3D model creation. The input needed uses a hardware-agnostic, easy to communicate format, and the output creates lightweight models, thus promoting hospital interoperability. Finally, the integration was accomplished with purely open-source systems, thus adhering to the ethos brought forward by the project partners.

Repository: https://liveuclac-my.sharepoint.com/:f:/g/personal/zcabnma_ucl_ac_uk/EryCipC9P_dEnZVeVIYKMJsBzxWVaKFoVHzHkBW0Rc6VA?e=OUsv4

YouTube: <https://youtu.be/qrQ0wUlrd8s>

<https://www.YouTube.com/playlist?list=PLtPyPeoW7wCqx2XfSi0IWjW59E2jvbiFP>

Federated on-device Machine Learning of Gesture Sequences with Speech Recognition Patterns in Healthcare

Author: Jiaxing Huang

Client: Sheena Visram

Organisation: GOSH

Technologies used: Python, Angular, TensorFlow

Keywords: ML

Abstract: This project is part of the IXN project 'Federated on device Machine Learning of gesture sequences with speech recognition patterns in healthcare'. This project aims to build a system that can run and train the speech recognition model in a local device without an internet connection.

The system provides a web page interface; users can use the web interface to upload and download the dataset to the server and launch the training process for the target model or get a transcript of uploaded audio file from the server produced by the target model.

This project mainly contains two parts. The first is the web

interface and server, which we implemented using Angular 11 framework and Python Flask microframeworks. The other part was a DeepSpeech model based on the dataset 'Medical Speech, Transcription, and Intent' in Kaggle to illustrate the possible improvement and ability of the use in the medical area.

Repository: <https://github.com/mrandypoet/Project>

Analysing Objective Measures on Incomplete Data for Assessing Fetal Ultrasound Skills

Author: Lib Kai Pneh

Technologies used: Python

Keywords: Data Science

Abstract: Evaluating the skills of an ultrasound trainee is subjective since they are measured against the skills of an experienced operator. Additionally, the expertise of an operator is directly related to the number of clinical scans completed. Research has shown that objective metrics can assess the skill level of a clinician in fetal ultrasound and other fields involving motion. This study aims to provide deeper insights into objective measures as well as to introduce new metrics.

The participants involved are 31 expert operators and 18 novice operators, with the former having more than 200 ultrasound scans and the latter having less than 25 ultrasound scans. A sensor attached to the ultrasound probe tracks the coordinate values during the scan. During the scan, the sensor may fail to follow the motion, resulting in possible missing data.

The metrics include: time, translational path length, rotational path length, dimensionless jerk, dimensionless rotational jerk, log dimensionless jerk and rotational log dimensionless jerk. This study finds that the log dimensionless jerk and possibly rotational path length can successfully differentiate between novice and expert operators, contributing to the progress towards an objective assessment of technical skills in ultrasound clinicians.

Graph AI

Author: Zi Lian Lim

Client: John McNamara

Organisation: IBM

Technologies used: TensorFlow, Deep Graph Library, Flask, React.js, Docker, Docker Swarm, PostgreSQL, NginX, NetworkX

Keywords: Machine Learning, Software Engineering

Abstract: This project involves the development of a machine learning (ML) pipeline and web application that aims to support consultants by analysing diagrams from clients. The project first investigates the viability

of different machine learning methods in detecting objects in diagrams and other methods of converting detection outputs into a graph object. The project's second aim is to develop a database-driven web application that encompasses said machine learning methods. Additionally, the project aims to explore graph classification.

After a literary review on object detection, requirements were gathered and analysed to identify the project's scope. We created a dataset and investigated the effects of different methods in identifying objects within diagrams. We also proposed various data augmentation techniques to improve object detection performance and performed hyperparameter tuning to obtain the final model. We took a test-driven development approach for the web application and incorporated new technologies and design patterns such as Docker, Docker Swarm, PostgreSQL, NginX, microservices architecture style.

The project's scope was a little ambitious, and currently, the application does not fully support graph classification. However, we developed the application so that the graph classifier model is easily replaceable. The project's biggest challenge was detecting arrows in diagrams due to the significant discrepancies in their size and direction. However, our proposed data augmentation techniques managed to solve this successfully. The result was a fully functional and heavily tested system driven by machine learning with an accompanying database.

Repository: https://github.com/SteveLim99/graphAI_webapp.git

Prioritising Inbound Callers for Ambulance Support

Author: Syed Fehed Wasti

Client: Prof Joseph Connor

Organisation: ABUHB/WAS

Technologies used: Python, IBM Watson Speech to Text, Cisco Call Handling

Keywords: Healthcare, ML, Data Classification

Abstract: The implementation of machine learning into day-to-day tasks is on the rise. Due to COVID-19, the strain on NHS workers has been extremely challenging, including emergency line handlers trying to direct callers to the correct specialist. The government has instructed the general public to stay indoors during the lockdown and call 111 for emergencies rather than leaving their homes. This instruction results in callers receiving long waiting times before being directed to a specialist or even a member of staff, which can have severe consequences for some callers in critical condition who may need immediate attention.

We used an approach to integrate ML models with call handling systems to see if the caller's condition could be identified and categorised by non-linguistic features

extracted from the calls.

The system's goal was to understand whether we could use such models for callers marked as critical ambulance support.

The system implemented takes timestamp data from conversations, extracts all the relevant non-linguistic features and runs them through a training and test method on several machine learning algorithms to analyse this approach. We evaluated the system and future works, such as implementing a more extensive system that analyses all other conversation features discussed at the end. We suggested improvements for the data processing to allow more efficient classifications and, in effect, improve the flow of calls within the NHS.

AAP/EFP Classification Website

Authors: Aleksei Sukhov, Jawahar Tunuguntla, Sercihan Kulak

Client: Eastman Dental Institute - UCL

Organisation: UCL

Technologies used: Azure, React.js, Redux.js, Node.js, Express.js, MongoDB

Keywords: Healthcare, Dentistry

Abstract: We designed the Eastman Periodontal Diagnosis Tool (EDIT) to identify periodontal and peri-implant diseases based on the prevailing classification standards in dentistry. The American Academy of Periodontology/ European Federation of Periodontology (AAP/EFP) and the British Society of Periodontology (BSP) established these standards. The intention is to end the status quo of tedious diagnostic methods consisting of costly third-party tools and paper assessments. The goal of EDIT is to make life easier for dental practitioners by providing a digital solution for periodontitis diagnosis.

Repository: https://github.com/UCLComputerScience/COMP0067_2021_Team14

YouTube: <https://www.YouTube.com/watch?v=kaRjt9QglwU>

CORDSS (Childhood-Onset Rare Disease Selfcare Support)

Authors: Eleni Rotsidou, Arianna Bourke, Megan Gallagher

Client: Gemma Molyneux, Lola Solebo

Organisation: GOSH Drive

Technologies used: Ionic Angular Framework, SQLite3

Keywords: Healthcare

Abstract: Young people with chronic health conditions often find it challenging to manage their health records, attend appointments at multiple locations, and communicate with several clinical team members. This

project has produced the mobile application CORDSS to help children manage their medical records, gaining independence as they transition into adulthood. The application includes the functionality to record contact details, family and clinical team information, emergency health plans, diagnoses, appointments, medicines, and test results. The product utilises the Ionic Angular framework with an SQLite database to store data locally, producing a cross-platform application with an easy to use interface and friendly design. We enhanced the usability by including features such as adding an avatar image, uploading photographs of test results, and exporting PDFs.

Repository: https://github.com/UCLComputerScience/COMP0067_2021_Team12.git

YouTube: <https://youtu.be/LOMvgIKIUpY>

Young Person App

Authors Mehdi Ghemati, Eve Davies, Yiwen Chen

Client: Paul Harris

Organisation: Step by Step

Technologies used: JavaScript, Node.js, MongoDB, ExpressJS, EJS, Salesforce Lightning API, Bootstrap, JQuery

Keywords: Charity, Web App

Abstract: The team aimed to develop a responsive web application that is easy to use. It displays the relevant information to users in an attractive and familiar format. The application is easy to navigate regardless of English ability. The application connects to the client database to give user-specific information and documents.

- The solution was a stack containing MongoDB, Express.js, Node.js(MEN).
- Frontend –including Bootstrap, JQuery and EJS for templating.
- Back end –An Express server run on Node.js.
- Deployed to the cloud and hosted on Heroku.

Repository: https://github.com/UCLComputerScience/COMP0067_2021_Team09

YouTube: <https://youtu.be/IZx4aaupAw>

A Musical Mirror: Development of a Musical Sonification Tool for Managing Chronic Pain During Daily Tasks

Author: Lilly Neubauer

Technologies used: Python, Android Java, Notch Motion Capture, SuperCollider

Keywords: Healthcare, Motion Capture, Music, Sonification, Auditory Display, Motion Analysis, Generative Music

Abstract: Chronic pain is a widespread condition that can have a significant adverse effect on daily life. Due to difficulties treating chronic pain with traditional analgesics, patients need alternative and complementary therapies to help manage their condition on a day-to-day basis. Advances in affordable and portable wearable motion capture technologies have opened new avenues for motion-capture-based interventions for chronic pain, including body movement sonification tools. Body movement sonification is the practice of turning human movement into sound; past research has shown initial promise for such tools to help people with chronic pain in their daily activities. In addition, the use of musical elements in such sonifications may increase their efficacy and functionality since music can have powerful relaxing and distracting effects. However, available musical sonification tools lack the complexity and flexibility necessary to carry out further research. This project develops a new, more complex body movement musical sonification tool for use in a research setting with people with chronic pain. The tool follows a modular architecture implemented using Notch sensors, an Android app, a Python motion analysis module, a sonification module in SuperCollider, and an OSC communication backbone between modules. We then evaluate the tool using comprehensive test data collection, visual and audio outputs, and unit testing and ultimately fulfil all the proposed requirements. Overall, the project offers its contribution through a functional and well-documented musical sonification tool that has potential in future research with people with chronic pain.

VR/AR: Sensory challenges of neurodivergent people

Author: Tamari Lukava

Technologies used: Webflow

Keywords: Neurodivergence, VR, AR, XR, Developers, Users, Accessibility, Games, Adults, Disability, Neurodivergent, Neurodiversity, Personas

Abstract: Everyday life settings are rapidly adopting virtual reality (VR) and augmented reality (AR). Nevertheless, there is a lack of studies and results that explore possible sensory challenges that VR and AR technologies might have on neurodivergent people across various applications (games, customer services, retail, and others).

Considering the immersive and different sense stimulating nature of VR and AR, it is logical to assume that triggers generated from these technologies might provoke negative experiences for neurodivergent users. This study explores them through research working directly with the neurodivergent community and VR/AR developers.

This study comprised three different stages. The initial research involved an online survey of 12 neurodivergent

participants to understand if participants could potentially be subject to negative VR/AR experiences. The subsequent study consisted of semi-structured interviews with four neurodivergent participants with and without VR and AR experiences and three VR and 1 AR developers. The initial study found that neurodivergent participants experienced barriers to using VR/AR technologies. The following stages, on the one hand, revealed their underlying factors. On the other hand, they demonstrated an interest in making VR and AR experiences more accessible. However, developers showed a substantial lack of awareness and understanding of accessibility needs and requirements of neurodivergent users.

As a final stage of the study, informed by previous findings, the XR Neurodivergent Persona Generator prototype had been developed and tested with both groups of participants. Results show that, potentially, neurodivergent personas can help enhance the VR/AR accessibility for neurodivergent users.

YouTube: <https://youtu.be/XIN-tq7Zv3Y>

AVINA (Accessibility and Visually Impaired Network Awareness): Sight++ V3

Authors: Lydia Tsami, Karish Singh, Zhaoxi Liu, Dongming Shi, Sen Lin

Client: Costas Stylianou , Phillippa Chick

Organisation: Intel

Technologies used: Node.js, Azure, MongoDB, Flutter, iBeacon, Intel

RealSense Cameras

Keywords: Health Technology

Abstract: In this project, as a collaboration with Intel, we have developed a system to help visually impaired (VI) people better access locations they visit (e.g. banks, hospitals, parks) by providing them with real-time insight into events occurring at these locations. VI users have a hard time understanding the environment around them without asking for assistance—this system helps alleviate this issue. This information comes from cameras installed at the location, then relayed to a mobile application installed on their device. Our system automatically detects the user's area and asks questions about the seating availability and queuing length—and general location questions. This system is unlike anything currently on the market, as it can give users real-time insight with minimal technology and doesn't require locations to be mapped out in detail to use.

Repository: <https://github.com/UCL-SightPlusPlus>

YouTube: <https://youtu.be/uOAJTeKzJzU>,
<https://youtu.be/FNccW2pKwbw>

Case study: PorterBLE with Apian

PorterBLE is a hospital porter tracking and request system to support drone delivery in UK hospitals.

About our team

We are second-year UCL Computer Science students, Ioakim Avraam, Ariel Harmoko, Modestas Gujis and Michael Fan. This project took place in 2022 and 2023.

Project partner

Our client, Apian, is a medical drone startup that partners with the NHS to connect the healthcare industry with the drone industry to improve patient health outcomes and staff wellbeing. Apian asked us to work with them on a project we called PorterBLE. Apian provided requirements, technical information and mentoring. Professor Graham Roberts was our UCL supervisor.

Background to the problem

The problem we are trying to solve revolves around the timely transportation of pharmaceuticals and other medical packages within UK hospitals. Currently, human porters move packages around a hospital, making deliveries according to requests they receive on SMS devices called pagers. In larger hospitals, drones transport packages from building to building and porters handle the journey and the loading and unloading of the drones to save time.

Unfortunately, there are significant inefficiencies with the current system hospitals use. When a delivery is to be made, a request is sent to all porters, and the first person who responds to this request is responsible for the delivery. This is clearly problematic as it doesn't take into account a porter's proximity to the parcel or their availability.

Solution

The PorterBLE system consists of a web app and an Android application.

The Android application is for medical porters to use. The purpose of the application is to track their location within the hospital. Once a porter with their smartphone comes close to a beacon placed in the hospital, the app will send the MAC address of that beacon to our web app's backend for us to display their live location. Porters will be tracked, allowing optimal task assignment based on proximity and availability so that no drones are waiting to carry out deliveries.

The web app is made for medical dispatchers to monitor the availability and location, and create a delivery request for porters who are available and closest to the pickup location. We aim to make it as intuitive as possible for hospital staff to place a delivery request in order to reduce patient waiting time.





Project goals

- Successfully monitor medical porters in real time with the use of our system.
- Send delivery requests to porters who are available and closest to the pickup location, improving delivery efficiency.
- Working Android app which scans for beacons placed in a hospital and allows users to respond to requests.
Main tools and dependencies
- Android app implementation: Kotlin, Android Studio, Gradle, Android Debug Bridge
- Web application - frontend implementation: React, Firebase Hosting, Node.js, npm
- Web application backend implementation: Spring Boot, Cloud Run, Gradle, Cloud SQL

Benefits

One of the main benefits of our solution is the reduction of waiting times for patients. In the current system, hospital staff send out requests for deliveries to all porters, which can result in delays as the first available porter may not be the closest one to the parcel. Our tracking and request system will aim to assign tasks automatically based on the closest porter to a parcel, thereby reducing the time it takes to deliver packages to patients.

Another key benefit is the improved work-life of porters. The current system can lead to an unequal distribution of tasks, with some porters receiving more requests than others, while others are left waiting for assignments. This can result in porters feeling overworked or underutilised. With our solution, the workload will be evenly distributed, and porters will only be assigned tasks that are within their vicinity and availability. This will lead to a more balanced workload and a better work-life balance for porters.

Achievement and Impact

Our proposed solution to optimise the transportation of pharmaceuticals and other medical packages within UK hospitals has the potential to revolutionise the way healthcare facilities operate. By implementing a system that tracks the movements of porters and assigns tasks based on their proximity and availability, we can significantly improve the efficiency of the delivery process.

We are particularly excited as we have been informed that our solution will be demoed in Wansbeck Hospital in March 2023, with the aim of being deployed to transfer renal pathology between Guy's and St Thomas' hospital later in the year.

“On behalf of Apian, I would like to express my thanks and gratitude for your collective hard work. We have enjoyed working with you all, from the inception of the idea to formalising the scope of work to executing and delivering a product. It was also great to be able to showcase the product to a porter at Northumbria NHS Foundation Trust, where we are currently flying, and receive great feedback. We have gained much from this experience and hope you have also. It was a pleasure to have you with us.”

Hammad Jeilani
Medical Director and co-founder at Apian, Doctor,
NHS Clinical Entrepreneur

2022-2023

A central source for BHF's health intelligence data

Authors: Filippo Fiocchi, Shabir Singh Dhillon

Academic: Dr Graham Roberts

Client: British Heart Foundation (BHF)

Organisation: BHF

Technologies used: Python, JSON

Keywords: Data Engineering

Abstract: The NHS database holds the medical records of 65 million people. These records of public health data are provided by multiple sources, collected in various datasets, and distributed across many websites. The British Heart Foundation (BHF) health intelligence team makes use of this data daily to come up with medical statistical insights on cardiovascular wellbeing using R scripts. To do so, the team collects data from various sources, the two main being NHS and NHS Digital. Because of a lack of technical tools in the team, before running the team's R scripts, this data needs to be manually downloaded from the website and individually cleaned.

In this project, we worked with the BHF health intelligence team to develop a tool that automatically scrapes and cleans the five major sources of data of the team (coming from NHS and NHS Digital). This data includes 214Mb of excel sheets which are locally downloaded and subsequently cleaned. We developed a scraping engine that downloads the predetermined necessary files and a cleaning parser that performs data filtering according to predetermined instructions from the BHF team. This tool is delivered through an executable. To facilitate the use of the tool, to allow users to input their chosen input and output folder on their machine, and see the current progress of the tool, we introduced a simple GUI. Our solution delivers increased automation to ensure that the health intelligence team will be more efficient and can direct all efforts to data analysis.

Repository: <https://github.com/filofiocchi02/BHFProjectTeam21.git>

YouTube: <https://www.YouTube.com/watch?v=5XYrwbunL0>,

<https://www.YouTube.com/watch?v=pXenoYAIUlw>,

<https://www.YouTube.com/watch?v=dIWptEb89rw>,

<https://www.YouTube.com/watch?v=PhwBAkqUrgQ>,

<https://www.YouTube.com/watch?v=VcAqdQZIIK0>

Visualisation of 3D automated quantification using machine learning

Authors: Tony Wang, Ofir Francis, Shuhan Yang

Academic: Dr Graham Roberts

Client: Sensyne Health

Technologies used: Python, Nibabel, Dash, Selenium

Keywords: Medical imaging, ML, Healthcare

Abstract: Machine learning (ML) is a fast-moving area in medical imaging, but there are barriers to adoption by the need to integrate into clinical practice. Cloud deployments offer this control but are less established for visualisation of 3D medical data. In this project we developed a system for 2D/3D visualisation of medical datasets with segmentation support within web applications to allow easy interrogation of ML-produced segmentation label.

Our project allows multiple concurrent users to interact with medical image datasets while having a wide range of useful tools and functionalities including 2D slice views covering every axis and a 3D visualisation with customisable shadow and colour enabling thorough inspection across the whole volume.

Additionally, our project provides segmentation support. Users can upload corresponding segmentation data generated by ML together with the input image dataset. This segmentation data will be overlaid on the original dataset.

One extra feature we've implemented is the problem report system. If users noticed areas worth paying attention to within the medical image dataset, or the segmentation data, they could choose to make a problem report with problem title, severity, description and annotation over the problematic area of the image. The problem report can then be seen and shared with other users.

Repository: <https://github.com/brudfors/UCL-IXN-023>

YouTube: https://www.YouTube.com/watch?v=UUSjQctAcPQ&feature=emb_imp_woyt

Automatic Question Generation System for Open Education

Authors: Utku Bilgi, Mathushan Mathiyalagan, Orhun Dogan, David Lu

Academic: Dr Yun Fu

Client: John Shawe-Taylor, Maliththa Sahan Sarojan Bulathwela

Organisation: Knowledge 4 All

Technologies used: Azure, Python, Flask, React js, TensorFlow, spaCY, allenNLP, GPT-2, T5, BERT, ElephantSQL

Keywords: NLP, Open Education

Abstract: X5GON is an industry-leading open education resource provider. This project aims to help both students and teachers that may not have the resources to create questions for certain educational material. For teachers, it can be difficult to invent questions from scratch on new educational material. Also, for students, it can be hard to assess and test themselves without the supervision of a teacher if they don't have the resources. Our software solves both problems.

In this project, we worked on developing a system that can generate questions from educational material by applying natural language processing (NLP) techniques and used a database to keep track of the user's performance. We chose to generate multiple-choice (MC) and true or false questions since it is one of the fastest methods to check users' understanding and it is easy to keep track of performance. Our system can be used by anyone, and it aims to be accessible to everyone.

We achieved the generation of multiple MC and true or false questions out of general educational material successfully. All the generated questions were up to very high standards and there were no non-sensical questions that might confuse the users.

YouTube: https://youtu.be/P2Ng_qvEyO8

IBM WAPETS v2.0 for AR

Authors: Can Kerem Akbulut, Toma Kolev, Alex Nathanail, Ce Cao

Academic: Dean Mohamedally

Client: John McNamara

Organisation: IBM

Technologies used: C#, Unity, IBM Watson, Rasa

Keywords: AR, AI, Virtual Pet

Abstract: Domestic animals have a long history of enriching human life. They play a wide range of roles, from emotional companions to life support. With the development of technology and the progress of the extended reality (XR) industry, virtual pets have become possible and can be used in a variety of applications.

Our WAPETS 2.0 project is a multiplatform AI virtual pet assistant that responds to being spoken to and interacted with using the mouse and or touch controls. It also serves as a voice assistant, helps retrieve bus times and local news, displays music, sets alarms, makes recommendations based on user interests and much more.

We aim to make this social pet encourage the elderly and isolated users to engage with technology while keeping them connected to the outside world.

Repository: <https://github.com/COMP0016/comp0016-blog>

YouTube: <https://www.YouTube.com/playlist?list=PLYgEc7fCemrv41B81V4jVem56iFCfupT6>

Care Quality Dashboard

Authors: Sarvesh Rajdev, Nathan D'Souza, Ahmad Daniel, Yipeng Qu

Academic: Dr Yun Fu

Client: Prof Joseph Connor

Organisation: NHS Wales

Technologies used: Next.js – Javascript framework
Node.js

React-Suite – handling front end components

- Prisma–object relational mapping
- PostgreSQL –database
- Keycloak – authentication
- Docker–containerisation
- Linode – deployment

Keywords: software engineering, web development, Full stack, DevOps

Abstract: At present, an influx of patients is coming to receive treatment from the NHS Wales (NHSW). Consequently, it is imperative for the NHSW to provide the best quality of treatment to patients as outlined by the Welsh Government's Health and Care Standards. Since doctors are becoming busier over time, the care quality provided by the clinicians from NHSW may be affected and this can cause a huge disruption in the healthcare services of the nation.

In line with the constant need for top-notch care services, our team has come up with an idea to help clinicians evaluate themselves so to check the quality of their care. That is how Care Quality Dashboard (CQD) was created. CQD is a web application that allows clinicians from different departments to self-report their progress in care services provided to patients. This platform also provides an intuitive interface for supervision of clinicians as an effort to maintain patients' satisfaction with the services provided.

Through the integration of our system into the NHSW, clinicians have been able to continuously self-evaluate and measure the quality of their services against the NHSW standards. On top of that, heads of departments, too, are able to supervise fellow clinicians to ensure constant quality treatment. This should lead to open and honest conversations about medical staff progress. As a result, we hope that the clinicians can see their improvements over time across different medical practices by using the CQD improved with the multi-dashboard feature.

Repository: <https://github.com/COMP0016-GROUP13/CareQualityDashboard>

YouTube: 8 minute portfolio video:
<https://www.YouTube.com/watch?v=Duz6NLmKo54>

MotionInput Android

Authors: Abinav Baskar, Clarissa Sandejas, Kyujin (Chris) Sim, Elyn See

Academic: Prof Dean Mohamedally

Client: Prof Dean Mohamedally

Organisation: UCL, Microsoft, Intel, IBM

Technologies used: Android, Java, XML, MediaPipeProject

Keywords: Accessibility, Apps, Touchless Computing

Abstract: While a smartphone touchscreen may seem like the most intuitive and, possibly, only way of controlling an Android device, it is not well equipped for all user's needs. In-air gestures are an increasingly attractive way of utilising the full capabilities of those with limited range of motion to bring the same level of freedom to control their digital world. However, the problem is that incumbent solutions are not able to control a device fully and aren't customisable.

There is a real need for a platform to bring existing camera interpretation libraries to Android devices in a way that is meaningful. There are many common problems in need of a touchless control solution – such as children being restrained in a car seat, AR experiences and projected devices.

We present MotionInput Android: an application that translates real-time camera input into taps, swipes, and click-and-drag gestures. MotionInput Android implements state-of-the-art technologies including the MediaPipe Android Hands API. We have created the first Android application that allows a user to control a device with their hands without touching the screen.

In addition, compared to any other camera-based accessibility systems, we have implemented all three main gestures needed to control a smartphone – click, swipe and drag. This broadens the scope of touchless Android apps considerably to include paint applications, 2D-browse systems like maps and many games.

In conjunction with our scalable constructed codebase, we have created a flexible base upon which other MediaPipe modules and ways of controlling a device can be built.

YouTube: <https://www.YouTube.com/watch?v=gTVgi6dcpOQ>

Locatient

Authors: Danny Xing, Cheng Loo, Guodong Liu

Academic: Dean Mohamedally

Client: Alexander Nicholas

Organisation: NHS

Technologies used: Reactjs, Expressjs, Nodejs, MongoDB, MongoDB Atlas, GCP

Keywords: Healthcare

Abstract: Finding patients in a hospital could be a critical yet hectic task. Precious time and effort are wasted on monotonous and trivial searching. With the Covid-19 pandemic, the situation became increasingly apparent. In search for a possible solution, Locatient was developed.

Locatient uses a collection of QR code wristbands, scanners, and software to achieve reliable indoor tracking and presents the data in an organised manner for staff to utilise. When a new patient is registered in the system, a unique QR code and hashed identifier will be generated. With this, the patient could willingly scan QR codes to share their location with the rest of the staff members. Their data will be organised in a visually intuitive dashboard and be available to export to the NHS service.

With the system, staff in hospitals will no longer need to painstakingly look for patients and can immediately give care to the ones who need it. We hope Locatient could reduce tedious efforts wasted by staff and give precious time to the treatments of patients.

Repository: portfolio: <https://portfolio-locatient.netlify.app/>
github: <https://github.com/dxing20/Locatient>

YouTube: <https://youtu.be/ay531ZaejHA>

Information Retrieval With Noisy Documents

Authors: Thatchawin Leelawat, Tim Widmayer, Vincent Lefeuvre

Academic: Dr Yun Fu

Client: Dr John Shawe-taylor

Organisation: Knowledge 4 All Foundation

Technologies used: React, Flask, ElasticSearch, Ranklib, Docker, Kubernetes

Keywords: Software Engineering, Web Development, Information Retrieval, Machine Learning

Abstract: The X5Learn platform hosts hundreds of thousands of learning resources in different formats. Most resources are in video, audio or PDF formats which cannot be searched directly. Therefore, search engines must rely on computer-generated transcripts, which are inherently noisy; i.e., they contain transcription errors. We tested different search engine implementations on a relevance-labelled dataset of podcasts. Our project is centred around an API that allows plugging in of different search engines into the same web interface. Our search platform gives learners more relevant results, allowing them to learn more effectively with X5Learn.

Repository: Frontend : https://github.com/COMP0016-IR-Noisy-documents/app_frontend

Backend: https://github.com/COMP0016-IR-Noisy-documents/app_api

YouTube: <https://youtu.be/TukG-rxGb2U>

Visual analysis of common gene clusters in disease causing viruses in Coronaviridae

Authors: Zain Saleem, Ammaar Bin-Maajid, Passawis Chaiyapattanaporn

Academic: Dr Graham Roberts

Client: Gadhu Sundaram

Organisation: NTT DATA

Technologies used: Azure, Docker, React, Node, Express, PostgreSQL, Neo4j, Redux, Redis, FastAPI, Nginx

Keywords: Healthcare

Abstract: NTT DATA is a Japanese multinational information technology service and consulting company. They help clients transform through consulting, industry solutions, business process services, IT modernisation and managed services. NTT DATA are looking for new software that enables researchers to analyse and compare different strains of the coronavirus. Currently, there is data available in the public domain from the KEGG orthology database. However, it becomes very difficult for researchers to analyse the gene commonalities between different strains of the virus due to the enormity of the dataset and inconsistencies in the API.

We intend to solve this issue by developing a web application purposed for providing graphical information on the similarities and differences between different gene clusters. Considering the complexity of traditional relational databases involving join commands, we plan on visually storing the data in a graph database using Neo4J. This will then provide the graphical representation for which we can display the necessary data.

This will ultimately transform the large inconsistent data to a significantly more digestible format aiding the analysis procedure for researchers. Researchers will then be encouraged to record their discoveries through a built-in report generation which can then be shared among other researchers for further collaboration.

Repository: <https://bitbucket.org/ntt-data-syseng/>

YouTube: <https://www.YouTube.com/playlist?list=PLHrXR0rraAoFeilf19ZDQSIpKsWMZ8lyK>

QnA bot for Clinical Tabular Data

Authors: Agnieszka Ostrowska, Ben Schlagman, Su Yee Julia Goh

Academic: Dr Graham Roberts

Client: Deepthi Karnam

Organisation: Infofys

Technologies used: Tapas, Rasa Open Source, Django

Keywords: ML, NLP

Abstract: Problem Statement

Medical jargon and terminology often mean patients have difficulty understanding and analysing the clinical data presented to them in their health reports. This means they can't draw conclusions and make informed decisions about their care. Without the proper mitigation of certain illnesses, this leads to an increased risk in patient wellbeing.

Our Solution

Our solution is to build a questioning and answering bot for clinical tabular data. The patient will be able to upload their medicate report into a chatbot and begin asking questions immediately. The conversation between the user and the bot will mirror that between a patient and doctor, ensuring clear and concise phrases are used without technical jargon, improving the user experience.

Achievement and impact

With the completion of the project, we had built a system that solved our problem statement. Patients can now better understand their health records, meaning they make more informed decisions about their care leading to better patient wellbeing. The improvement to patient wellbeing not only improves the patient's quality of life but also will put less stress on the medical sector. Reducing the patient-doctor communication time in mass can lead to innovation and medical discoveries, as significant time is spent away from their patients and towards research. This ultimately will lead to a number of positive externalities for wider society.

YouTube: https://l.facebook.com/l.php?u=https%3A%2F%2Fwww.YouTube.com%2Fwatch%3Fv%3DpVTqBL_Y85l%26fbclid%3DIwAR0lqMkqhuSq0a5z7kYxGSe68UZFPaJEp9n_TJT6tD4UsWYh5mnhWj9-DX8&h=AT0zrEzDEaX5ZJZ9aTMWX6ltAeFd3VB5uuYlgkdhxFJ9624PzyrnHX4asA84Vvc6XVDPwBu6iyj6ae9phTF5VAWj9LrlAgreeL2U9q1_JozWRiO2ALZPo15_EoDWulKrVccPYQ

BHF Key Statistics Chatbot - HeartBOT

Authors: Ivan Varbanov, Neil Badal, Maheem Imran

Academic: Prof Dean Mohamedally, Dr Yun Fu

Client: Kate Cheema, Naomi Herz

Organisation: British Heart Foundation (BHF)

Technologies used: Python, FuzzyWuzzy, HTML, CSS, JavaScript, pandas, nltk, Flask

Keywords: Chatbot, Artificial Intelligence, Statistics and Data Analysis, Natural Language Processing (NLP)

Abstract: Looking through piles of Excel Sheets, searching for information, is a tiring and cumbersome process. British Heart Foundation (BHF) website users (predominantly researchers and policymakers) are often in search of a single statistic, but to find it, they have to scroll through large bits of the BHF compendium, before they

find what they're looking for. Currently, the only alternative to browsing hundreds of tabular data is to ask the BHF support team for help. That slows down the work process for users and creates more hassle for BHF staff.

HeartBot is an innovative solution to that problem; it implements a complex two-step algorithm that classifies a question as either an FAQ or a retrieval-based query. If it's an FAQ, then it simply gives the correct answer, referring to an integrated set of FAQ answers. If the query is based on retrieval, it filters out the most appropriate sections of the BHF compendium and shows them to the user in tabular form. The bot works quickly and is simple and intuitive to use. It is flexible and future-proof because it allows BHF staff to add more data, on-demand, as well as synonyms to commonly abbreviated or misspelt words. Ultimately, our goal for this project was to provide a working key statistics chatbot that the BHF can integrate into their website to ease access to information.

Repository: <https://github.com/HeartBot-Comp0016-Team20/HeartBot>

YouTube: https://YouTube.com/playlist?list=PLMgg4eEYNHX4oxlnJ9_eNbvClivCzwYA

Nice Shot!

Authors: Morgane Ohlig, Prithvi Kohli, Jin Feng

Academic: Dr Dean Mohamedally

Client: InfoSys

Technologies used: Python, JavaScript, TensorFlow, MediaPipe, OpenCV, Three.js

Keywords: ML, Computer Vision, Tennis Analytics

Abstract: Tennis analysis applications have long been extremely complex and expensive systems that only professional players and coaches could use and afford. This leaves the average amateur player in the dust; all they want to do is practice playing. Gaining access to this analysis, which includes costly multi-camera setups and advanced tennis expertise, would be near impossible.

In comes Nice Shot!, an online platform which uses high-end computer vision and machine learning to help the everyday user easily gain access to this complex analysis by simply uploading a video of themselves attempting various tennis shots. The system will then provide the user with metrics, shot classifications as well as a 3D interfaceable replication of their performance. Furthermore, users can feel free to use the tool in a professional setting, meaning fans can retrieve quick analytics on their favourite player's shots.

Development on this project has led to the delivery of a web application which would make 3D tennis analytics more accessible and inexpensive than ever. The system is specifically made to tolerate a wide range of abilities, so people of all ages, young or old, can use it. Moreover, the analysis pipeline we've developed provides a foundation

for other tennis analytics as developers can use the API for their own purposes.

Repository: <https://github.com/UCL-COMP16-2021-Team1/nice-shot>

YouTube: <https://www.YouTube.com/watch?v=O6tUD6OBi1U>

CopyClare

Authors: Adi Bozzhanov, Yan Lai, Sree Sanakkayala, Tianhao Chen

Academic: Prof Dean Mohamedally

Client: Prof Joseph Connor, Prof Dean Mohamedally

Organisation: NHS

Technologies used: PySide6, OpenCV, Mediapipe, Nuitka, Sphinx

Keywords: Computer Vision, Healthcare

Abstract: In the global epidemic environment, it is not convenient to make an appointment with a physiotherapist for in-person consultation. And for a long time, physiotherapists have only been able to understand the rehabilitation of patients through words, which lacks sufficient evidence to support it. Also, when patients are trying to do rehab exercises alone, they face problems such as a lack of feedback to improve movements and a lack of motivation to track progress.

Therefore, our solution to this problem is CopyClare. CopyClare is an exercise video analysis tool that provides real-time accuracy feedback as patients are doing their rehabilitation exercises. The easy-to-use native Windows app provides a side-by-side view for users to compare their postures with the exercise video. Not only will CopyClare motivate patients as they monitor their live accuracy, but it can also provide physiotherapists with their patient's progress over time. Since our tool creates rehab assessment forms as well, we are, in essence, digitalising physiotherapy, which is particularly relevant in the face of the pandemic.

YouTube: Playlist: <https://YouTube.com/playlist?list=PL3f6w3jXvARNPIVsl1jVlbXLmgCfQcDjZ>

<https://youtu.be/5vrA5355YGM>

<https://youtu.be/kmr1TxTSdvs>

<https://youtu.be/xntf0dvBeHY>

<https://youtu.be/2DAhznyu7PU>

https://youtu.be/yTthLF_Flaw

<https://youtu.be/P7sY2v9EhDA>

IBM Design Thinking Playground

Authors: Carol Hanna, Alexis Chrysostomou, Haziq Shahrin Al-Johary, Henry Russell, Yiwen Shang, Yangtao Ge

Academic: Dr. Emmanuel Letier, Prof Dean Mohamedally, Eric-Tuan Lê

Client: John McNamara

Organisation: IBM

Technologies used: Electron.js, Redux, React, Konva.js, Material UI, Typescript

Keywords: Enterprise Design Thinking, Web Development

Abstract: Requirements engineering is a multidisciplinary problem. Effective and successful projects typically meet a set of requirements that result in the delivery of a product that satisfies clients and that users want to use. Getting requirements right early on is essential.

A proven technique is enterprise design thinking, used by IBM to design innovative user-centred products at the speed and scale of modern industry. Design thinking provides a framework, which professionals can follow with diverse teams, creating designs in iterative phases, identifying important features, and generating unique solutions for a problem statement. This report presents our prototype tool IBM Design Thinking Playground, custom-designed from the ground up to enable design thinking. It discusses our use of native web technologies and agile processes involved, as well as the current limitations of the prototype and how these could be addressed in future iterations.

Repository: <https://github.com/IBM-Design-Thinking-POC/dt-canvas-app>

Babelfish Transformer for Chatbot Engines

Authors: Zhilin Hu, Angel Oyelade & Vishaol Vignaraja

Academic: Dr Yun Fu

Client: Prof Joseph Connor

Organisation: NHS x CarefulAI

Technologies used: Python, Flask, NGINX, Pandas, Unicorn, MySQL, SQLAlchemy, IBM Watson, Microsoft Azure, Telegram, Discord, HTML, CSS

Keywords: Healthcare, Chatbots

Abstract: The aim of this project was to be able to provide users access to their chatbot data so they can have more control of it in case they wanted to switch providers but also to provide organisations with a method of auditing their chatbots for clinical risk management. The NHS is made up of multiple organisations and trusts, each individual organisation having its own structure and resources. Hence different

trusts use different technologies, finding it very hard to share resources with one another. Currently, trusts within the NHS use various providers for their chatbots ranging from IBM Watson to Microsoft Azure. With this system, it is hard to transfer data to and from chatbots in the case of risk management auditing or changing providers to suit their business needs. Our solution, named Babelfish, will provide a system that is able to pull data from existing chatbots and render it into a file that can be read for analysis purposes. You will also be able to upload the file from our system to another chatbot provider and be able to share data from different chatbots.

Ideas Platform for CNWL

Authors: Jack Bland, Leran Li, Siqi Zhu

Client: Prof Joseph Connor

Organisation: Central and North West London NHS Foundation Trust

Technologies used: Python, Django, PostgreSQL, REST, Selenium, OrchaWebserver, Ideas Platform, Healthcare (technically)

Abstract: Our task was given by the Central and North West London NHS Foundation Trust (CNWL) and was to finish the production of the prototype Ideas Platform site that is intended to allow users both from inside the NHS and in the wider public to submit challenges or problems and collaborate on ideas either to solve these challenges or to improve the NHS in general.

Users will be able to vote on these challenges and ideas to give the administration insight into what problems need more urgent fixing and what ideas are popular and should be looked into. There is also a vetting process to ensure no unwanted or inappropriate content is let onto the site

Repository: <https://github.com/Lokeyli/idea-platform>

https://youtu.be/9Zfi3T9_rlw

YouTube: <https://youtu.be/qf-eBSigM4c>

<https://youtu.be/4aml3-mQYQ8>

<https://drive.google.com/file/d/1HoOJ5Khi3d0S-F0-TyAqJ4vRG7BtN-Z/view?usp=sharing>

<http://students.cs.ucl.ac.uk/2021/group11/index>

NHS Soundlab Dashboard: Visualisation for engineers and data providers

Author: Matthew Schulz

Academic: Dr. Petru Manescu

Client: Prof Joseph Connor

Organisation: NHS England

Technologies used: Careful AI Python, (Django) Healthcare,

Keywords: Machine Learning, Data Science, Human-Computer Interaction

Abstract: This project is a user-friendly sound classifier platform allowing healthcare providers to create and understand Machine Learning models for various clinical use cases. Reducing complexity through Human-Computer Interaction and Data Science is at the core of Soundlab, enabling users to comprehend the data without assistance from specialists. This has multiple benefits, such as directly speeding the process of identifying and assisting patients with breathing problems, a major concern highlighted by the COVID-19 pandemic. Soundlab enables clinicians to share their projects with each other and build together new models for specific use cases.

Repository: <https://matthieuschulz.notion.site/BLOG-c21681e477bd43bda639dd3a50c31302>

FISECARE

Authors: Aisha Niraula, Pun Kamthornthip, Raquel Silva

Academic: Prof. Dean Mohamedally

Client: Prof. Dean Mohamedally (UCL Computer Science Professor), Sinead Tattan (UCL), Sibghah Khan (UCL), John McNamara (IBM), Costas Stylianou, Pippa Chick (Intel), and Lee Stott (Microsoft)

Organisation: UCL, IBM, Intel and Microsoft

Technologies used: C# (WPF Framework)

Keywords: MotionInput, Touchless Computing, ThinKiosk

Abstract: During the COVID-19 pandemic, restrictions were imposed on care home residents that made them unable to enjoy their normal life due to decreased human contact and activities. One of the major impacts of social isolation was the increased loneliness among care home residents.

Therefore, we have developed the application FISECARE that provides services to care home users such as online shopping, entertainment, communicating with family and accessing help, as well as encouraging them to exercise while having fun. This application is designed to run on a TV and use MotionInput touchless computing.

This enables users to access the internet in an easy and intuitive way, feel connected to family members and friends via chat and videocalls, and exercise physically and mentally through fun games while being indoors.

YouTube: <https://www.YouTube.com/watch?v=-YQ0g5rSfcw>

<https://www.YouTube.com/watch?v=PnwRtwKhKkM>

<https://www.YouTube.com/watch?v=qEO4zduUVsc>

<https://www.YouTube.com/watch?v=oLBQVb9cwKg>

<https://www.YouTube.com/watch?v=B3som3872gQ>

<https://youtu.be/MACXdc3QpkY>

Smartphone-Based Blood Pressure Measurement Using Transdermal Optical Imaging Technology (TOI)

Authors: Marek Masiak, Duy An Tran, Jongwon Lee

Academic: Dr Yun Fu, Ahmed Shahin

Client: Pjero Petej

Organisation: Sensyne Health

Technologies used: Swift, SwiftUI, Objective-C, Objective-C++, C++, Kotlin, Android Jetpack, OpenCV, Heartbeat, Python, FastAPI, SQLAlchemy, Alembic, PostgreSQL, AWS (EC2 t2.micro, 1vCPU and 1Gb of RAM), Docker, docker-compose, nginx

Keywords: Healthcare, Computer Vision, Mobile Development, Remote Monitoring

Abstract: There is a need for a reliable, fast and robust means of measuring human vitals remotely. In the world of the global pandemic, this is more visible than ever before. Physicians require means of remotely monitoring their patients, many without access to sophisticated equipment capable of sending data to a specialist –especially significant for the seniors in our society.

The solution we have created addresses this need by providing a fast, reliable and open-source mobile app available on iOS and Android. It also uses a remote back end and database, deployed on AWS. The app measures heart rate using a smartphone selfie camera and stores the measurements in the remote database. This allows sharing of the measurement data with medical professionals and prevents the data from being lost. Additionally, if a person has a dangerously high or low heart rate, the application will indicate it using an intuitive design. Moreover, the application allows its user to track the trends in their heart rate over time with stunning visuals (charts and lists).

According to the data collected by Ofcom, 93% of people aged 45-54 and 78% of people aged 55+ own a smartphone. By offering free means of measuring heart rate, this project provides significant value and enables the most vulnerable of us to gain access and share their vital information with medical specialists.

YouTube: https://drive.google.com/file/d/11-4kJAdAmASgcYwD_VayzNR8YTd2opbp/view?usp=sharing

<https://drive.google.com/file/d/13IbBiOWI6vi1N-JHPynKgxZzkRpYRED7/view?usp=sharing>

https://drive.google.com/file/d/1E_zu46IFQXTuOWdhRpkhUpQlpwfmIid/view?usp=sharing

https://drive.google.com/file/d/1Ja-bfNuPEbbQ4_4t0HCTv5D2nnkKRpUi/view?usp=sharing

<https://drive.google.com/file/d/1LApPk1y3XMx1TiD-UnCUI3LsJGQmffK/view?usp=sharing>

<https://drive.google.com/file/d/1XaAs7StB9kd9nv7XnNSm1-n3Qu-MpJgE/view?usp=sharing>

https://drive.google.com/file/d/1eOWbSXx2OKNad8Ft4b6aF_u-tKtoMySL/view?usp=sharing

https://drive.google.com/file/d/1q2sjcj43doBQwASmhfEBj_u9LqPNeHPw8/view?usp=sharing

CMS for SkyView + SoundScape

Authors: David Cook, Hongxi Tao, Jj Macakiage, Zeqi Zhu, Yaser Ennimer, Chao Zhang

Academic: James Callan, Prof. Dean Mohamedally

Client: Jarnail Chudge

Organisation: Microsoft

Technologies used: C#, Azure, .Net Core, Umbraco, Swift

Keywords: Tourism, Spatial Audio

Abstract: This project involved the development and implementation of a content management system (CMS) into a pre-existing iOS application for the SkyView tourist attraction in Stockholm. This involved upgrading an app that used custom core libraries, which limited our available approaches. To solve this, we used a combination of Umbraco, Azure Blob Storage, SQL Server and modifications in the iOS app, which allowed us to improve the scalability and reliability of the app, while also making it easier for people to modify and deliver content to the devices.

By the end of development, we had moved the content previously stored on the device to an Umbraco CMS and had upgraded the iOS application to retrieve content. This succeeded in making it easier to add and edit new content, while also ensuring that the iOS devices still require minimal downtime for updates.

Create mixed reality AI AR Greetings

Authors: Chen Yang, Joshua Darmon, Nafiz Zaman

Academic: Dr Manuel Birlo

Client: Prof John McNamara

Organisation: IBM

Technologies used: Node.js, Vue.js, PlugXR, MySQL, Azure, IBM Cloud

Keywords: Augmented Reality, Mobile App

Abstract: Handwritten greeting cards are a very easy way to add a personal touch to gifts; you may have received some for many different occasions: your birthday, Valentine's, Christmas... However, recent studies have shown that the yearly carbon footprint of the greeting card industry in the UK is equivalent to the production of 10,000 cars. We've designed a modern alternative to

greeting cards in the form of a cross-platform augmented reality (AR) app. Users can customise their AR greetings as much as they desire to keep the personal touch that their physical counterparts had while also allowing for more freedom in the form it takes. Thanks to PlugXR, the editing and viewing of the AR greetings are easier than ever for anyone who is not familiar with 3D modelling. We also made it possible for users to publish their templates on the app to showcase their creations while also allowing others to use them if they want to get a quality greeting immediately. Users can 'like' templates to make them easier to find and save their favourite ones for quick access whenever they want to use them.

Repository: <https://github.com/IBM-AR-Greeting-Tool/>

YouTube: <https://students.cs.ucl.ac.uk/2021/group39/>

NudgeShare: Speech Analysis Tool

Authors: Dinesh Anantharaja, Jay

Academic: Mr Maliththa Sahan Sarojan Bulathwela

Client: Prof Joesph Connor

Organisation: NHS Wales

Technologies used: React, Flask, IBM Watson STT SDK

Keywords: Healthcare, Voice Recognition

Abstract: Speech is useful for analysing conditions like depression. It is typically surveyed through phone calls, which take time to record and analyse. MobileV is a speech analysis tool which automates this process. Apps are easier to use and can add data visualisation.

MobileV only supports Android devices. Our project, NudgeShare, is a progressive web app, making it more accessible to a wider range of users. It is optimised for both desktop and mobile users, and everything in between. We have spent significant time on this project to make it as easy to use and intuitive as possible. We hope that this project will yield a larger user base than MobileV.

YouTube: <https://www.YouTube.com/watch?v=1xgCNK4l-Fw>

Appointment Scheduling and Workflow Management Tool

Authors: Kamil Ebanks, Arslan Aftab, Yue He

Academic: Prof Graham Roberts

Client: Moorfields Eye Hospital

Organisation: NHS

Technologies used: Python, Django, Bootstrap, HTML, CSS, Docker, Azure Container Registry, Azure Container Instances, Github Actions.

Keywords: Healthcare

Abstract: Moorfields Eye Hospital use Excel spreadsheets to record patient information and update their appointment schedules. This is inefficient – ocularists and admin staff

have to navigate and modify across several different spreadsheets to perform simple actions such as booking appointments.

Our workflow management web app was designed to eradicate the friction with the current system. We believe that this system will help ophthalmologists better prioritise their time, spending it on what they do best, by allowing them to spend less time on tedious admin work and more time consulting patients and creating ocular prosthetics.

We provide a simple user interface that intuitively displays information. It is easy to navigate the patients and appointments, with the ability to filter and search by a variety of factors. Ophthalmologists can view their own and their colleagues' rotas at the click of a button, with expanding windows if they desire to see more information. The system automatically fills new appointments into the ophthalmologists' rotas.

By simplifying the admin work, this app reduces the time spent on tedious tasks and gives ophthalmologists more time to do what they do best!

Repository: <https://github.com/ArslanAftab/ucl-ixn-team19>

YouTube: https://youtu.be/Y8Y-DTTF_tU

<https://youtu.be/0yir8PnMf4>

<https://youtu.be/ZyxBLIPzKQY>

<https://youtu.be/umaFfwAvSOo>

ML via NoCodeUI (WHATDAR)

Authors: Andreea Irina, Justin Koo, Jai Vaswani

Academic: Mr Luke Jenkinson

Client: Prof Joseph Connor

Organisation: The Apperta CIC Foundation

Technologies used: Python, HTML, CSS, JavaScript, Django, IBM Watson, Spacy, Gensim, NLTK, Linode, Gunicorn, Nginx

Keywords: Healthcare, Machine Learning, Data Analytics, Data Visualisation, Web Development

Abstract: When people engage the NHS by phone and leave a recorded message, such messages often indicate demand for a particular NHS service. These, in essence, represent the NHS front door. However, the NHS had no way to analyse recordings to understand the demand for these services.

These recordings could have common concerns and being able to summarise them automatically could be a game changer for the NHS and doctors. Modern problems require modern solutions – the project addresses this issue by providing natural language processing techniques and visualisation tools to help doctors quickly grasp the major concerns among their patients, thus saving a lot of time and effort.

Model Match

Authors: Gabriel Turner, Jeffrey Li, Laasya Eluri

Academic: Prof Yun Fu

Client: Joseph Connor

Organisation: Careful AI

Technologies used: Python, JavaScript, Docker, FastAPI, React, PostgreSQL, SQLAlchemy, Alembic

Keywords: Healthcare, ML

Abstract: Our project seeks to break the barrier behind interdisciplinary collaboration within AI model development and testing. Our web app provides a secure platform for data scientists and clinicians to upload and download trained machine learning models as packaged docker images with a provided front end, ready to be run for model testing without the need for clinicians to work with code or handle dependencies. The service also provides a hosting solution for datasets, and users can provide feedback to help improve future iterations of the model.

YouTube: <https://www.YouTube.com/watch?v=aPhLVsqXtJY>

<https://www.YouTube.com/watch?v=rD5kSmWLzNM>

Children Diary App

Authors: Christopher Carty, Yiting Cao, Tiffany Allegra Gerstmeier, Yun-Tzu Yin

Academic: Dr Yun Fu

Client: Professor Elizabeth Shepherd

Organisation: UCL Information Studies

Technologies used: React Native, Node.js, MySQL, Azure

Keywords: Mobile Development

Abstract: At present, in the context of child social care in England, participatory record-keeping approaches are oriented towards service providers, with a focus on risk management, reporting to the central government, and the needs of social workers. As a result, the voices and feelings of care-experienced people, carers, and families are often missing or misrepresented. Children are especially affected by this lack of personalised record-keeping, as records can be a vital resource in understanding the circumstances of their lives. In fact, having no control over the creation and management of records that document their childhood may even lead to feelings of disempowerment and isolation. Our solution was to build a React Native mobile application that creates a safe, simple way for a young person in care (aged 13 to 17) to record a personalised digital diary. The app places special emphasis on exploring and sharing feelings, allowing the young person to express themselves and feel heard. The main features of the app include the ability to create text or image entries to document anything the user wishes to share, as well as a scrollable and searchable feed that provides access to all previous posts.

MotionInput v3.0 for Creativity

Authors: Siam Islam, Eva Miah, Keyur Narotomo, Fawziyah Hussain

Academic: Prof. Dean Mohamedally

Client: Prof. Dean Mohamedally, Prof. Lee Stott, Prof. John McNamara, Costas Stylianou, Philippa Chick

Organisation: UCL, Microsoft, Intel, IBM

Technologies used: Python, MediaPipe, OpenCV, Win32 API, C#, WPF

Keywords: Computer Vision, Gesture Recognition

Abstract: The way we currently use computers may not be suitable for everyone and accommodate the needs of all people, such as those with limited mobility. MotionInput is a software platform that allows touchless navigation using webcam input through gesture and motion recognition, which aims to give all users a seamless computing experience. Currently, there is a lack of touchless interaction in modern devices for the purpose of creativity, and our project, MotionInput v3.0 for Creativity, improves upon the legacy MotionInput v2.0 by adding additional functionality to overcome these issues.

Our solution to these problems has been developed, and we are happy to say that MotionInput v3.0 now has extra support for creativity. Specifically, we created an in-air keyboard, digital inking with depth pressure sensitivity, and multitouch. This allows users to simulate touch and pen interactions using gestures and enables in-air typing and drawing without the need for a physical keyboard or pen. The software also allows multiple users to interact with a computer simultaneously.

A summary of our achievements includes:

- allowing users to draw, type, and touch their devices from up to 6 ft away
- a 4x increase in the number of keys in the in-air keyboard
- interactions with up to six new touchpoints and three new click gestures.

The impact that this project will have is that it will help all users to carry out any computer-related tasks regardless of any limitations they may have.

Clinical QR Kit

Authors: Huijie Yan, Robbie Lin, Safiyya Onanuga

Academic: Prof Dean Mohamedally

Client: David Cox

Organisation: NHS England

Technologies used: React, Spring Boot, PostgreSQL

Keywords: Software Engineering/Development,

Healthcare

Abstract: As clinical staff work in the hospital, they are met with a large range of equipment with various methods of use. Due to the sheer amount of equipment, staff may forget how to use equipment – this could potentially lead to adverse consequences. This is where our solution comes in.

The Clinical QR Kit is our solution to this problem – creating a web application that utilises QR codes for ease of access ensures that staff can quickly get to resources to work on the equipment. The website is filled with a wide range of resources regarding the equipment, which can also be searched through and filtered if QR code access is unavailable. For admin users, other key features such as equipment sharing, equipment viewings and issues raised by staff can also be managed within the system.

KONLA (Knowledge Organisation through Natural Language Analysis)

Authors: Bartosz Grabek, Suraj Kothari, Minyi Lei

Academic: Prof Graham Roberts

Client: Dr Chris Harding

Organisation: Lacibus Ltd

Technologies used: Python, JavaScript, Django, Vue.js, spaCy, Poppler, Docker

Keywords: NLP

Abstract: Researchers, both in industry and academia, spend a significant portion of their time gathering research resources. They browse through hundreds of different research papers, but only a small percentage of them are truly relevant to their study. KONLA was created to speed up the process of pre-analysing research papers. It is a web application that uses natural language analysis techniques to give insight into the most important details contained within an uploaded document, thereby increasing overall research productivity, particularly at the stage of gathering materials. KONLA offers an intuitive user interface and a range of features, including whole paper summarisation, partial summarisation (by section/subsection), extraction of keywords, references, metadata and more. It also involves an API for further development or use in a different setting.

Repository: <https://github.com/hzlmy2002/konla>

MotionInput Configuration Tool

Authors: Lama Alluwaymi, Jianxuan Cao, Jiaying Huang, James Zhong, Zemiao Huang

Academic: Dean Mohamedally

Client: Lee Stott

Organisation: Microsoft

Technologies used: Python, C#, MediaPipe

Keywords: Touchless Computing

Abstract: Touchless computer interaction has become increasingly important during the COVID-19 pandemic, as has people's desire to be active at home. MotionInput (MI) is an open-source solution that provides a touchless computer interface, allowing users to perform actions such as moving the mouse, clicking, and executing keyboard shortcuts by using various face/hands/body gestures. As a result of the project's success, MI 3.0 intends to take the previous versions' designs and ideas further to extend the number of gesture functionalities. Our contribution, MotionInput Configuration Tool, tackles the lack of an efficient central gesture database in the system by allowing users to record custom 3D gestures, map recorded gestures to computer events, and generate 3D heatmap of the recorded gestures. MotionInput Configuration Tool is a function extension of the original MI 3 system. It was built using Python for the back end, C# for the front end, and Pipeline was used for the connection between the back end and front end. The user can record a short video of a custom gesture (hand movements), trim the video so that it only contains the gestures' frames, and then assign the gesture to a corresponding computer action. To improve the recognition efficiency and conserve storage space a reduction algorithm has been applied to select 16 evenly distributed keyframes from the trimmed video. Ultimately, the Configuration Tool has helped improve the number of possible gesture functionalities and insight, and improves its usability with disabled users, increasing the effectiveness of MI as a touchless computing solution.

AR Art with Node-RED

Authors: Lilin Huang, Walid El Kotob, Zhengfeng Cen, Ioannis Sophocleous, Simone Lin

Academic: Prof Emmanuel Letier and Eric-Tuan Le

Client: John McNamara

Organisation: IBM

Technologies used: Node-RED, React Native, Node JS, IBM Cloud, Viro React

Keywords: Augmented Reality

Abstract: Since the start of the pandemic, artists have been trying to sell and even create art online more than ever before. Our application allows artists and people in general to create augmented reality (AR) experiences in which they can exhibit art and share it with the world. The app allows users to move existing artwork they've created or seen in the real world (such as a painting) into AR. They can then virtually post their AR artwork in an open-air location so that anyone that physically passes by that location would be able to experience their art in AR and listen to a description of the artwork as if they were viewing it in real-life at an art gallery.

NudgeShare

Authors: Nicholas Daskalovic, Dinesh Anantharaja, Jay McCaughrean

Academic: Dr Yun Fu

Client: Joseph Connor

Organisation: NHS Wales

Technologies used: React.JS, Python, Flask

Keywords: Healthcare

Abstract: NudgeShare is a progressive web application that enables healthcare providers to better connect and understand their patients through speech analysis and journaling. Users can use NudgeShare as a standalone voice diary where they can track their wellbeing and view all their historical data to get a better picture of their progress. Users can also share their data with trusted senior responsible officers and healthcare providers for a deeper analysis of their data.

Repository: <https://github.com/TheTruffh/NudgeShare>

YouTube: <https://www.YouTube.com/watch?v=1xgCNK4l-Fw>

Exploring Two Pipelines for Distantly Supervised Relation Extraction with Multi-instance Learning

Author: Jingze Xu

Academic: Prof Anthony Hunter

Organisation: UCL

Technologies used: Python, PyTorch

Keywords: NLP, Relation, Extraction

Abstract: The main goal of the project is to explore a usual pipeline of distantly supervised(DS) relation extraction with multi-instance learning (MIL). Two pipelines for DS with MIL models were implemented, evaluated and analysed.

The first pipeline was to train a DS model on a DS trainset on bag level, and make it predict and evaluate on sentence level. The second pipeline was to use a pre-trained DS model to extract and label a small number of sentences with high confidence in DS trainset, and train a supervised model on the DS-extracted or DS-labelled data, finally let the supervised model predict on sentence level.

It was inferred that the second pipeline is supposed to be better than the first pipeline when the DS model has high performance. Also, a balanced DS dataset with appropriate bag size is important for the DS model to extract sentences. It was also found that adding restrictions could not reduce the noise efficiently. More advanced models are necessary to further compare the two pipelines.

MotionInput V3: Core Architecture

Authors: Carmen Meinson, Jason Ho, Radu Bogdan-Priboi

Academic: Prof Dean Mohamedally

Client: Prof Dean Mohamedally

Organisation: UCL, Microsoft, Intel, IBM

Technologies used: Python, OpenCV, MediaPipe, OpenVino, Vosk, Dlib

Keywords: Computer Vision, ML

Abstract: The COVID-19 pandemic forced staff, students and the world to stop in their tracks and to stay at home at a scale never seen before in history. This motivated development for novel and more active ways of computer interaction, especially ways that could extend from general purpose use in homes, to industry level applications like in medicine and healthcare.

MotionInput V3 is the 3rd generation of UCL Motioninput, a touchless computing system that allows for users to control and interact with the computer using physical gestures captured by their web camera. The platform allows users to replace input functionality normally provided with a keyboard, mouse, or joypad, and instead use gestures defined by movements of their hands, head, eyes or even their full body.

As the core team for Motioninput V3, our project concerned designing a new system architecture that was firstly highly functional (porting over the capabilities of the previous MI versions), efficient in processing, as well as extending functionality with several new modes. The architecture is also developer-oriented, allowing new developers to easily create use-case specific apps due to the architecture's modularity, configurability, and scalability. Finally, well-formed code and highly detailed documentation allow developers to quickly understand the architecture and ease their development.

Our architecture provided the groundwork for the collaboration of over 50 more students working on MotionInput V3, spanning Year 2 undergraduates and final year students, with the results shown at: touchlesscomputing.org

Analysing factors which affect the severity level of vehicle collision

Author: Yinrui Huyinrui

Academic: Dr Dmitry Adamskiy

Organisation: UCL

Technologies used: ATensorFlow, Sklearn

Keywords: Machine Learning, Supervised Learning, Deep Learning

This project aims to find out the feature that affects the prediction of a machine learning (ML) model. More

specifically, it analyses the feature importance of a ML model when predicting the collision's severity level. The whole process includes the data preprocessing system to deal with the large portion of the categorical data and uses a self-defined preprocessing method to use all available data in hand to perform a transformation of road surface (categorical data) into the stopping distance.

Three candidate models are being selected and trained with a train test split ratio 80% for training and 20% for testing. Due to the fact that the dataset is strongly imbalanced, typical evaluation matrices: f1 score, confusion matrix, false negative rate and accuracy have been selected to deal with this problem. Weighted logistic regression, random forest with SMOTE-NC and feed forward neural network with two hidden layers have been used as candidate models in this project.

The results show that SMOTE-NC has the worst performance regarding to the f1 score. It scored 0.3292, which is 0.0265 lower than the weighted logistic regression's score. The neural network has the best performance, it receives a f1 score of 0.5538 and a 0.8747 overall accuracy. Two feature importance methods are being used depending on the model. Permutation feature importance is being used for the random forest model and neural network model. The results obtained from this project gives a promising result and can be beneficial to the future work of studying collision severity level in London.

Disaster Risk Reduction (DRR) Terminology

Authors: Harry Daintith, Wenyong Lai, Bobi Martens, Anelia Gaydardzhieva

Academic: Dr. Yun Fu

Client: Federico Federici

Organisation: UCL Centre for Translation Studies

Technologies used: React Native, React.js, Node.js, MySQL

Keywords: Mobile, Web App Development

Abstract: Sierra Leone is home to a very diverse range of cultures and multilingual communities. Communication among these communities can often be challenging and can sometimes seem impossible. There is a need for establishing a common understanding and access to crucial information about national matters, especially when they concern the health and wellbeing of all citizens. The DRR mobile application is designed to be a tool for crisis managers, trainers, several humanitarian organisations, and local citizens alike. It contains important terminology translated from English into five local languages and allows these to be played as audio recordings to also reach illiterate users. The application is both iOS and Android compatible and has been tested to adjust well for various screen sizes. The user interface was built using React

Native for the mobile and ReactJS for the web application, while the back end was developed using Node.js and a MySQL database.

Tech Skills Game

Authors: Giancarlo Grasso, Mohammed Ariq Rahman, Yat Lam Yung, Yuting Shen

Academic: Dr Yun Fu

Client: John McNamara

Organisation: IBM

Technologies used: React Native, Flask, MongoDB

Keywords: Mobile App Development

Abstract: IBM currently has an offering for university students known as the IBM Academic Initiative. This provides students with the opportunity to leverage IBM tools and courses to prepare them for the industry through direct hands-on experience. Currently, it is very difficult for students to navigate the website, and the order in which these learning experiences should be completed is unclear. The solution for this is to gamify the IBM Academic Initiative to increase student engagement and provide direction for which academic initiatives they should complete. Therefore, we developed a mobile app where university students compete against each other. The main way of progression through the game must be through engagement with the IBM Academic Initiatives, and the user must have a clear roadmap of which academic initiatives to complete and in which order. Although the application is a game that is like tribal wars, it can promote the connection between users and the IBM academic website and encourage users to expand their clan by learning more skills on the website and obtaining more badges. The delivered app can be deployed on both Android and iOS devices.

ANCSSC Members' Web App

Authors: Marc Solomon, Elynor Kamil, Jiahui Shi, Yingbo Zhou

Academic: Dr Yun Fu

Client: Inès Belliard

Organisation: The Alliance of NGOs and CSOs for South-South Cooperation (ANCSSC)

Technologies used: Bootstrap, Laravel, MySQL

Keywords: Web App Development

Abstract: The Alliance of NGOs and CSOs for South-South Cooperation (ANCSSC) is a charity concerned with connecting charities and charitable organisations in the global South-South. They requested a new version of their web application to strengthen these connections and sharing of knowledge. We developed a web

application that provides a subscription-controlled service and enables ANCSSC or their users (organisations) to share knowledge with other subscribed members. The application meets all the requirements. Each user can subscribe, allowing them to view resources and events provided by ANCSSC, and projects and reports set up by fellow members. Through being able to find users in their region sharing their sustainable development goals, each member organisation is given an easy way to connect with organisations whose insight they would most benefit from. All the data presented to users is consistently formatted, easy to understand, and simple to navigate.

I Am Somebody's Child Soldier (IamSCS) Website

Authors: Viet Cuong Nguyen, Shalaka Makarand Yerawadekar, Anthony Ma, Yanling Sun

Academic: Dr Yun Fu

Client: Shirah Mansaray

Organisation: I am Somebody's Child Soldier

Technologies used: Tailwind CSS, Next.js

Keywords: Web App Development

Abstract: I Am Somebody's Child Soldier (IamSCS) is a charity established in 2014 that works to empower and support child soldiers and victims of war suffering from undiagnosed mental ill-health across Africa. The organisation advocates for the improvement of mental health services, wellbeing, and basic needs, through the support of sustainable livelihood initiatives, rehabilitation, and raising awareness about the social stigma of mental illness across Africa. IamSCS wants to refresh the website in a way that increases visitors to the site, highlights donations and brings a clean aesthetic to match current trends. They also want to allow admins to add and edit site content easily. We successfully delivered the main requirements and multiple peripheral features recorded in the initial requirements capture. After several forms of testing, IamSCS is now able to comfortably alter its website content through a third-party content manager, and deliver well-structured information to platform visitors, and accept user donations.

MotionInput 3.0 website

Authors: Benjamin Threader, Hei Man Chan, Kaiwen Xue, Thomas Langford

Academic: Dr Yun Fu

Client: Dr Dean Mohamedally

Organisation: UCL Dept of Computer Science

Technologies used: React.js, Node.js, MySQL

Keywords: Web App Development

Abstract: The project goal is to create an informative and developer community web platform to improve the current website. The required features include demonstrating the MotionInput applications, providing download links of various MotionInput microbuilds, and building a community where users can share feedback and upload ratings. We designed and implemented a web application that fulfills all the requirements. The web application back end technologies used Node.js and MySQL. For the front end, React.js was used.

Rating App for Assistive Technologies for ALS/MND

Authors: Ewan Smith, Wenjing Yang, Olusola Adeyemi, Ruijun Yao

Academic: Dr Yun Fu

Client: Cathy Cummings

Organisation: International Alliance of ALS/MND Associations

Technologies used: React.js, Node.js, Express, MongoDB

Keywords: Web App Development

Abstract: People with ALS/MND gradually develop generalised paralysis. Some patients even struggle to communicate with others and lose the ability to speak as the disease progresses. Voice banking can approximate the patients' voices and greatly improve their quality of life. Currently, there is no application exists for ALS/MND patients to compare services and find the best product for their needs. The International Alliance of ALS/MND Associations wants to develop a web application to fill this necessity. By working with the International Alliance of ALS/MND Associations, we developed a web application that uses the MERN stack and implements most of the required features.

VisualNav for Visual Studio

Authors: Henry Russell, Jianxuan Cao, Shihao Liang, Qinglan Ye, Yaser Ennimer, Zemiao Huang

Academic: Dr David Clark

Client: Costas Stylianou and Prof. Dean Mohamedally

Organisation: Intel, Microsoft

Technologies used: C#, Windows WPF, MotionInput, OpenVino, Visual Studio, Blockly

Keywords: Healthcare, accessibility

Abstract: Touchless computing has long been a product of science fiction; however, it may soon become a reality. UCL's MotionInput enables voice and gesture controls of a computer with only a webcam and microphone. The implications of this are industry-changing, with many benefits in user interaction, such as increased immersion

and accessibility for individuals with severe motor impairment or injury.

Much like the adoption of touch interfaces in the mobile app space, touchless interfaces require a paradigm shift, with additional consideration for ways to approach the usability of mouse and keyboard. We created VisualNav for Visual Studio in collaboration with UCL, Intel, and Microsoft, an extension for Visual Studio designed to solve two fundamental problems; making learning to code for the first time for young students interactive and enhancing the integrated development environment accessible to those with disability. This is achieved with a unique interface, where a radial dial menu is used to select visual programming language building blocks that can be semantically combined and compiled into several languages.

YouTube: <https://www.YouTube.com/watch?v=HnDAWcXJ9N8>

<https://www.YouTube.com/watch?v=DqeLhyXifRw>

Data Extraction Tool for the IFRC

Authors: Zayn Baig, Hannah James, Stone Chen, Tosin Fadahunsi

Academic: Prof Graham Roberts

Client: Jenny Paola Yela Bello, Ana Maria Escobar

Organisation: International Federation of Red Cross and Red Crescent Societies (IFRC)

Technologies used: Python, SQL, HTML

Keywords: Data Extraction

Abstract: Many national societies will work on PDF documents with a lot of collaborators, and we developed an import functionality that allows the national societies to upload the PDF documents and this information can be mapped out to the correct fields within the form we have already created.

Repository: <https://github.com/StoneChen917/COMP0016-Team-3.git>

Donor Data Insights

Authors: Waseh Khan, Gustas Pladis, Tushann Arya

Academic: Prof Graham Roberts

Client: Tom White

Organisation: St Margaret's Hospice

Technologies used: React(JS), Flask (Python)

Keywords: Data Science, ML

Abstract: Donor data holds many insights. Hospices and other fundraising organisations, such as St Margaret's Hospice, collect vast and wide-ranging amounts of donor data; storing donation history, events attended, and

all communications sent to each donor etc. However, handling and searching through this vast amount of data can be extremely daunting, time-consuming and inefficient for fundraising and analytical teams. They therefore miss the opportunity to identify commonalities between different donors as well as the ability to tailor communication to donors with the intention of retaining their support. This is of profound importance as these organisations rely heavily on public funding to maintain support.

Our project utilises the data provided by St Margaret's Hospice to generate 'profiles' that cluster donors together based on common attributes such as their: donation journey (the history of donations made by a single donor) as well as donation types, values and frequencies. To display the results found, we provide a visual representation of profiles through a web application. Our application provides the hospice with the ability to: efficiently view each donor and their corresponding journey as well as a page to view the aforementioned profiles. Finally, our solution also has the functionality of predicting what source group a donor is likely to donate to next and an indication of when and how much.

Define Return Periods for Low-impact Hazardous Events

Authors: Yuhang Zhou, Dekun Zhang, Hardik Agrawal, Jucheng Hu

Academic: Prof Graham Roberts, Prof Dean Mohamedally

Client: Justin Ginnetti

Organisation: International Federation of Red Cross and Red Crescent Societies (IFRC)

Technologies used: CLIMADA, Python, Pandas, Numpy, Beautiful Soup

Keywords: Data Science

Abstract: The IFRC aim to allocate resources to take proactive measures to mitigate the effects of relatively high-frequency, low-intensity natural hazards. Although these events are categorised as low impact, they significantly impact the poorest communities in developing countries and they continue to receive inadequate support. In the future, the IFRC intends to disburse CHF 100 million from its Disaster Relief Fund. To allocate funding, they require more insight into the impact of the retrospective events we are analysing.

To assess when an event (forecasted or occurred) reaches the impact threshold, we need to produce impact exceedance curves on observational data for specific types of events. We are using publicly available datasets mainly the national disaster loss database (DesInventar) and EM-DAT to produce exceedance curves for multiple impacts for as many National Societies as possible.

Our project aims to support the IFRC in allocating funding more effectively to neglected countries in need, by producing impact exceedance curves based on observational data for specific types of natural disasters. This will allow the IFRC to anticipate the impact of future events and take preventive measures, as well as use the model for risk analysis. By making the model open source, all national societies can access and use it to improve their disaster response and reduce the impact of natural disasters on vulnerable communities.

Repository: <https://github.com/COMP0016-IFRC-Team5/>

Resilient Teleoperation of Kinematically Unmatched Robotic Systems by Visual Hand Tracking

Author: Aashvin Chandru

Academic: Dr Vijay Pawar

Client: Dr Vijay Pawar

Organisation:

Technologies used: Python, ROS, MediaPipe

Keywords: Hands, Robotics, Computer Vision

Abstract: Controlling robotic hands and arms can be made very intuitive if the robot mimics what the operator is doing by hand tracking. Many current methods of performing this involve additional wearable devices such as gloves with various sensors, or expensive equipment such as (potentially multiple) specialised cameras. In addition to this, these systems are specialised to be able to control one specific type of robot hand/arm.

The new system presented provides a low cost and computationally efficient method of controlling robotic hands and arms using visual hand tracking with a single webcam. The algorithms developed also generalise to kinematically unmatched systems i.e., robotic hands with varying numbers of fingers or grippers. Also presented is an extensible framework from which control methods of new robotic hands and arms can be easily implemented to work with the defined system.

This system allows investigation into the effectiveness of the proposed control methodology: success rate of gesture matching for the hand under different rotations, and variation off the optimal movement path for the arm. It also allows for experimentation on how the refresh rate of the proposed solution affects user performance on different movement or manipulation tasks.

Repository: <https://github.com/Aashvin/hand-tracking-robot-control><https://www.YouTube.com/watch?v=0TzbkJRuB-caashvincr@gmail.com>

The development of a generic ML Engine based App (Windows) on 3D models with meta tagged geometry, with the example of patients suffering with tooth wear

Authors: Tilen Limbäck-Stokin, Yoong Xin Chong, Hongrui Tang

Academic: Dr Yun Fu

Client: Dr Junaid Malik, Dr Lambis Petridis

Organisation: UCL Eastman Dental Institute

Technologies used: Python, Azure, PyTorch, PySide2, Flask, Open3D

Keywords: Healthcare, Dentistry, Prosthodontics, Clinical Decision Support System, Tooth Wear, Machine Learning, Deep Learning, Neural Network, 3D data, point cloud, PointNet, Regression

Abstract: Tooth wear is a widespread issue within the population where teeth degrade over time due to abrasion, attrition, and erosion. Presently, dentists have varying approaches and philosophies to tooth wear diagnosis and prognosis. Hence much time is wasted, and potentially resources too, providing accurate treatment plans.

Current clinical decision support systems (CDSS) focus on 2D tooth scans and the realm of 3D tooth models remains largely unexplored due to the complex structure of teeth. The aim of our project is to create a first stage proof-of-concept CDSS Windows-based app to provide treatment plan suggestions for patients with tooth wear using their 3D tooth scans and medical background.

We use PySide2 and Open3D for the front end UI and 3D model processing. The back end is hosted on an Azure virtual machine using Flask. Our algorithm for providing tooth wear evaluation is based on the PointNet deep learning architecture, written with PyTorch. This focuses on classification of point cloud models to provide a numerical grade for the wear of teeth. The loss achieved by this model, with limited data, using MSE is 0.21.

This project shows great potential as we have only had very little data and implemented only a part of the whole system and already achieved promising results. In the future, the overall grading algorithm will be incorporated into a larger algorithm that will take the tooth wear grade results and the patient's medical background as inputs to provide tailored treatment plan suggestions to assist dentists.

Repository: <https://github.com/TilenLS/COMP0016-2022-10>

YouTube: https://YouTube.com/playlist?list=PLsCNa_35acSJRF-r-bWcg-6qvE3ODop5m

MotionInput In-Air Multitouch with Multiviews

Authors: Maria Toma, Filipp Kondrashov, Luke Jackson

Academic: Prof Dean Mohamedally

Client: Prof Dean Mohamedally

Organisation: UCL

Technologies used: MotionInput 3.2

Keywords: Computer Vision

Abstract: The previous version of the MotionInput software presented a challenge for users due to its implementation of multiple gestures to switch displays and cameras. Such a feature proved to be unnatural and hindered the navigation flow of the program. In response to this, we aimed to make the program more user-friendly by implementing a new approach that would allow for seamless navigation between displays.

The proposed solution involved modifying the program to enable users to change displays by simply moving their hand to the desired monitor. This was accomplished by calculating the angle of the user's hand in relation to the camera, and when it exceeded a certain threshold, the software would begin sampling the cameras to determine which camera provided the clearest view of the user's hand. The software would then automatically switch to the best camera and the corresponding display.

We are pleased to report that we were successful in implementing this new feature, which now allows users to navigate between up to four displays with ease. Additionally, users can now drag objects and windows between screens, further enhancing the software's versatility. These new capabilities can be applied in a wide range of scenarios, from organising workspaces and sketching to real-time surgical guidance.

PorterBLE

Authors: Ioakim Avraam, Modestas Gujis, Michael Fan, Ariel Harmoko

Academic: Prof Graham Roberts

Client: Apian

Technologies used: Spring Boot (Java), Cloud Run, Cloud SQL, React, Node.js, Firebase, Kotlin

Keywords: Healthcare

Abstract: Our partnership with Apian aims to address the issue of delayed medical package transportation in UK hospitals. Currently, package deliveries are fulfilled by human porters, whose job is to respond to requests they receive on SMS devices called pagers to load and unload drones which carry pharmaceuticals between hospital buildings. Unfortunately, there are significant inefficiencies with the current system hospitals use as, when there is a delivery to be made, a request is sent to all porters and the first person who responds to this request is then

responsible for the delivery. This is clearly problematic as it doesn't consider a porter's proximity to the parcel or their availability.

Our goal is to track porters for optimal task assignment based on proximity and availability, to eliminate drones waiting for deliveries, and to create an intuitive delivery request system for hospital staff, ultimately reducing patient waiting time.

Our proposed solution to optimise the transportation of pharmaceuticals and other medical packages within UK hospitals has the potential to revolutionise the way healthcare facilities operate. By implementing a system that tracks the movements of porters and assigns tasks based on their proximity and availability, we will significantly improve the efficiency of the delivery process. We are particularly excited moving forward, as our solution was already demoed in Wansbeck Hospital, receiving terrific feedback, with the aim of being deployed to transfer renal pathology between Guy's and St Thomas' Hospital later in the year (Q4).

UCL MotionInput v3.2 Resilient Kiosk

Authors: Aryan Agarwal, Aaryaman Sharma, Yidan Zhu

Academic: Prof Dean Mohamedally

Client: Prof Dean Mohamedally (UCL), Prof Graham Roberts (UCL), Tom Winstanley (NTT DATA), Prof. Phillippa Chick (Intel), Prof. Costas Stylianou (Intel)

Organisation: NTT DATA, Intel

Technologies used: Python, MotionInput (Mediapipe), ReactJS, C++

Keywords: Healthcare, Retail, Computer Vision

Abstract: Kiosks are found everywhere and provide a range of services. But individuals with motor disabilities are unable to use them, and physical interaction poses a hygiene risk. To solve this, our team planned to develop a touchless kiosk system controlled by hand gestures using UCL MotionInput. This approach is more hygienic and user-friendly, and has the potential to make a significant impact on the self-service industry.

Our team successfully created a touchless kiosk system that's controlled by hand gestures, with a resilient design that automatically relaunches if it crashes. Our system supports crowd detection to track only the active user's hand, improving accuracy and the user experience. Plus, we've made a web extension which provides a live animated preview of the user's gestures and enables our software to be used with any web-based kiosk UI, making it versatile and adaptable.

UCL MotionInput 3.2 Bedside Media Navigator

Authors: Nandini Chavda, Haoran Xu, Donghyun Lee

Academic: Prof Dean Mohamedally

Client: Costas Stylianou, Pippa Chick, Atia Rafiq

Organisation: Intel, GOSH, IBM

Technologies used: Python, TensorFlow, C#, WPF, C++, MFC

Keywords: Healthcare, Machine Learning, Touchless Computing

Abstract: People with disabilities or who are less digitally literate put off using their computers or devices because it is too complicated to use or the device does not provide the necessary features they require to use the device. For example, children suffering from cerebral palsy have difficulty with movement and coordination, which can make it challenging to hold or use objects such as the mouse. This is when MotionInput and our Bedside Navigator come into play.

The Bedside Navigator merges MotionInput technology with a friendly and easy-to-navigate interface, UCL FISECARE, to provide our users with a computing experience that suits their abilities. This interface is built to work with the new MotionInput Bedside Navigator modes, which enable hand and face tracking from an angle. This means that our bedside navigator and the camera can be placed on the bedside table allowing the user to comfortably navigate UCL FISECARE while lying in bed.

The bedside navigator will serve as our user's buddy by helping them to complete their daily tasks with more ease. Children will be able to access a variety of reading books, including picture books as well as educational resources. Online multiplayer gaming sites such as UNO will encourage children and older people to stay active and connected with friends and family at home. Overall, the Bedside Navigator will create an immersive and unique experience for children and older people who are otherwise very restricted by the complicated steps of using a computer normally.

YouTube: https://youtu.be/ye_L57dhPtk

<https://youtu.be/w4HpSiTS644>

Complaints, Compliments and Comments Reporting Suite for the British Red Cross

Authors: Bryan Cheong, Cheuk Tseung, Sachi Lad

Academic: Dr Yun Fu

Client: Russell Craigie

Organisation: British Red Cross

Technologies used: Power BI, Power Query, DAX Expressions

Keywords: Business Analytics, Business Intelligence, Data Analytics,

Abstract: The British Red Cross currently has an inconsistent approach to translating feedback into learning and service improvements. To improve this process, the British Red Cross has initiated a programme intended to streamline and centralise the complaints, compliments, and comments (CCC) procedure.

As part of this larger programme, our goal is to create a reporting suite using Microsoft Power BI that would display reports on the CCC received at the British Red Cross to support future learning and actions. This suite would produce tailored reports displaying visualisations on different aspects of the CCC lifecycles, metrics related to performance levels and high-level overviews for senior management and stakeholders. Additionally, we also aim to provide a template that can be reused by other Red Cross entities and become a citable reference for charities using Microsoft Azure.

The reporting suite provides valuable insights into the CCC management lifecycle, which allows for a clear understanding of the strengths and weaknesses of the process. By using this information, the British Red Cross can generate specific action points for future improvements, which ensures that the organisation is continually learning and evolving. Ultimately, this suite helps to build trust with stakeholders and reinforces the organisation's commitment to providing high-quality services to those in need.

YouTube: <https://www.YouTube.com/watch?v=l4ssapbDhME>

Quality Standards Framework

Authors: Michael Berlingieri, Samir Sarker, Szymon Goralczuk, Aiste Mikstaite

Academic: Dr Yun Fu

Client: Prof Joseph Connor

Organisation: CarefulAI

Technologies used: JavaScript, HTML, CSS, Airtable, Softr

Keywords: Healthcare

Abstract: Care Quality Dashboard is an online platform that enables clinicians to complete self-reports and reflect on their performance, while also incorporating user management based on the hospital's hierarchy. The problem we face stems from a significant lack of data regarding clinicians meeting the high-quality care standards established by the Welsh Government in 2015. This results in various issues, ranging from an inability to gauge the pressure clinicians are under to the clinicians themselves being unaware of how to improve their services. Currently, this data is collected using pen and paper methods, which not only make it easy for data to be lost but also create difficulties for clinicians in completing self-reports. Our project provides a solution to these

problems as the self-reporting task is significantly less time-consuming and the visualisation comprehensively displays clinicians' performance against the standards.

Repository: <https://github.com/miberl/COMP0016-Group-9-2022-23.git>

YouTube: Final Project Video: <https://www.YouTube.com/embed/nnZJY-gsUTs>

UCL MotionInput v3.2 – Pseudo-VR: Childs Play

Authors: Liv Urwin, Filip Trhlik, Chidinma Ezeji, Ajay Mahendrakumaran

Academic: Prof Dean Mohamedally

Client: UCL MotionInput v3.2

Organisation: Intel, Microsoft

Technologies used: Python, C++, MFC, MediaPipe

Keywords: Motion Input, Child's Play, Accessibility, Rehabilitation

Abstract: The use of UCL's MotionInput v3.2 to make games available in touchless mode to all children, regardless of size, limitations or disabilities, using a combination of hit triggers using the wrist and nose extremities, walking detection and voice commands. The project is built upon the robust MotionInput architecture, which has been expanded with new functionalities. These include data logging, which is critical for further research and development, as well as calibration for hit triggers. The latter is particularly important, as it ensures a seamless, tailored experience for users, enabling them to build strength and mobility through their game of choice. A Microsoft Foundation Library Class is used for user settings, allowing the choice of seated and standing modes, hand domination, game style, sensitivity, jump height and more. Our solution solves the aims of accessibility, affordability and immersion, creating a way for children to increase their activity levels while in rehabilitation.

YouTube: <https://www.YouTube.com/watch?v=pYjLnU03U0w>

Microsoft Power Platform with IBM Watson Platform Connectors

Authors: Andrew Lau, Ivan Leong, Kin Cheung, Lucas Titus

Academic: Dr Yun Fu

Client: Lee Stott, John McNamara

Organisation: Microsoft, IBM

Technologies used: Power Apps, IBM Cloud, IBM Watson APIs, Natural Language Processing

Keywords: Healthcare, Automation

Abstract: The demand for NHS services is at an all-time high, facing an ageing population and an ever-increasing burden of chronic diseases. We believe by using IBM Watson's natural language processing services and Microsoft Power Platform to build custom connectors, non IT professionals can easily utilise a suite of powerful AI services with little to no code. This will automate many of the redundant tasks that medical practitioners currently perform manually and allowing them to focus on providing care to their patients. With the use of these technologies, we can automate tasks such as patient triage, appointment scheduling and diagnostic decision-making.

Repository: <https://github.com/Andrew0000000/COMP0016>

YouTube: https://liveuclac-my.sharepoint.com/personal/zcabyhi_ucl_ac_uk/_layouts/15/stream.aspx?id=%2Fpersonal%2Fzcabyhi%5Fucl%5Fac%5Fuk%2FDocuments%2F2023%2DCOMP0016%2DNONTECHNICAL%2Dteam16%2Dwatsonconnectors%2Emp4&ga=1

UCL Open-Illumiroom V2

Authors: Fabian Bindley, Aishwarya Bandaru, Damian Zi_ber, ChanHuyk Lee

Academic: Prof Dean Mohamedally

Client: Prof Dean Mohamedally, Prof Lee Stott

Organisation: UCL, Microsoft

Technologies used: Python, OpenCV, Nuitka, Keras, C++, Boost, MFC

Keywords: Augmented Reality, Computer Vision

Abstract: Our project builds on Microsoft Research's IllumiRoom proof-of-concept from 2013. The team has been working to remaster this project, creating our own deployable software to provide real-time expanded experiences for TV-based gaming and entertainment. Against the backdrop of the rising interest in virtual and augmented reality, we investigated the use of a projector for accessibly creating immersion.

UCL Open-Illumiroom V2 displays complementing effects around the user's TV to expand their display. With nine different projection modes currently in operation and the possibility for many more to be developed, the system offers unparalleled possibilities for creating immersive experiences.

We have designed UCL Open-Illumiroom V2 to project effects onto the irregular surroundings around a TV, instead of the usual flat, plain wall. Extensive research was conducted into how to calibrate the projection system to map projections onto uneven objects. A novel algorithm was developed to achieve this, correcting projections for a fixed user perspective and replacing the Kinect for Windows depth sensor in Microsoft's IllumiRoom. This also allows the projector to be placed to the side instead of

directly opposite the TV, preventing glare on the screen.

Due to our focus on accessibility, the system is hardware compatible. It can run on any computer using the Windows operating system, using any projector, and supports game consoles, such as the Xbox One, Series S and more!

Repository: Main System: Currently Private

Calibration system: <https://github.com/lomqer/SpaceUnfolded>

YouTube: This is UCL Open-Illumiroom V2 - <https://youtu.be/QwhNlhRxhog>

Remote Physiotherapy with MS Teams and UCL MotionInput v3.2

Authors: Adil Omar-Mufti, Arvind Sethu, Youngwoo Jung, Setareh Eskandari

Academic: Prof Dean Mohamedally

Client: Microsoft (Lee Scott and Ayca Bas)

Technologies used: Python, MediaPipe, MotionInput, Javascript, React, LiveShare SDK

Keywords: Physiotherapy, Microsoft Teams

Abstract: The COVID-19 pandemic has presented significant challenges to physiotherapy patients. Traditional tele-health technologies have not adequately met the needs of patients requiring rehabilitation. The gamification of physiotherapy has been shown to increase patient motivation and engagement. However, patients struggle to find engaging ways to perform their prescribed exercises, leading to a lack of progress.

To address this issue, we have developed a solution that allows patients to play games during their physiotherapy sessions using movement with UCL MotionInput. Our Microsoft Teams application offers patients the ability to play a variety of interactive games, either individually or collaboratively, all through motion, eliminating the need for physical input devices – making it an ideal solution for patients who may have limited mobility.

We have also developed an network-device-interface-(NDI)-based remote Teams solution, enabling patients to remotely access and use MotionInput without any download or installation required, significantly increasing accessibility for physiotherapy patients, allowing them to receive virtual care from the comfort of their own homes and devices. Our NDI-based solution can also be implemented with other MotionInput solutions and projects, enhancing remote accessibility for MotionInput projects.

Our solution offers a revolutionary means of delivering physiotherapy care, potentially allowing patients with mild and severe injuries and disabilities to participate at their own level of movement, making it an inclusive and accessible solution. Overall, our solution offers an

effective and accessible means of delivering virtual physiotherapy care, along with our NDI-based solution enhancing remote accessibility for MotionInput projects.

YouTube: 8 minute technical video: <https://youtu.be/Wk4nd67Eg2w>

4 minute non technical video: <https://youtu.be/w1aZ4o-EDVI>

3D Views in Stereoscopy

Authors: Takuya Boehringer, Gauri Desai, Zineb Flahy, Hadi Khan

Academic: Dean Mohamedally

Client: Dr Taner Shakir, Prof Manish Chand

Organisation: WEISS, Intel, Microsoft

Technologies used: Python, C#, Unity, OpenCV, Open3D

Keywords: VR, ML

Abstract: This is an implementation of 3D stereoscopy using the headtracking from the UCL MotionInput software package. Two separate versions have been created, geared towards different, specific use cases.

The first version uses this new technology to create a more immersive gaming experience. The head tracking is mapped to either keys or cursor to create a strafing effect in tandem with users 'peering around' the screen. This removes the need for an expensive virtual reality (VR) headset that could cause dizziness and motion sickness in some younger gamers.

The second version of this software combines left and right eye images to generate a point cloud in Unity that can be stereoscopically viewed using the same headtracking. This is designed for surgery students viewing footage from the Da Vinci robotic surgery machine. The Da Vinci is designed to perform endoscopic surgeries at the UCL WEISS centre, streaming left, and right eye footage to its stationary VR interface. The stereoscopic view of said footage being generated means that students don't need a VR headset or any extra equipment to watch it and be able to 'peer around' inside the human body.

YouTube: <https://mega.nz/file/dJUgnApl#xAmggPg3PjYiQc2IMve-BgHkmXOg-LtP7dQNdyhn7x4>

Project VeloCity

Author: Bane Trajkovic, Ramon Gonzalez Bordas, Hsu-han Hsieh, Seun Ayoobane.

Academic: Dr Yun FuJarnail

Organisation: Microsoft

Technologies used: C#, NET MAUI, Xamarin.

Keywords: Forms, Fitness technology

Project VeloCity aims to tackle accessibility problems for people with disabilities, especially visually impaired people, when using sports technology. Our project partner is Microsoft and the project's main goal is to create an accessible Android app where users can connect their Bluetooth sensors, start a workout which tracks their metrics, and analyse their performance afterwards. With our app, we aim to increase engagement by disabled people in fitness activities. The inspiration for the project comes from Mark Pollock's story: he is an Irish athlete who is both blind and physically disabled. He is collaborating with Microsoft, and it is largely due to him that they are developing this project. He is our target user and is testing our app.

Repository: <https://github.com/BaneTrajkovic/IXN-Group14-app>
<https://students.cs.ucl.ac.uk/2022/group14/>
<https://projectvelocity2023.wordpress.com>

Anima v2 – Voice Banking

Authors: Pallav Hingu, Ziyang Sun, Baris Cavusoglu, Rebecca Harris

Academic: Dr Yun Fu

Client: Prof Dean Mohamedally

Organisation: UCL

Technologies used: Python, MFC, Docker

Keywords: Healthcare, Voice Banking, Modelling, Entertainment

Abstract: Every day, six people in the UK are diagnosed with motor neurone disease (MND) and, ultimately, all of them will face the devastating reality of speech loss. This is just one of many illnesses that can cause an individual to lose their voice, which can be an incredibly challenging and distressing experience.

We understand how important a person's voice is to their sense of identity and we want to help make life easier for those affected.

That's why we've created Anima – a software that preserves the person's voice so that even when their natural voice is lost, they can still communicate and maintain their sense of self.

We want to empower those facing speech loss and give them their voice back.

Repository: <https://github.com/BaneTrajkovic/IXNGroup14-app>
<https://students.cs.ucl.ac.uk/2022/group14/>
<https://projectvelocity2023.wordpress.com>

Enhanced Assessments of Seasonal Hazards

Authors: Dylan Penney, Hogan Ma, Omung Bhasin, Ryan Lock

Academic: Prof Graham Roberts

Client: Justin Ginetti

Organisation: International Federation of Red Cross and Red Crescent Societies (IFRC)

Technologies used: Python, Selenium, os, Pandas, Requests, Pycountry

Keywords: Data scraping, data cleaning, data merging, data analysis

Abstract: The International Federation of Red Cross and Red Crescent Societies (IFRC) is currently the largest humanitarian network in the world. Their influence and helping hand stretch across 192 countries where they support local Red Cross and Red Crescent activities. They are also made up of more than 10 million global volunteers.

The IFRC does not have an official centralised source of information which presents accurate seasonal data regarding disasters around the world. In this project, UCL Group 4 will work alongside the IFRC (communicating with Justin Ginetti) to design a system which gathers data from multiple sources, have them processed, and moved to a singular data frame.

The project objective is to provide a centralised source of information for the public where they have access to useful data which can determine resource allocation at the IFRC.

Repository: <https://github.com/UCL-IFRC-IXN4>

YouTube: Literature Review: <https://www.YouTube.com/watch?v=sZYlqhO2P2Y>

Technical Video: <https://www.YouTube.com/watch?v=c91C0i22Vek>

Non Technical Video: https://www.YouTube.com/watch?v=_6pzQcneQg

Code Runthrough: <https://www.YouTube.com/watch?v=f5twrNhbzgg>

Linux Energy Monitor Application

Authors: Wentao Huang, Safwan Shah, Zihan Zhu

Academic: Prof Graham Roberts

Client: Costas Stylianou (Intel), James Bown (Intel)

Organisation: Intel

Technologies used: C++, Qt, Linux, Doxygen, NCurses, QMake, CMake

Keywords: Software Development, Sustainability, Energy Efficiency

Abstract: The burgeoning gaming landscape, dominated by power-intensive hardware, necessitates a sophisticated energy management solution for environmental and financial concerns. Existing tools inadequately cater to gamers' requirements, creating demand for an advanced, user-friendly energy monitor application.

Our energy monitor adeptly manages power consumption for gamers using 12th gen Intel hardware, providing real-time metrics on CPU utilisation, temperature, and RAM usage while monitoring live power consumption. Users can scrutinise energy trends, establish budgets, and select from multiple power modes. The solution offers granular insights into core utilisation and prioritises processes based on CPU consumption.

This cutting-edge energy monitor fosters sustainable gaming practices and empowers users to make informed energy management decisions. With customisable reporting and comprehensive control over system energy consumption, our application cultivates a culture of sustainability within the gaming industry. This sophisticated solution upholds our moral obligation to preserve the planet while enabling gamers to optimise their technology usage.

Repository: <https://github.com/huang-wt/energy-monitor-app>

YouTube: <https://www.YouTube.com/watch?v=rO5885YaAhg>

Creating Custom WhatsApp and WebEx Connectors with Microsoft

Authors: Satbir Viridi, Zakariya Fakira, Oscar Hui, Chaohui Wang

Academic: Dr Yun Fu

Client: Lee Stott

Organisation: Microsoft

Technologies used: Microsoft Power Apps, Microsoft Power Automate, Postman

Keywords: Communication, automation, healthcare

Abstract: Approximately 5% of patients miss their appointments each year due to a variety of reasons. This is mainly due to some patients being physically unable to visit their GP, be it mobility issues or having communicable diseases, or others simply forgetting their appointment times due to their busy schedules.

Our WhatsApp connector will allow NHS to send reminder messages alongside existing SMS messages to remind patients of their appointments. Our WebEx connector will provide another avenue for the NHS to set up online meetings for patients who are physically unable to attend. A connector is an API wrapper that can be used in custom Power Apps. Power Apps is a rapid development environment to build custom apps for a business which uses connectors.

Our connectors and power platform will create a streamlined solution to reduce the 5% of patients that miss their appointments per year. The scalability, no-code philosophy of power platform, along with seamless integration with the NHS N365 ecosystem will allow for faster development of power apps than with a native environment. Our connectors will supplement this convenience. Additionally, the reusability of connectors means that all businesses can utilise our connectors for their apps.

Repository: https://github.com/ocarhui/COMP0016_Team_18

YouTube: <https://www.YouTube.com/watch?v=19zsTNcLCDM>

IFRC Community Sampling Tool

Authors: Nick He, Aadi Singhi, Matyas Huba, Qiren Dong

Academic: Dr Yun Fu

Client: Rachel Yales

Organisation: International Federation of Red Cross and Red Crescent Societies (IFRC)

Technologies used: React, Vercel, Django, Postgresql, Azure, Vercel

Keywords: sampling

Abstract: In a survey, we want to know certain characteristics of a large population, but we are almost never able to do a complete census of it. So, we draw a sample – a subset of the population – and collect data on it. Then we generalise the results, with an allowance for sampling error (usually within 5% at a 95% confidence level), to the entire population from which the sample was selected.

It is critical for understanding the views of affected populations and how effective programmes are. Often, country-level teams do not have technical expertise in sampling.

This tool supports your sampling design process, guiding you through a series of questions about the population you are working with to recommend a sampling method and size. It covers simple random, systematic random, time-location and cluster sampling methods, with plans to expand and improve in the future.

Repository: <https://github.com/hubamatyas/ifrc-api>, <https://github.com/hubamatyas/ifrc-sampling>

Open Telemetry SDKs for feeding into _ Software Carbon Intensity Calculator

Authors: Charlie Barber, Vladimiro Karim, Xi Chen

Academic: Prof Graham Roberts

Client: Gadhu Sundaram, Senior Technologist

Organisation: NTT DATA UK

Technologies used: OpenTelemetry, Docker, Go, Python, JavaScript, Svelte, Prometheus

Keywords: Software development

Abstract: As concerns over environmental impact continue to grow, there is an increasing focus on reducing carbon emissions caused by human activities. This includes the energy consumption associated with technology, including software programs. The Green Software Foundation has called on developers to prioritise

sustainability, and in response, UCL and NTT DATA have partnered to develop the OTCIC SDK project. This SDK aims to measure the carbon footprint of software programs and provide developers with tools to optimise energy consumption and reduce emissions. By promoting sustainable software development practices, this project represents a significant step towards an eco-friendlier tech industry.

Repository: <https://github.com/charliebarber/OTCIC-SDK>

YouTube: https://liveuclac.sharepoint.com/:v:/s/COMP0016Group19/ER_PJ7pnekBKgDLBmjFmQugBc9k1sCQJEkzkBR6yfi72FQ?e=PsUOIJ

Developing TrueLearn Library

Authors: Tim Qiu, Aaneel Bin Srazali, Denis Elezi, Karim Djemili

Academic: Prof Graham Roberts

Client: Sahan Bulathwela

Organisation: Knowledge4All Foundation

Technologies used: Python

Keywords: ML, Education, Educational Technology

Abstract: TrueLearn is a family of Bayesian algorithms designed to support the construction of educational recommendation systems by modelling learners' knowledge and making predictions about their engagement with educational resources. Our project aims to build a deployable Python library based on the existing TrueLearn algorithmic logic and create a rich set of visualisations to help learners reflect on their learning progress.

Repository: <https://github.com/TrueLearnAI/truelearn>

UCL MotionInput v3.2: In-Air Contractures Navigation

Authors: Imaad Zaffar, Molly Zhu, Jie Li

Academic: Prof Dean Mohamedally

Client: Rebecca Gill

Organisation: VR Therapies

Technologies used: Python, C, OpenCV, MediaPipe, C#, Unity

Keywords: Computer Vision, Healthcare, Accessibility, Gaming

Abstract: We've developed a Windows application to address the unique challenges faced by individuals with contractures, such as those with curved hands resulting from conditions like cerebral palsy. These users often struggle with traditional input methods that require fine motor control and dexterity. They may also experience hand tremors and spasms, making it even more challenging to interact with digital devices comfortably.

Our app uses wrist tracking with spasm reduction, speech, and gestures to provide an intuitive navigation system. We've incorporated novel gesture interactions like force fields and punching, which give a user two levels of depths as switches or buttons to configure and press. This allows users to control a wide range of applications and games in a natural and intuitive way. With our technology, individuals with contractures can finally engage with digital devices in a way that was previously impossible.

In addition to our Windows app, we've created a base Unity environment to showcase how navigation and forcefield gestures can be implemented in a gaming context. We believe that our technology has the potential to revolutionise the way that individuals with contractures interact with digital devices, making it more accessible and inclusive for all.

YouTube: <https://youtu.be/y9JZ5DPxwuA>

Human-in-the-loop OER Collector

Authors: Rajan Chandale, Wesley Choy, Pragya Sinha

Academic: Prof Graham Roberts

Client: Dr Sahan Bulathwela

Organisation: Knowledge4All Foundation

Technologies used: Python, JavaScript, React, D3, PostgreSQL, FastAPI

Keywords: Data Science

Abstract: There are many educational resources scattered across the Internet that are available for people to utilise without commercial obligation. Repositories such as YouTube and MIT OpenCourseWare contain thousands of resources that can effectively facilitate learning if matched and connected with the correct group of learners. The X5Learn platform wishes to achieve this and thus this OER collector is created.

The OER collector can allow users to index and bundle learning materials they find online, so they share them with other people and expand the pre-existing database. A back end system is also built to gather data from the resources saved in the database and a front end system can allow users to administrate the repositories that they have built and view statistics relevant to them. Combining these features, more users can gain access to a wider variety of educational resources more quickly and easily.

Repository: https://github.com/rajanchandale/COMP0016_OER_COLLECTOR

Data-driven Methods on Legged Robot Path Planning

Authors: Shirui Lyu

Academic: Dr. Dimitrios Kanoulas

Client: Dr. Dimitrios Kanoulas

Organisation: UCL

Technologies used: Python, Pytorch, ROS, Gazebo

Keywords: Machine Learning, Robotics

Abstract: Machine learning theories have inspired a range of data-driven methods to provide efficient and reliable path planning algorithms. Legged robot, on the other hand, is capable of performing a range of complex tasks, from package delivery to search-and-rescue missions, and is in constant need for efficient and reliable path planning modules. This project aims to investigate the behaviour of one particular data-driven algorithm and benchmark its performance on legged robots under simulations. With a template design for planners, this project successfully incorporated a state-of-the-art data-driven planner that exploits the differentiable A* design, into a Go1 robot under Gazebo simulation. The performance of the planner is evaluated using a set of criteria against an A* planner. The results suggest that the data-driven methods indeed demonstrate improvements by trading off path optimality to improve planning speed. Nevertheless, the result also argues that the improvements are largely dependent on non-algorithmic factors such as training methods and hardware devices.

Repository: <https://github.com/RPL-CS-UCL/Neural-A-star/tree/devel>

Student internships: Next-Step Experience

Internships (NXI)

Students who have completed IXN projects can work on paid internship opportunities. These internships are through the NXI programme. The interns have already gained industry experience and work on projects during their summer or winter breaks. Get in touch to find out more.

EMIS

UCL Computer Science students worked with EMIS, the leading provider of clinical IT systems, for three months during their summer break. Their projects delivered improvements to the software that enables healthcare staff to access vital patient information.

EMIS said the students were technically gifted but could also operate effectively in a team and develop solutions that suited the business. They brought a novel way of thinking, a passion and a pace which benefitted the rest of the team.

EMIS's HR department remained in touch with the students and offered a full-time job to one student to start after graduation.

Odin Vision

UCL spinout Odin Vision, now acquired by Olympus Corporation, uses AI to improve traditional colonoscopy methods. UCL master's students helped the company explore new areas of machine learning.

Odin Vision said that the students were problem solvers; they knew how to diagnose issues and find solutions. Extremely keen, they were always pushing to research new concepts. They went above and beyond in their work.

The projects were ground-breaking: one was presented at NeurIPS, the world's biggest machine learning conference. One of the students became a full-time employee of the company.

"We were delighted by the attitude and innovative spirit that the UCL students brought. They quickly integrated into the team, and their work has provided us with lasting value."

Richard Jarvis, Chief Analytics Officer at EMIS

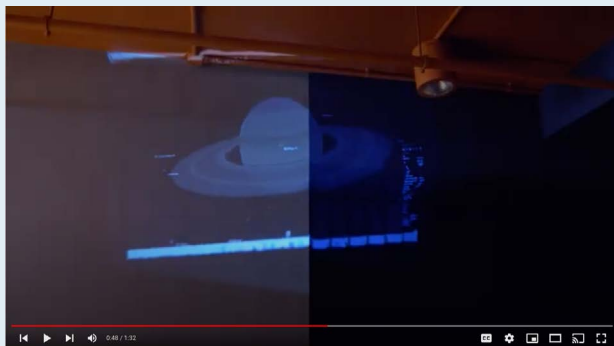
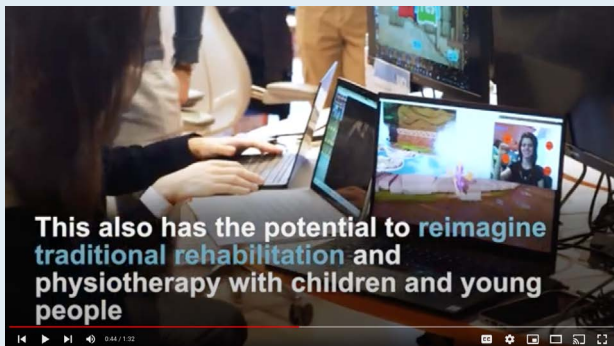
"We were incredibly impressed by the students' knowledge, drive and the results they produced in such a short time."

Peter Mountney, CEO at Odin Vision



What's next for IXN for the NHS?

With a host of exhilarating projects already in the pipeline, here's a preview of what our students, academics and partners are working on next.



Our students found the event at GOSH on 'Wards of the Future' incredibly insightful and inspiring. We're dedicated to using technology to help create supportive environments, to make empathetic spaces that deliver the best patient experience.

Referring back to our IEI framework, efficiency is a watchword. AI copilots will bring many benefits, helping to optimise existing processes and save time. They already feature in this year's projects, and we're building our own.

We're investigating how Microsoft Power Apps can be applied in an NHS setting, such as using existing services to message hospital staff.

There's nothing like a hackathon for getting ideas flowing. We're returning to the topic of FHIR for our upcoming event.

Of course, we will be rolling out updates to existing projects such as UCL MotionInput and Sight ++. We're excited about developing the HoloRepository using Project MONAI.

We're now working with NHS England and NHS Wales to advertise for project proposals.

This means we're engaging with more healthcare partners than ever. Indeed, our network of entrepreneurs, digital health teams, MDTs and trusts continues to grow at pace. Get in touch to be part of it.





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