ARCLG207
Remote Sensing in Archaeology
15 credits

2017–2018

Co-ordinator: Dr Kris Lockyear
Email: k.lockyear@ucl.ac.uk
Preferred (and generally faster) email: noviodunum@hotmail.com
Room 204c, Tel. 020 7679 4568 (Ext. 24568)

Turnitin password: IoA1718; Turnitin Class ID: 3543867

Please see the last page of this document for important information about submission and marking procedures, or links to the relevant webpages.
1 Overview

1.1 Short description

This course provides a working knowledge of the theory, method, equipment and software associated with remote sensing in archaeology, whether the latter is undertaken by ground-based, airborne or spaceborne methods. Students develop practical familiarity with basic GIS for the production of reports, and remote sensing packages such as TerraSurveyor, ENVI and QGIS, various raster-based image formats, and a variety of equipment for field capture of remote sensing data.

The structure of the course provides students with opportunities for both field- and lab-based learning and is taught using a combination of lectures, practical lab sessions and tutorials in the Institute’s AGIS laboratory, as well as a short fieldwork component. It is assessed via a notebook of analytical work and one essay. It would benefit both those who thereafter wish to use remote sensing approaches in a commercial environment and those looking to design future research projects with these methods in mind.

1.2 Week-by-week summary

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<th>Session</th>
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<td>12th January 2018</td>
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<td>Introduction to Remote Sensing Techniques</td>
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<td>2</td>
<td>19th January 2018</td>
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<td>Resistance survey and related techniques</td>
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<td>26th January 2018</td>
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<td>Magnetometry</td>
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<td>Ground Penetrating Radar</td>
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<td>Magnetic susceptibility, multi-instrument techniques and ground truthing</td>
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<td>6</td>
<td>12–16th February 2018</td>
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<td><em>Reading week</em> Practical course at St Albans / Verulamium</td>
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Mark Altaweel

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<td>23rd February 2018</td>
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<td>Introduction to Aerial and Satellite-borne remote sensing</td>
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<td>High-resolution and multi-spectral imagery. Basic methods</td>
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<td>Multi- and hyper-spectral imagery. Advanced methods</td>
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<td>23rd March 2018</td>
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<td>Data fusion</td>
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1.3 Basic texts

The key texts for this course are:

CONYERS, L. B. 2012. *Interpreting Ground-Penetrating Radar for Archaeology*. Left Coast Press, Walnut Creek. INST ARCH AL 12 QTO CON.


1.4 Methods of assessment

This course is assessed by means of a total of 5000 words of coursework, divided into a portfolio of practical work of about 2000 words in total (50%) and one 3000 word essay (50%). The topics and deadlines for each assessment are specified below. If students are unclear about the nature of an assignment, they should contact the Course Co-ordinator. The Course Co-ordinator will be willing to discuss an outline of their approach to the assessment, provided this is planned suitably in advance of the submission date.

1.5 Teaching methods

Teaching will be by a mixture of lectures, seminars, demonstration and supervised practical exercises. Lectures and seminars will last for two hours, or one hour when followed by a practical class. Practical classes will normally involve direct supervision for one hour, often followed by a further hour during which time the tutor will be available to help as you work through exercises on your own.

N.B. Participation in practical exercises is limited by the availability of suitably equipped computers, and is guaranteed only for those who are taking this course as an examined module for a Masters degree.

The course also includes a two-day field course held in reading week.
1.6 Workload

There will be 15 hours of seminars/lectures for this course and 15 hours of supervised practicals, as well as 15 hours on the field course. You will be expected to undertake around 75 hours of reading and independent project work for the course, plus 30 hours producing the assessed work. This adds up to a total workload of 150 hours for the course.

1.7 Prerequisites

There are no formal prerequisites for this course, but it is strongly recommended that students have at least some prior experience of GIS.

2 Aims, objectives and assessment

2.1 Aims

The course aims to provide:

- An advanced knowledge of remote sensing techniques
- Practical experience of geophysics and survey equipment
- The statistical and theoretical concepts behind image-based processing and classification

2.2 Objectives

The course objectives are that you will be able to:

- Evaluate the strengths and weaknesses of different remote sensing methods or platforms
- Design and implement reliable ground-based remote sensing projects
- Integrate ground-based methods with air photos and satellite imagery
- Manipulate remote sensing imagery in ways that go well beyond simple inspection of the results by eye

2.3 Learning outcomes

In meeting these objectives you will also be able to demonstrate the following learning outcomes:

- Detailed knowledge of remote sensing techniques
- Ability to evaluate critically published examples of these applications
- Familiarity with the range of remote sensing software
2.4 Coursework

Assessment tasks

This course is assessed entirely by coursework consisting of the two assignments described here.

1. One 2,850–3,150 word essay (50%) giving you an opportunity to demonstrate your theoretical understanding of an important issue in archaeological remote sensing. You should choose one of the following questions:

   - In recent years, geophysical survey has increasingly been used as the sole method for investigating an archaeological site rather than as an adjunct or prelude to excavation. What are the advantages and disadvantages of such an approach? Discuss with reference to one or more specific examples.
   - What are the benefits and the difficulties of using multi-sensor approaches in terrestrial geophysical surveys? How might the different sources of data be combined?
   - ‘The manipulation of aerial and satellite imagery by archaeologists typically falls into one of two unsatisfactory camps, involving either (i) complicated classification routines that are hard to interpret or, more often, (ii) unstandardised, visual assessment of pixel patterns.’ Discuss this statement via two or more case studies.
   - Self defined question. If there is a topic that particularly interests you, please see the relevant lecturer (KL for geophysics, MA for everything else) to discuss a specific question. Note: this cannot overlap with other pieces of course-work for other classes.

2. One written account of laboratory and fieldwork work (50%), comprising the answers to three exercises set during practical classes. This will provide an opportunity for you to demonstrate technical competence in a range of remote sensing methods. You will be provided with further information about the exact nature of the portfolio tasks.

The submission deadlines are as follows:

   (a) Essay: Friday 23rd March 2018;
   (b) Notebook of lab work:
      i. Part 1: processing of Earth Resistance data (Monday, 19th February).

The portfolio will require you to include illustrations, such as maps and graphs. Please ensure that these are carefully presented. General guidance is available at: http://www.ucl.ac.uk/archaeology/handbook/common/illustrations.htm. All illustrations should have informative captions. Where appropriate, maps should include indicators of scale and orientation, as well as a legend (key) based on sensible ranges of data values. Graphs should include informative labels for the X- and Y-axes.

Students are not permitted to re-write and re-submit essays in order to try to improve their marks. However, students may be permitted, in advance of the deadline for a given assignment, to submit for comment a brief outline of the assignment. The Course Co-ordinator is willing to discuss an outline of the student’s approach to the assignment, provided this is planned suitably in advance of the submission date.
Word-length

The following should not be included in the word-count: title page, contents pages, lists of figure and tables, abstract, preface, acknowledgements, bibliography, lists of references, captions and contents of tables and figures, appendices.

The essay should be 2,850–3,150 words. The practical portfolio should be 1,900–2,100 words. Penalties will only be imposed if you exceed the upper figure in the range. There is no penalty for using fewer words than the lower figure in the range: the lower figure is simply for your guidance to indicate the sort of length that is expected.

In the 2017–18 session penalties for over-length work will be as follows:

- For work that exceeds the specified maximum length by less than 10% the mark will be reduced by five percentage marks, but the penalised mark will not be reduced below the pass mark, assuming the work merited a pass.

- For work that exceeds the specified maximum length by 10% or more the mark will be reduced by ten percentage marks, but the penalised mark will not be reduced below the pass mark, assuming the work merited a pass.

Coursework submission procedures

- All coursework must normally be submitted both as hard copy and electronically. (The only exceptions are bulky portfolios and lab books which are normally submitted as hard copy only.)

- You should staple the appropriate colour-coded IoA coversheet (available in the IoA library and outside room 411a) to the front of each piece of work and submit it to the red box at the Reception Desk (or room 411a in the case of Year 1 undergraduate work).

- All coursework should be uploaded to Turnitin by midnight on the day of the deadline. This will date-stamp your work. It is essential to upload all parts of your work as this is sometimes the version that will be marked.

- Instructions for turnitin are given below. Note that Turnitin uses the term ‘class’ for what we normally call a ‘course’.

  1. Ensure that your essay or other item of coursework has been saved as a Word .doc, .docx or PDF document, and that you have the Class ID for the course (3543867) and enrolment password (this is IoA1718 for all courses this session — note that this is capital letter I, lower case letter o, upper case A, followed by the current academic year).

  2. Go to http://www.turnitinuk.com/en_gb/login

  3. Click on ‘Create account’

  4. Select your category as ‘Student’

  5. Create an account using your UCL email address. Note that you will be asked to specify a new password for your account — do not use your UCL password or the enrolment password, but invent one of your own (Turnitin will permanently associate this with your account, so you will not have to change it every 6 months, unlike your UCL password). In addition, you will be asked for a “Class ID” and a “Class enrolment passwor” (see point 1 above).
6. Once you have created an account you can just log in at http://www.turnitinuk.com/en_gb/login and enrol for your other classes without going through the new user process again. Simply click on ‘Enrol in a class’. Make sure you have all the relevant class IDs at hand.

7. Click on the course to which you wish to submit your work.

8. Click on the correct assignment (e.g., Essay 1).

9. Double-check that you are in the correct course and assignment and then click ‘Submit’.

10. Attach document as a ‘Single file upload’.

11. Enter your name (the examiner will not be able to see this).

12. Fill in the ‘Submission title’ field with the right details: It is essential that the first word in the title is your examination candidate number (e.g., YGBR8 In what sense can culture be said to evolve?).

13. Click ‘Upload’. When the upload is finished, you will be able to see a text-only version of your submission.

14. Click on ‘Submit’.

If you have problems, please email the IoA Turnitin Advisers on ioa-turnitin@ucl.ac.uk, explaining the nature of the problem and the exact course and assignment involved.

One of the Turnitin Advisers will normally respond within 24 hours, Monday-Friday during term. Please be sure to email the Turnitin Advisers if technical problems prevent you from uploading work in time to meet a submission deadline — even if you do not obtain an immediate response from one of the Advisers they will be able to notify the relevant Course Coordinator that you had attempted to submit the work before the deadline.

3 Schedule and syllabus

3.1 Teaching schedule

The course will be taught in Term 2. Classes will be held on Fridays, with lectures in room B13 and the AGIS lab from 10:00–12:00. In addition, a mandatory two-day field course will also take place in Reading Week about which further details will be made available at the beginning of the course. There will be no taught class on 16th February (Reading Week). Except in the case of illness, the 70% minimum attendance requirement applies to all classes.

3.2 Detailed week-by-week syllabus

The following is an outline for the course as a whole, and identifies essential and supplementary readings relevant to each session. Information is provided as to where in the UCL library system individual readings are available. For journals, if no specific location is given they are available over the internet either via the library catalogue or the online reading list which can be accessed via Moodle. Often, however, the images are poor and you might like to look at the printed versions in the library.

**Session 1: Introduction to Geophysical survey (KL)**

Aims and methods in geophysical survey; survey basics (grids, GPS).
Reading

The best general book in archaeological geophysics remains that by Gaffney & Gator (2002) and should be seen as essential reading for most of the first half of the course. The paper by Millett (2013) has many sensible comments on geophysical survey from the perspective of an archaeological ‘consumer’.


**Session 2: Earth Resistance survey (KL)**

This lecture will introduce you Earth Resistance survey. The basic techniques will be introduced, and then methods for examining multiple depths, resistance pseudo-sections and resistivity tomography.

**Practical** Basic data processing.
Reading

See the relevant sections in Gaffney & Gator (2002).


SCHMIDT, A. 2013. Earth Resistance in Archaeology. Altamira, Plymouth. INST ARCH AL 12 SCH.


Session 3: Magnetometry (KL)

This session will examine the principals and practicalities of magnetometry survey.

Practical Basic intro to data processing.

Reading

See the relevant sections of Gaffney & Gator (2002).


Session 4: Ground Penetrating Radar (KL)

This session will look at the third main geophysical technique: Ground Penetrating Radar.

Practical Basic GPR processing.

Reading

The best general introduction to GPR is that by Conyers (2013, 2004). His other books (Conyers 2012, 2017, 2016) are also worth consulting.


Conyers, L. B. 2012. *Interpreting Ground-Penetrating Radar for Archaeology*. Left Coast Press, Walnut Creek. INST ARCH AL 12 QTO CON.


**Session 5: Magnetic susceptibility survey, EM survey, multi-methods and ground truthing**

**Practical**

**Reading**

There are a variety of papers which should be consulted depending on your interests. That by Dalan (2008) should be considered essential. There are a few multiple instrument papers published, including a useful selection in the new book edited by McKinnon & Haley (2017).


HARGRAVE, M. 2006. ‘Ground truthing the results of geophysical surveys.’ In Johnson (2006), pp. 269–304. INST ARCH AL 13 JOH.


**Session 6: Introduction to Aerial and Satellite-borne imagery (MA)**

Aerial and satellite imagery has become a fundamental feature of landscape survey in archaeology and we introduce the use of these methods, with particular emphasis on longitudinal comparisons of such imagery (e.g., of historic air photos) and on best practice for processing and combining their insights.

**Practical** Acquisition of imagery, georeferencing, photo mosaics, metadata

**Reading**


Wilson, D. R. 2000. Air Photo Interpretation for Archaeologists. Tempus, Stroud. INST ARCH AL 21 WIL.

Session 7: LiDAR and landscape-scale 3D photogrammetry

Reading


Session 8: High resolution and multi-spectral imagery. Basic methods

Fine-scale air photos and, increasingly, high-resolution satellite imagery provide information at spatial scales that are particularly appropriate for archaeological prospection. Multi-spectral imagery provides yet a wide range of information about the earth’s surface. Here we consider how such datasets support the creation of base mappings for archaeological projects.

Practical Air photos and Quickbird imagery, pan-sharpening, pseudo-true colour and false colour composites.

Reading


Session 9: Multi-spectral imagery. Advanced methods

Most effective remote sensing applications ultimately go further than just simple band combinations and close human scrutiny. Instead, they usually deploy a range of data generalisation or clustering techniques to suggest multivariate trends that are not intuitively obvious. This week we consider Principal Component Analysis (PCA) and classifications that involve formal ground-truthing as well as those that do not.

Practical Data fusion techniques, PCA transformation, unsupervised classification, supervised classification, feature extraction.

Reading


Session 10: Data fusion

Reading


4 Online resources

The full UCL Institute of Archaeology coursework guidelines are given here: http://www.ucl.ac.uk/archaeology/administration/students/handbook.

Information will also be posted on Moodle for course ARCLG207.
5 Additional information

Libraries and other resources

In addition to the Library of the Institute of Archaeology, other libraries in UCL with holdings of particular relevance to this degree are the main library in science and engineering.

Information for intercollegiate and interdepartmental students

Students enrolled in Departments outside the Institute should obtain the Institutes coursework guidelines from Tina Paphitis (email t.paphitis@ucl.ac.uk), which will also be available on the IoA website.

6 Institute of Archaeology coursework procedures

General policies and procedures concerning courses and coursework, including submission procedures, assessment criteria, and general resources, are available on the IoA website. It is essential that you read and comply with these. Note that some of the policies and procedures will be different depending on your status (e.g., undergraduate, postgraduate taught, affiliate, graduate diploma, intercollegiate, interdepartmental). If in doubt, please consult your course co-ordinator.

7 Granting of extensions

Note that there are strict UCL-wide regulations with regard to the granting of extensions for coursework. Note that Course Coordinators are not permitted to grant extensions. All requests for extensions must be submitted on a the appropriate UCL form, together with supporting documentation, via Judy Medringtons office and will then be referred on for consideration. Please be aware that the grounds that are acceptable are limited. Those with long-term difficulties should contact UCL Student Disability Services to make special arrangements. Please see the IoA website for further information. Additional information is given here http://www.ucl.ac.uk/srs/academic-manual/c4/extenuating-circumstances/