Linnæus University

Course syllabus

Faculty of Arts and Humanities

Department of Cultural Sciences

4AE455 Digital Archaeology, 7,5 högskolepoäng
4AE455 Digital Archaeology, 7.5 credits

Main field of study
Archaeology, Digital Humanities

Subject Group
Archaeology

Level of classification
Second Level

Progression
A1N

Date of Ratification
Approved 2020-09-08
Revised 2022-03-10 by Faculty of Arts and Humanities.
The course syllabus is valid from autumn semester 2022

Prerequisites
General entry requirements for studies at the second-cycle level and special entry requirements: A Bachelor of Arts (any discipline) or the equivalent (at least 180 credits). English B/English 6 or the equivalent.

Objectives
Intended learning outcomes for the course as a whole
After completing the course, the student should be able to:

- characterise digital archaeology, its main areas, and its applications
- demonstrate basic knowledge of spatial analysis using GIS, 3D modelling, and text mining from an archaeological perspective
- evaluate the advantages and disadvantages of using digital methods in archaeology, and problematise how they impact the research process and knowledge production in archaeology.

Intended learning outcomes for each module

Module 1: Spatial analysis using Geographical Information Systems (GIS)
After completing the module, the student should be able to:

- describe the concept of spatial analysis and its application in archaeology
- describe the process of collecting, processing, and presenting archaeological geographical data
- discuss the possibilities and limitations of GIS and how its application affects knowledge production in archaeology.

Module 2: 3D modelling, visualisation, and virtual reconstruction
After completing the module, the student should be able to:

- explain how 3D modelling is used in archaeology and describe the most commonly used software and applicable tools for different purposes
- explain and problematise the following concepts: virtual archaeology, digital replica, and virtual reconstruction
- critically examine the possibilities and limitations associated with virtual reconstruction in archaeology
- create a simple 3D reconstruction using digital replicas and open-source software for 3D modelling.

Module 3: Machine learning and text mining
After completing the module, the student should be able to:

- explain the concept of artificial intelligence and its potential and application in archaeology
- explain and review the following concepts: machine learning, text mining, F1 score, text classification, sequence labeling, and deep learning
- develop a basic algorithm for analysis using machine learning and text mining.

Content
The course introduces students to three core areas of digital archaeology: 1) Spatial analysis using Geographical Information Systems (GIS), 2) 3D modelling, visualisation, and virtual reconstruction, and 3) Machine learning and text mining. Students learn principles for applying various digital techniques, from field documentation to data processing, analysis, visualisation, and presentation of archaeological research data. The course develops foundational practical skills and provides an overview of theoretical perspectives in all three core areas.

Module 1: Spatial analysis using Geographical Information Systems (GIS)
This part of the course familiarises students with the use of GIS in archaeology. It introduces basic principles of field data collection, creation of a geodatabase, and a web map where archaeological data can be analysed and presented. Interpretations and biases are emphasised at each step, and the use of archaeological GIS material in presentation of research findings to the public is explored.

Module 2: 3D modelling, visualisation, and virtual reconstruction
This part of the course consists of online lectures on the principles of creating virtual reconstructions in archaeology. It introduces concepts such as virtual archaeology, digital replicas, Structure-from-Motion photogrammetry, and key techniques and software used for virtual reconstructions in archaeology. Finally, this part of the course provides an insight into how virtual reconstructions are used in public presentations, such as in museums.

Module 3: Machine learning and text mining
This part of the course comprises online lectures on the methods and theories associated

with machine learning and text mining in archaeology. The lectures introduce the concepts in terms of various applications in archaeology, from biological sex determination of human remains to mapping archaeological sites in LiDAR data.

Type of Instruction

Teaching is delivered in the form of online lectures and tutorials, practical exercises and supervision online. All teaching will be delivered in English.

Examination

The course is assessed with the grades A, B, C, D, E, Fx or F.

The course is examined through three separate practical assignments and a written exam.

The grade A is the highest grade and the grade E is the lowest grade for passing the course. The grade F means that the student's performance is assessed as failed. Grading criteria for the A–F scale are communicated to the students in a special document. The students will be informed about the course grading criteria when the course starts, at the latest.

Resit examination is offered in accordance with Local regulations for courses and examination at the first and second-cycle level at Linnaeus University.If the university has decided that a student is entitled to special pedagogical support due to a disability, the examiner has the right to adapt the exam or to let the student conduct the exam in an alternative way.

Course Evaluation

During or shortly after the course, a course evaluation should be conducted. The result and analysis of the course evaluation should be promptly communicated to the students who have taken the course. Students who are taking the course when it is offered the next time should be informed of the result at the course introduction. The course evaluation is anonymous.

Required Reading and Additional Study Material

Caraher, William 2016. Slow archaeology: Technology, efficiency, and archaeological work. In: Averett, E. W., Godron, J. M. & Counts, D. B. (eds.) *Mobilizing the past for a digital future: the potential of digital archaeology.* Grand forks: University of North Dakora. Pp. 421–441. 20 pp. ISBN-13: 978-062790137

Conolly, J. & Lake, M. 2006. *Geographical Information Systems in Archaeology.* Cambridge Manuals in Archaeology. Cambridge: Cambridge University Press. The latest edition. 250 pp.

Demetrescu, Emanuel, Ferdani, Danieli, Dell'Unto, Nicholo, Leander Touati, A.-M. & Lindgren, S. 2016. *Reconstructing the original splendour of the House of Caecilius Iucundus. A complete methodology for virtual archaeology aimed at digital exhibition.* SCIRES-IT-SCIentific RESearch and Information Technology 6(1):51–66. 15 pp.

Ferdani, Danielle, Demetrescu, Emanuel, Cavalieri, Marco, Pace, Gloriana, & Lenzi, Sara 2020. *3D Modelling and Visualization in Field Archaeology. From Survey To Interpretation Of The Past Using Digital Technologies.* Groma. Documenting archaeology. 1–21. 21 pp.

Fiorucci, Marco, Khoroshiltseva, Marina, Pontil, Massimiliano, Traviglia, Arianna, Del Bue, Alessio, & James, Stuart 2020. Machine Learning for Cultural Heritage: A Survey. *Pattern Recognition Letters* 133: 102–108. https://doi.org/10.1016/j.patrec.2020.02.017. 6 pp.

Gillings, Mark, & Goodrick, Glyn Thomas 1996. Sensuous and reflexive GIS: exploring visualisation and VRML. *Internet Archaeology* 1. https://doi.org/10.11141/ia.1.2 https://intarch.ac.uk/journal/issue1/gillings_index.html

Gunnarsson, Fredrik 2018. *Archaeological Challenges, Digital Possibilities. Digital Knowledge Development and Communication in Contract Archaeology*. Lnu Licentiate No. 21. Växjö: Linnaeus University Press. 129 pp. ISBN 9789188898067

Kintigh, Keith W. 2015. Extracting Information from Archaeological Texts. *Open Archaeology* 1(1), 96–101. 5 pp. https://doi.org/10.1515/opar-2015-0004

Kwan, Mei-Po. 2008. From oral histories to visual narratives: re-presenting the post-September 11 experiences of the Muslim women in the USA. *Social & Cultural Geography* 9(6):653–669. Routledge. 16 pp. http://meipokwan.org/Paper/SCG_2008.pdf

Lercari, Nicola 2017. 3D visualization and reflexive archaeology: A virtual reconstruction of Çatalhöyük history houses. *Digital Applications in Archaeology and Cultural Heritage* 6: 10–17. 7 pp.

Morgan, Colleen & Wright, Holly 2018. Pencils and pixels: drawing and digital media in archaeological field recording. *Journal of Field Archaeology* 43(2): 136–151. 15 pp.

Reilly, Paul 1990. Towards a virtual archaeology. In: Rahtz, S. and K. Lockyear (eds.) *Computer Applications in Archaeology*, pp. 133–139. Oxford: British Archaeological Reports. 6 pp.

Richards, Julian, Tudhope, Douglas & Vlachidis, Andreas 2015. Text Mining in Archaeology: Extracting Information from Archaeological Reports. In: J. A. Barcelo & I. Bogdanovic (eds.) *Mathematics and Archaeology*, pp. 240–254. Boca Raton: CRC Press. 15 pp. Link: https://uwe-repository.worktribe.com/preview/844192/TextMininginArchaeology-authorVersion.pdf

Schuurman, Nadine 2000. Trouble in the Heartland: GIS and Its Critics in the 1990s. *Progress in Human Geography* 24(4): 569–590. 21 pp. DOI: 10.1191/030913200100189111

Tagliaferri, Lisa 2017. Tutorial: An Introduction to Machine Learning. Link: https://www.digitalocean.com/community/tutorials/an-introduction-to-machine-learning