DOCTORAL WORKSHOP

SPATIAL ARCHAEOLOGY: FROM REMOTE SENSING TO ANALYSIS, NEW APPROACHES TO THE SPACE OF ANCIENT SOCIETIES

September 30 - October 4, 2024

École française de Rome

ÉCOLE FRANÇAISE DE ROME
Histoire, Archéologie, Sciences sociales

Centre Camille Jullian
Histoire et archéologie de la Méditerranée et de l'Afrique du Nord de la Protohistoire à la fin de l'Antiquité

INTELESPACE
Plateforme géomatique

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FRANCE 2030

Monday, September 30

9h00 – 9h45 **Opening of the Meeting & introduction**

Break

10h15 – 11h00 *Conference r.*
Lecture n° 1 - Michael DONEUS
Airborne Laser Scanning for Archaeology: Potential, Limitations and Latest Developments

Two decades after its first mention in archaeology Airborne Laser Scanning (ALS) has turned out to be an extremely useful prospection technique in many environments. Its potential to measure dense, precise and accurate digital surface (DSM) and digital terrain models (DTM) is of relevance for a wide range of archaeological applications. Today we can state that, regardless of whether ALS is used in open fields or forested and otherwise densely vegetated areas, it has the potential to assist in three main aspects of cultural heritage protection: detection, documentation, and monitoring of sites, monuments and landscapes. The lecture will give an introduction to the concept of ALS, explain its workflow to create archaeologically relevant terrain models. Additionally, it will focus on airborne laser bathymetry (ALB), which is applied to measure underwater topography over large areas.

11h00 – 11h45 *Conference r.*
Lecture n° 2 - Sara POPOVIĆ
Interpreting ALS data

This talk will focus on the steps following the acquisition and processing of ALS data, after deriving an appropriate Digital Elevation Model (DEM). We will explore how various visualizations of the DTM (topic that will be discussed in greater detail during the workshop) can enhance the visual analysis of the dataset with the aim of extracting the most archaeological and environmental information from your studied landscape.
We will provide examples of how different archaeological questions can shape and guide your approach to interpretation and vectorization, and consequently influence how you organize attributed data. The talk will stress the critical role of integrating additional sources of information in the interpretation process. This includes the use of historical maps, as well as other remote sensing data such as aerial photographs. These supplementary sources can significantly enhance your understanding of the landscape and inform your analysis.
Finally, we will emphasize the importance of field inspections in the data interpretation process. On-site evaluations can lead to new insights and potentially prompt a reinterpretation of the data, thereby refining your understanding of the landscape and improving the accuracy of your findings.

11h45 – 12h30 *Conference r.*
Lecture n° 3 - Sašo POGLAJEN
Sonar technologies in underwater archaeological research

This presentation will provide an overview of the various acoustic sensors employed in underwater archaeology, including side-scan sonar, multi-beam sonar, and sub-bottom profiling. We will discuss the principles of these technologies and their application in locating, mapping, and analysing archaeological sites beneath the water's surface. Case studies will illustrate successful implementations of sonar in discovering shipwrecks, ancient ports, and other significant underwater features, highlighting the advantages of non-invasive surveying methods. Additionally, we will address the integration of sonar data with Geographic Information Systems (GIS) to enhance data visualisation and analysis, allowing archaeologists to make more informed interpretations of maritime history. Ultimately, this presentation seeks to illustrate the potential of sonar technology as an essential tool in the effort to preserve and interpret our underwater heritage.

Lunch

Monday, September 30

14h00 – 16h00
Seminar r.

Workshop n° 1 - Elise FOVET, Sara POPOVIĆ, Michael DONEUS
DTM and LiDAR visualization

DTM and lidar visualization workshop will cover basic and advanced tools to analyse archaeological and landscape features from a lidar DTM. We will start with a step-by-step example of 'reading' and interpreting topographical data, to progress towards self-driving archaeological features detection.

Break

16h15 – 16h30
Seminar r.

Nirefs MARKAKIS
Archéo-hydrologie entre terre et mer : Une analyse intégrée de l'estuaire du Guadalquivir et de l'embouchure du fleuve depuis 6000 ans

16h30 – 16h45
Seminar r.

Donia BOURAI
Les ports entre les villes de Caesarea et Tuniza durant la période antique

16h45 – 17h00
Seminar r.

Lorenzo RADAELLI
Entre le Tavoliere et la mer : les paysages d'eau en Daunie

17h00

Discussion

Tuesday, October 1

9h00 – 09h45 — *Conference r.*

Lecture n° 4 - Bertrand DOUSTEYSSIER

Aerial archaeological prospecting

Aerial archaeological prospecting is a non-invasive method of investigation that uses aerial views to discover, document and interpret remains. This technique, which originated with aviation at the beginning of the 20th century, has recently evolved considerably thanks to new technologies.
Under certain conditions, remains buried in the ground (invisible) can be reflected by the overlying vegetation or revealed by their imprint in the topography and microtopography (perceptible on the ground but difficult to interpret without an overall view).
We will briefly present the main resources of vertical aerial imagery available for France, and develop an example of scientific processing of data acquired during an oblique aerial survey, arguing for a cross-mobilization of different sources.

9h45 – 10h30 — *Conference r.*

Lecture n° 5 - Sébastien GADAL

Multispectral spaceborne remote sensing in archaeology

Spatial remote sensing in archaeology is inherent to advances in Earth observation systems. It developed strongly in the 1970s and early 1980s under the generational influence of photo-interpreters, before disappearing and even becoming a confidential approach - at least in France - within the archaeological sciences until the beginning of the 2015-2020 period, when it became the object of interest again with the revival of spatial archaeology. However, this domain of research can be characterized by a conceptual gap and a methodological and technological impasse in the use of geospatial data, which means that the archaeological objects are analysed using photo-interpretation methods and 2D-3D representations in opposite to geo-visualisation. This is more surprising considering that the literature of the Nordic and Baltic countries, and even the Soviet Union is important to this area; and, it has produced a big part of methods, and concepts, in the field of Landscapes and Spatial Archaeology. The spatial remote sensing applied to landscape archaeology has its rightful place in the construction of knowledge in archaeology and geography; and this must be integrated with a truly territorial approach to the geographical space of the ancient periods.

Break

11h00 – 11h45 — *Conference r.*

Lecture n° 6 - Thibaut PERES

Multispectral imaging (UAV data) (*Provisional title*)

Pending.

Tuesday, October 1

11h45 – 12h30 *Seminar r.*

Lecture n° 7 - Élise FOVET
Thermal imaging (UAV data)

Thermal method has been used in archaeology since the 1970s, initially with airborne or spaceborne systems which made the method unwieldy due to its cost and lack of organizational flexibility. The use of thermal remote sensing for archaeological prospection is still in its infancy: thermal technology is not yet fully mastered, and seemingly straightforward questions about how to use it (when? in which environment? for what type of remains?) and how to interpret the results remain unanswered. The parallel development of Unmanned Aerial Vehicles (UAV) and miniaturization of sensors introduce a technological breakthrough for thermal prospection, making it possible to explore and experiment the method. The lecture will give an introduction to the basic concepts of thermal remote sensing, and will discuss some of the current methodological challenges for archaeological detection based on a case study.

Lunch

14h00 – 16h00 *Seminar r.*

Workshop n° 2 - Sébastien GADAL
Multispectral spaceborne remote sensing: Applications for landscape archaeology

The practical workshop will present the basics of multispectral medium-resolution remote sensing analysis and AI for analyzing landscapes from NASA/USGS Landsat satellite image archives on a Tunisian landscape and/or the Rhône delta river. [Depending on the time available], PhD students/candidates will work on multispectral processing fusion methods and on the extraction of past landscape spatial structures using Machine Learning algorithms. [Depending on the time available], a spatial analysis of the results may be carried out and discussed. Data will be processed using TerrSet software, which will be available to download, and Landsat 5 TM and Landsat 9 OLI satellite images as well. It is needed to bring your own computer.

Break

16h15 – 16h30 *Seminar r.*

Yani AIDALI
La politique de l'eau à Tubusuptu (Algérie) et son territoire pendant la période romaine

16h30 – 16h45 *Seminar r.*

Alessia MANDORLO
Metodi non invasivi nel telerilevamento di prossimità con UAV: creazione di un iter metodologico per lo studio dei paesaggi antichi e per l'attuazione di misure di archeologia preventiva

16h45 – 17h00 *Seminar r.*

Quentin VERRIEZ
New spatial and statistical approaches to studying the Thule Migration in the northern Arctic

17h00 – 17h15 *Seminar r.*

Thomas GLOAGUEN
Modélisation complexe des interactions entre les espaces urbanisés et les espaces naturels des régions côtières de la mer Baltique

17h15 *Discussion*

Wednesday, October 2

9h00 – 09h45
Seminar r.

Lecture n° 8 - Laura EBANISTA
Multispectral thermal imagery

The aim of the lesson is to outline the use of multispectral and thermal sensors in the field of proximity remote sensing for archaeological diagnostic purposes. After a brief introduction relating to the use of specific sensors installed on UAV and the physical principles that underlie this type of data reading, a series of experiences and tests undertaken in different contexts will be presented.
The objective is to present the methodological framework for reading and interpreting the vegetation indices developed starting from the individual bands acquired by the sensor for data interpretation, taking into account the interpolation of phenological, meteorological, seasonal and anthropic aspects.

9h45 – 10h30
Seminar r.

Lecture n° 9 - Fabiana BATTISTIN
Remote sensing technology and archaeological heritage safeguard: the experience of the project RESEARCH and its risk assessment for archaeological sites threatened by soil-related hazards

The use of remote sensing tools in archaeology is an established approach to research today, particularly for detecting and mapping archaeological landscape features and sites. Nevertheless, as is increasingly being demonstrated, the data collected by these methods can also be effective in research aimed at risk assessment, in which the archaeologist can provide a unique perspective on the vulnerabilities of the object at risk, similar to environmental experts on the hazard. This presentation illustrates the use of remote sensing technologies for cultural heritage preservation through the example of a recent international and multidisciplinary project called RESEARCH (Remote Sensing Techniques for Archaeology; H2020-MSCA-RISE 2018-2023, grant agreement n.), which focused on soil erosion, land movement and land cover change as some of the most urgent threats for the preservation of landscape features and sites, particularly archaeological deposits, often “invisible” in this field of studies.

Break

10h45 – 12h15
Seminar r.

Workshop n° 3 - Alessandro JAIA, Laura EBANISTA
Stereoscopic reading of aerial images

The workshop includes the practical experimentation of reading stereoscopic couple of aerial photos. Starting from the optical principles of stereoscopy, students will be asked to experiment with the practical use of a stereoscope, in order to obtain a three-dimensional view of the image viewed. The investigation methodology will be inserted in the context of archaeological research and photogrammetric restitution for archaeological reading purposes.

Lunch

Wednesday, October 2

13h00 – 13h15
Seminar r.

Andrea MELERI
Il limes romano in Algeria. Analisi dei dati cartografici e archeologici, editi e inediti, e proposte di tutela e valorizzazione

13h15 – 13h30
Seminar r.

Laura DE GIROLAMO
Paesaggi rurali eassetti agrari dell'Irpinia antica:conoscenza, sostenibilità evalorizzazione

13h30 – 13h45
Seminar r.

Stéphanie MAILLEUR-ALDBIYAT
UrbaPort - Exploring the Urbanism of Roman Mediterranean Ports: from iconographic data to 3D reconstruction

13h45 – 14h15

Discussion

Break & walk

Departure for the National Aerial Photo Archive at 2:30 p.m.

15h00 – 17h30

Daniela Simonetta PALAZZI, Francesco DI LORENZO, Gianluca CANTORO, Alessandra DELL'ANNA
Guided tour of the National Aerial Photography Library (ICCD)

The staff of the Aerofototeca Nazionale in Rome will present to doctoral students the vast collection of aerial photographs preserved in the premises of the largest Italian civil aerial photography archive, which houses images dating from the late 19th century to the present day.
The characteristics of the major collection (such as MAPRW collection, AM collection, Fotocielo Fund) will be described, examining the historical use of aerial photography and the contemporary value of the information derived from these images.

Thursday, October 3

9h00 – 09h45 — *Seminar r.*
Lecture n° 10 - Élise FOVET, Zoran ČUČKOVIĆ
Path network modelling

9h45 – 11h15 — *Seminar r.*
Workshop n° 4 - Élise FOVET, Zoran ČUČKOVIĆ
Path network modelling

Path modelling workshop will cover both basic and advanced topics. We will start with simple cost surface models and point-to-point optimal paths, to progress towards multiple path networks and calculations of overall landscape accessibility.

Break

11h45 – 12h00 — *Seminar r.*
Stefania PESCE
La viabilità romana nel Salento. L'eredità di Uggeri: una rilettura alla luce dei più recenti progressi nel campo della ricerca archeologica

12h15 – 12h30 — *Seminar r.*
Olivier BRUNET
Des champs dans la ville maya : une étude du système agraire de Río Bec (Campeche, Mexique) entre 700 et 900 de n.è.

12h30 – 13h00
Discussion

Lunch

14h00 – 14h45 — *Seminar r.*
Lecture n° 11 - Dries DEAMS
Agent-based modelling

Break

15h00 – 17h00 — *Seminar r.*
Workshop n° 5 - Dries DEAMS
Agent-based modelling

Agent-Based Modeling (ABM) is a powerful way to simulate complex systems as emergent phenomena generated by the behaviour of agents and their interactions. In the introductory lecture, I will discuss some of the theoretical tenets of computational modelling in general, and ABM in particular, followed by some case studies derived from my own research on human-environment interactions, urbanism and community formation. In the practical session, you will learn to code archaeological models from scratch based on existing models and archaeological case studies.

Friday, October 4

9h00 – 09h45 — *Seminar r.*
Lecture n° 12 - Antonin NÜSSLEIN
Statistical and multivariate analysis

9h45 – 11h15 — *Seminar r.*
Workshop n° 6 - Antonin NÜSSLEIN
Statistical and multivariate analysis

Since the 1960s and 1970s, archaeologists have used geographical space as an object of study in its own right to describe the evolution of ancient societies. Within this framework, spatial, statistical and multivariate analyses bring together methods for analysing the geography of ancient populations. In this workshop, several concepts and tools will be presented and used by participants to introduce them to these constantly evolving archaeological disciplines.

Break

11h45 – 12h00 — *Seminar r.*
Jacopo SCOZ
Micro-ecologie urbane nel Quartiere Bizantino del Pythion di Gortina, 365-800 d.C

12h15 – 12h30 — *Seminar r.*
Emmanuel HAMON
Émergence et évolution des communautés urbaines d'Europe celtique : le cas de l'agglomération de Verdun-sur-le-Doubs

12h30 – 12h45 — *Seminar r.*
Ana-Marija KRNIC
Colonie de Salona : Aménagement du territoire et formes d'habitat du Ier au VIe siècle

12h45 – 13h15 — *Discussion*

Lunch

14h30 – 15h15 — *Seminar r.*
Lecture n° 13 - Zoran ČUČKOVIĆ
Visibility modelling

Break

15h30 – 17h00 — *Seminar r.*
Workshop n° 7 - Zoran ČUČKOVIĆ
Visibility modelling

Visibility modelling workshop will address a series of both common and less common approaches. We will practice simple and multiple viewsheds on the basis or relevant case studies (Greek and Roman countryside towers), as well as landscape visibility index, a.k.a. "total viewshed" in order to analyse prehistoric barrow (tumuli) landscapes. Finally, the modelling of intervisibility networks will be introduced, along with several common network analysis methods.

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