

**CHORAL**  
**RESEARCH PROJECT** *(max. 5 pages)*  
**APPLICATION FORM TO REQUEST FOR FUNDING FOR JOINTLY SUPERVISED DOCTORAL THESIS**

**TITLE OF THE RESEARCH PROJECT**

Remote Sensing Data Analysis for Agriculture and Archaeological Crop Marks

**SUPERVISORS**

From recruiting University	First name	LAST NAME	University	Department
Supervisor	Mihai	Ivanovici	Universitat ea Transilvania din Braşov	Electronics and Computers
HDR or equiv.				
<input checked="" type="checkbox"/>				
	First name	LAST NAME	University	Department
Co-Supervisor	Jorge	Angás Pajas	University of Zaragoza	Antiquity Sciences
HDR or equiv.				
<input checked="" type="checkbox"/>				

## 5 main KEYWORDS

Remote sensing data; Earth Observation; hyperspectral; SAR data; archaeological crop marks

## ABSTRACT (250 words max.)

A large number of archaeological remains and even entire sites are still there to reveal. Being covered with ground, agricultural crops, forests or built-up areas, they are very difficult to detect based on purely historical data. With the latest technologies in the remote sensing domain, the multitude of sensors and the possibility to scan large area from various altitudes, there became a standard approach to search for buried archaeological remains. However, the locally-specific approaches may not work when applied in a different context, thus the necessity of designing new approaches that can work at a global scale. In this project we propose a hybrid vision between remote sensing and archaeology, which is aimed at developing non-invasive approaches based on remote sensing / EO data analysis for the purpose of supporting the detection and interpretation of buried archaeological remains. The hypothesis is that the water stress of agricultural crops can be a very good indicative of buried archaeological remains. By using a combined multisource, multiscale and multitemporal use of information through satellite data, together with an extensive use of drones with visible, multispectral and thermographic sensors, possibly terrestrial LiDAR technology for greater details, in order to cover large areas that allow comparison in different growing seasons. By the joint collaboration between a Romanian and Spanish research labs and universities, we aim at making steps towards the development of global solutions, which are independent of the specific location of the particular type of studied area or agricultural crops.

## Research aims and methodology

- Analyze agricultural crops and/or archaeological sites from Romania and Spain (Brasov + Zaragoza) from a multisource, multiscale and multitemporal perspective.
- Perform EO data analysis (Brasov + Zaragoza).
- Design and implement (using Matlab or Python) remote sensing data analysis (hyperspectral image + SAR + LiDAR) for country-specific crop and soil marks analysis (Brasov).
- Create a specific data set of remote sensing data + meta data/ground truth (Brasov + Zaragoza).
- Develop a relational database between the research team based on the WebGL standard specification that allows sharing and analyzing multiscale and multitemporal geospatial analysis on a web platform with: LiDAR data, multispectral data, GIS web mapping, satellite data, historical aerial images (Zaragoza).

## Relevance and added-value of the proposed research in relation to the current state of knowledge

- Contribute to open data and open science by creating a specific data set.
- Contribute to the refinement of crop and soil marks analysis.

- Contribute to the design of global or site-independent approaches that work both for Romanian and Spanish agricultural / archaeological sites.
- Discover the forms of occupation and ancient population of both territories from an interdisciplinary and multidisciplinary perspective through a non-invasive study with crop marks and soil marks in the field of archaeology.

### Interdisciplinary nature of the research together with the alignment with the CHORAL programme and complementarity expertise of the teams

The research project brings together electronics engineering, telecommunications and information technologies and Cultural Heritage in a field, that of remote sensing data analysis for applications in agriculture and archaeology, where a transdisciplinary approach is vital.

Prof. Mihai Ivanovici is expert on designing algorithms for Remote Sensing/EO data, image processing and analysis with application to agriculture.

Prof. Jorge Angas is expert on Geospatial sciences applied to Cultural Heritage, multiscale and multitemporal remote sensing applications for archaeological research.

### Output plan including publication and dissemination activities

Publications in IEEE IGARSS and IEEE WHISPERS. Plus IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING or MDPI REMOTE SENSING (or similar)

### Estimated schedule

September 2024 – August 2025: Brasov (R&D Institute of Transilvania University) – identify regions and applications of interest, perform data preparation / remote sensing data download and construction of a 1st data set of images

September 2025 – August 2026: Zaragoza (University) – perform data analysis

September 2026 – February 2027: Brasov (R&D Institute of Transilvania University) – refined data analysis

March 2027 – August 2027: Zaragoza (University) – writing PhD thesis