

TITLE OF THE RESEARCH PROJECT

Monitoring traditional agricultural crop fields with multi-modal multi-temporal Synthetic Aperture Radar data

SUPERVISORS

	First name	LAST NAME	University	Research Unit
Supervisor	Mihai	Ivanovici	Transilvania University of Brasov,	Space Intelligence and Earth Observation (ISOP) Research Laboratory
Co-Supervisor	Yajing	Yan	University Savoie Mont Blanc	Laboratoire d'Informatique, Systèmes, Traitement de l'Information et de la Connaissance (LISTIC)

Fields of study

Computer Sciences, Environment and Geosciences, Information Science and Engineering

Requirements (academic background, languages...) needed to apply for this research topic

Master degree in Remote Sensing, computer science, electronics engineering
English – mandatory, French - optional

5 main KEYWORDS

Remote Sensing, Synthetic Aperture Radar, agriculture monitoring, traditional crops, climate change

ABSTRACT (250 words max.)

Distinct agricultural crops and practices play a central role in shaping the culture and cultural heritage of rural communities in specific regions. The Braşov region in Romania, for instance, is particularly renowned for its potato and sugar beet cultivation, which has earned it the designation 'Potato Country'.

However, these traditional crops are increasingly being replaced by others, such as rapeseed, which are more resilient and better adapted to changing climate conditions. This shift contributes to the loss of cultural heritage. Remote sensing, and in particular Synthetic Aperture Radar (SAR), provides valuable insights into vegetation structure, soil roughness, and soil moisture. The Copernicus program of the European Commission, together with other space agencies, offers free and regularly updated data for the long-term monitoring of agricultural systems. In this project, conducted in close collaboration between French and Romanian research units, we aim at contributing to the preservation of cultural heritage in the selected region of Romania, while the ultimate goal is to take steps towards the development of global strategies to address climate change. In order to reach the aim, we leverage multi-modal, multi-temporal SAR data to (i) quantify the impact of climate change on traditional agricultural crops, (ii) estimate the water demand of these crops, (iii) evaluate nature-based solutions to preserve soil quality, and (iv) predict future dynamics."

Research aims and methodology

Research aims: leverage multi-modal, multi-temporal SAR data to monitor the crop growth, crop fields roughness and moisture evolution.

Methodology:

- Analyze the historical data of agricultural crops on the identified cultural heritage sites in Romania
- Multi-modal multi-temporal SAR data acquisition
- Perform SAR data analysis for the assessment of climate change impact
 - crop structure evolution analysis
 - soil roughness evolution analysis
 - soil moisture evolution analysis
 - correlation analysis with in situ data
- Predict the future dynamics with meteorological data
- Create open access data sets and tutorials for the community

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

- Full deployment of multi-modal (multi-frequency, multi-resolution, multi-polarization, amplitude/phase/interferometric coherence), multi-temporal SAR data for crop monitoring. This richness of information is expected to provide new insights into the subject.
- Creation of open data sets and tutorials for the community

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

This project deals with the agricultural heritage; it thus fits well the CHORAL program. It brings together computer science, electronics, information technologies, remote sensing and agriculture.

Pr. Mihai Ivanovici is an expert on algorithm design, image processing and analysis with application to agriculture. Dr. Yajing Yan has an expertise on SAR data analysis.

Output plan including publication and dissemination activities

Communications in international conferences like IEEE IGARSS, and publications in peer reviewed international journals, e.g. IEEE Transactions on Geosciences & Remote Sensing, IEEE Geosciences & Remote Sensing Letters or similar.

Open access data sets and tutorials to share with the community.

Participations to local dissemination activities (seminars, UNITA activities, etc.).

Estimated schedule

October 2026 – September 2027: Brasov (R&D Institute of Transilvania University) – identify regions and applications of interest, historical data analysis, perform SAR data download and preparation

October 2027 – June 2028: Annecy (LISTIC, Université Savoie Mont Blanc) – perform SAR data analysis

July 2028 – September 2028: internship to CESBIO, Toulouse or INRAE, Grenoble or similar

October 2027 – September 2028: Brasov (R&D Institute of Transilvania University) – refine analysis with in situ data - predict the future dynamics; writing PhD thesis