AI4AGRI Summer School 2025

EO Big Data for Agriculture

Final program

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14 – 19 July 2025

Brasov, Romania

Universitatea Transilvania din Brașov

UNIVERSITÉ TOULOUSE III PAUL SABATIER

UNIVERSITÉ TOULOUSE Jean Jaurès

TOR VERGATA UNIVERSITÀ DEGLI STUDI DI ROMA

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School program overview

Day 1	*14 July 2025*	**Big Data and Deep Learning**
Day 2	*15 July 2025*	**Advanced Machine Learning**
Day 3	*16 July 2025*	**Advances in Remote Sensing for Agriculture**
Day 4	*17 July 2025*	**Data Preparation and Preprocessing**
Day 5	*18 July 2025*	**More Big Data and Applications in Agriculture**
Day 6	*19 July 2025*	**Brunch in the potato field**

Day-by-day school programme

Day 1 –Big Data and Deep Learning	
Welcoming the participants	8:30 – 9:00
Mihai Ivanovici – Welcome speech and event presentation	9:00 – 9:10
M. Werner – Big Data and Deep Learning (I)	9:10 – 10:30
Coffee break	10:30 – 11:00
M. Werner – Big Data and Deep Learning (II)	11:00 – 12:30
Lunch	12:30 – 13:30
P. Soille – JRC's Big Data Analytics Platform (I)	13:30 – 15:00
Coffee break	15:00 – 15:30
P. Soille – JRC's Big Data Analytics Platform (II)	15:30 – 17:00

Day 2 – Advanced Machine Learning	
E. Aptoula – Domain Adaptation	9:00 – 10:30
Coffee break	10:30 – 11:00
E. Aptoula – Domain Generalization	11:00 – 12:30
Lunch	12:30 – 13:30
M. Garouani – Explainable AI for Agriculture	13:30 – 15:00
Coffee break	15:00 – 15:30
M. Garouani – Explainable AI for Agriculture	15:30 – 17:00

Day 3 – Advances in Remote Sensing for Agriculture	
F. Del Frate - Advanced Remote Sensing Techniques for Agriculture	9:00 – 10:30
Coffee break	10:30 – 11:00
I. Petracca - Meteo Variables Estimation from EO Data using ML	11:00 – 12:30
Lunch	12:30 – 13:30
A. Di Noia - Interaction Mechanisms between EM Radiation and Crops	13:30 – 15:00
Coffee break	15:00 – 15:30
E. Borgogno Mondino - Vegetation Phenology from EO Time Series	15:30 – 17:00

Day 4 – Data Preparation and Preprocessing	
Y. Yan – SAR Image Processing and Analysis	9:00 – 10:30
Coffee break	10:30 – 11:00
N. Richard - Metrological Features for Multivariate Data	11:00 – 12:30
Lunch	12:30 – 13:30
I. Plajer – Multi- and Hyper-Spectral Image Visualization using AI	13:30 – 15:00
Coffee break	15:00 – 15:30
L. Chaari – Image Denoising, from Inverse Problems to Deep Learning	15:30 – 17:00

Day 5 – More Big Data and Applications in Agriculture	
M. Debu, A. Băicoianu – DACIA5 Data Set and Applications	9:00 – 10:30
Coffee break	10:30 – 11:00
A. Băicoianu, A. Racovițeanu – DACIA5 Data Set and Applications	11:00 – 12:30
Lunch	12:30 – 13:30
D. Faur – EO Data Applications in Agriculture	13:30 – 15:00
Coffee break	15:00 – 15:30
D. Săcăleanu – In-field environmental parameters monitoring	15:30 – 17:00

Day 6 – Brunch in the potato field	
	10:00 – 12:00

Modules brief description

Martin Werner – *Big Data and Deep Learning*
Tutorials on Big Data and Deep Learning

Pierre Soile – *JRC Big Data Analytics Platform*
Presenting the JRC experience with its Big Data Analytics Platform

Erchan Aptoula – *Advanced Machine Learning*
Domain Adaptation and Domain Generalization.

Moncef Garouani – *Explainable AI for Agriculture*
Explainable AI: fundamentals, challenges and opportunities in the Agriculture domain.

Fabio Del Frate – Advanced Remote Sensing techniques for Agriculture
An overview of the latest advanced remote sensing techniques and their application in Agriculture

Ilaria Petracca - *Meteo variables estimation from EO data using ML*
Machine learning-based techniques for meteo parameter estimation from EO data.

Antonio Di Noia - *Interaction Mechanisms between EM Radiation and Crops*
How to model the interaction mechanisms between electromagnetic radiation and crops.

Enrico Borgogno Mondino – *Vegetation Phenology from EO time series*
Estimation of vegetation phenology from satellite imagery time series.

Yajing Yan – *SAR Image Processing and Analysis*
Synthetic Aperture RADAR (SAR) models for image processing and analysis.

Noël Richard – *Metrological Features for Multivariate Data*
Metrological vs. latent features for multivariate data (multi-spectral, hyperspectral, multimodal,...)

Ioana Plajer – *Multi- and Hyper-Spectral Image Visualization using AI*
Multi-spectral and hyper-spectral image visualization as color composites using AI models

Lotfi Chaari – *Image Denoising, from Inverse Problems to Deep Learning*
An overview of image denoising techniques from inverse problems to deep learning.

Alexandra Băicoianu , Matei Debu, Andrei Racovițeanu - *μDACIA Data Set and Applications*
A multispectral data set based on Sentinel-2 data for crop identification and early crop identification.

Daniela Faur – *EO Data Applications in Agriculture*
CEOSpaceTech projects and applications of EO data in Agriculture.

Dragos Săcăleanu – *In-field environmental parameters monitoring*
The sensors and approaches for in-field monitoring of parameters of interest for Agriculture.

Lecturers' biographies

Prof. Martin Werner studied mathematics at University Bonn, did a doctorate at the intersection of geometry and applications related to indoor navigation at LMU Munich. In his time as a postdoctoral researcher, junior professor, and senior researcher he completed his view on the processing of spatial data to a comprehensive perspective with stations at LMU Munich, Leibniz-University Hannover, German Aerospace Center (DLR), and UniBW Munich. In April 2020 he joined the Technical University of Munich, Faculty of Aerospace and Geodesy with a professorship for Big Geospatial Data Management. His research area includes methodological research around topics of acquisition, organization, compression, analysis, and visualization of georeferenced or geometric data in large scales. He puts emphasis on methods of distributed computing, machine learning, image and text analysis, randomized data structures, high performance computing and quantum algorithms.

Dr. Pierre Soille is a senior expert at the Joint Research Centre (JRC) of the European Commission. He is leading the JRC Big Data Analytics project and is responsible for the JRC Big Data Platform, a versatile platform for linking data, data scientists, and domain experts to generate insights and foresight in support of EU policies and decision making. Pierre received the engineering degree in 1988 from UCLouvain, Belgium, the PhD degree in agronomical sciences in 1992 from the same university in collaboration with the Centre for Mathematical Morphology of the Ecole des Mines de Paris, and the habilitation degree in computer science in 1997 from the Montpellier II University, France. He has been with JRC, Ispra, Italy, since December 1999, concentrating on the automatic information extraction from geospatial data at continental or global scales in support of EU policies. Since 2015 he is involved with the area of big data at JRC initially to address the challenges posed by the massive data streams delivered by the Sentinel satellites of the Copernicus Programme of the European Union and now expanding to any other data sources of interest to JRC thematic activities. He is co-chairing the Big Data from Space conference series co-organised by the European Space Agency (ESA), the Joint Research Centre (JRC), and the European Union Satellite Centre (SatCen).

Prof. Erchan Aptoula received a BSc in computer engineering from Galatasaray University (1999-2004); MSc in computer science, Strasbourg University (2004-2005); PhD in computer science, Strasbourg University (2005-2008). He is a full professor at Sabanci University, Istanbul, Turkey. He is an IEEE member and IEEE Geoscience and Remote Sensing Society. His areas of interest include Computer Vision, Deep Learning, Remote Sensing, Precision agriculture, Industrial vision, Biomedical image analysis, Automotive vision systems.

Moncef GAROUANI is an Associate Professor at the University Toulouse Capitole and a member of the IRIT lab (SIG team), since 2023. In 2022, Dr. Garouani successfully completed his doctoral studies, earning a Ph.D. in Computer Science through a collaborative program between Littoral Côte d'Opale University in France and Hassan II University of Casablanca in Morocco. His research interests lie at the intersection of several key areas within AI, including Automated Machine Learning (AutoML), Explainable AI (XAI), and meta-learning. He focuses on developing sophisticated techniques for the automatic

selection and optimization of machine learning algorithms, investigating methods to make the decision-making processes of AI models more understandable. Beyond these core areas, Dr. Garouani's research interests also encompass Natural Language Processing (NLP) and Computer Vision, investigating how AI can be used to understand and interpret different data modalities.

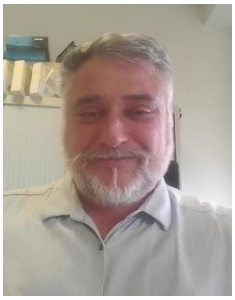
Prof. Fabio Del Frate is Full Professor at University of Rome “Tor Vergata” since 1999, where he is currently a Full Professor, teaching courses on Remote Sensing and Applied Electromagnetism in various Master and PhD Programs. He is the Coordinator of the “Design, Application, Regulation of UAVs” MSc program and Erasmus coordinator for the Engineering Macroarea. He is, or has been, principal investigator/project manager in several ESA and Italian Space Agency (ASI) funded research projects, author of more than 200 international scientific publications with a special focus on feature extraction algorithms from EO data using neural networks. He has been session organizer and in technical boards of International Conferences and Workshops focused on Geoscience and Remote Sensing. He has been Associate Editor for Geoscience and Remote Sensing Letters, Guest Editor for EURASIP Journal on Advances in Signal Processing and Remote Sensing. Currently he is a Member of the scientific section board of the Remote Sensing journal and Associate Editor for Frontiers of Remote Sensing. He has been a member of the ESA GOME ozone profile retrieval working group. In 2006 and 2007 he was a member of the group winning the IEEE data fusion contest. In 2015 he was appointed EUMETSAT Associate Scientist for activities regarding the estimation of precipitation rate from satellite data. From 2019 to 2022 he received an appointment by ESA as Visiting Professor at the ESA ESRIN centre to provide support in the use of AI for EO data processing. In 2006 he co-founded GEO-K srl, the 1st spin-off company of the University of “Tor Vergata”.

Ilaria Petracca received her Ph.D. in Computer Science, Control and Geoinformation in July 2024 and her M.S. in Environmental Engineering in June 2020 from the University of Rome "Tor Vergata", where she is now a research fellow since 2023. In 2022-2023 she was a visiting researcher at the Massachusetts Institute of Technology (MIT), Department of Aeronautics and Astronautics. Since 2020 she has been collaborating with the Tor Vergata spin-off GEO-K, working in national (e.g., IRIDE project for the implementation of a service value chain aimed at providing essential climate variables and greenhouse gas related products) and international projects (e.g., AI-OBSERVER project for the development of a risk assessment procedure for coastal erosion) and participating in various international conferences. Her research activity includes the application of AI techniques to EO data, in particular for the monitoring of volcanic ash and extreme weather events, and the study of the Bidirectional Reflectance Distribution Function (BRDF) for calibration and validation activities of satellite data.

Antonio Di Noia is a tenure-track assistant professor at the University of Rome Tor Vergata, and has previously held research positions at SRON Netherlands Institute for Space Research, University of Leicester and University of Bremen. His research interests include satellite remote sensing, polarimetry, radiative transfer modelling and inverse methods based on machine learning.

Enrico Borgogno Mondino he is Full Professor in Geomatics at the Dept. of Agricultural, Forest and Food Sciences, University of Torino. His main research topics concern agro/forestry applications of Geomatics, included optical and SAR satellite, airborne and UAV remote sensing, digital photogrammetry, LiDAR, GIS and survey. Author of more than 150 papers in National and International Scientific Proceedings, Journals and Books. President of the Italian Association of Remote Sensing. President of the ASITA Scientific Committee. Vice-President of the Italian Confederation of Scientific Associations for Territorial and Environmental Information. Chair of the Agriculture Special Interest Group of the European Association of Remote Sensing Laboratories EARSeL. He is/has been scientific responsible of various national and international research projects. He is Editorial board member in MDPI Remote Sensing, MDPI Agronomy, MDPI Geomatics and has been Guest editor of Special Issues in the European Journal of Remote Sensing, MDPI Land, MDPI Remote Sensing, Frontiers in Forests and Global Change.

Yajing Yan received Ph.D. degree in geosciences and environment from the Laboratoire d'Informatique, Systèmes, Traitement de l'Information et de la Connaissance (LISTIC) and the Institut des Sciences de la Terre (ISTerre), Université Savoie Mont Blanc, Annecy-le-Vieux, France, in 2011. She was a Post-Doctoral Fellow with the Institut d'Électronique et des Télécommunications de Rennes, France, from January 2012 to June 2012, and with the Geo-Hydrodynamics and Environment Research group, University of Liège, Liège, Belgium, from July 2012 to August 2014. Since September 2014, she has been an Associate Professor with LISTIC, Université Savoie Mont Blanc. Her research interests include multitemporal interferometric synthetic aperture radar (InSAR) processing, data fusion, data assimilation and ML.



Noël Richard is an Associate Professor at the University of Poitiers and as a Researcher at XLIM Laboratory, UMR CNRS 7552. He is the Technical Chair of the CIE Technical Committee TC8.14 working on the definition and assessment of the spatio-chromatic complexity. Facing the lack of stability and accuracy of the existing approaches in color image processing, he developed a new image processing paradigm based on distance functions and non-linear expressions for metrological purposes. Since 2013, he has been extending the paradigm to hyperspectral images, where a full-band vector processing is developing to respect the metrological constraints.

Ioana Cristina Plajer received the B.E. and the M.S degree in Computer Science from the University of Bucharest, Romania, in 1997 and 1998 respectively. She received the Ph.D. degree in Computer Science at the Transilvania University of Brasov, Romania, in 2011. She is currently a lecturer with the Faculty of Mathematics and Computer Sciences of the Transilvania University, Brasov, Romania. She is also a member of the department's Machine Learning and Quantum Computing research group, founded in 2018 and part of the project Artificial intelligence and Earth observation for Romania's agriculture (AI4AGRI). Her research interests include machine learning, image processing, spectral imaging and remote sensing, formal languages, algorithms and data structures.

Lotfi Chaari is full professor (since 2024) with Toulouse INP where he worked as associate professor from 2012 to 2024. He is a researcher with the IRIT lab (MINDS team, SI department). His research is focused on model-based and data-driven approaches for signal and image processing/analysis. With a large background in inverse problems and Bayesian methods, he mainly works on developing hybrid optimization algorithms, combining variational and Bayesian tools, for sparse deep neural networks learning where all parameters are automatically estimated from the data. These methods are applied to biomedical signal and image processing, and to remote sensing. He also works on light machine learning techniques for data analysis in those fields. The handled data is generally multi-dimensional with temporal/spectral dimensions.

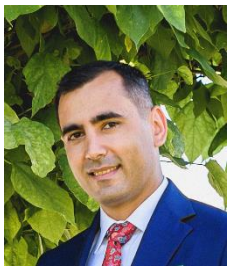
Alexandra Băicoianu holds a PhD in Computer Science from Babeș-Bolyai University, Cluj-Napoca. She is currently an Associate Professor in the Department of Mathematics and Computer Science at Transilvania University of Brașov. Her research interest and expertise are in the field of machine learning, formal languages and compilers, algorithms, remote sensing and Earth Observation data, autonomous driving, electric and hybrid vehicles. She is particularly focused on the practical applications and implementation of these topics, bridging theoretical research with real-world practice.

Matei Debu received a bachelor's degree in computer science from the Transilvania University of Brașov in 2023 and is currently pursuing a master's degree in Modern Technologies in Software Systems Engineering at the same university. He is actively involved as a research assistant in several projects, including notable initiatives such as AI4AGRI, which focuses on the integration of artificial intelligence in agriculture, and other projects like AI4RiSK, IMINT and SEEN all of them focus on using artificial intelligence in different scenarios. His research interests span artificial intelligence, software systems design, and the application of modern technologies to solve complex, real-world problems.

Andrei Racovițeanu received his PhD title from Politehnica University of Bucharest, Romania. He is a lecturer at the same university, now called National University of Science and Technology Politehnica Bucharest. He is also a member of the AI4AGRI project and researcher within the Image Analysis and Processing Laboratory. His research interests include image processing and analysis, machine learning and remote sensing.

Daniela Faur is an associate professor at the National University of Science and Technology Politehnica Bucharest, co-founder and coordinator of the Geospatial and Smart Sensors for Environmental Applications research laboratory – Geosense, within the Campus Research Institute of Politehnica University. Daniela Faur has authored over 70 publications and has been actively involved in numerous national and European research projects. In 2019, together with a team of IT specialists, she won both the Copernicus Incubation and Copernicus Accelerator programmes with the precision agriculture solution OGOR, which later evolved into a successful EO-based startup. Her research expertise includes scalable processing of satellite image time series, visual analytics frameworks for high-dimensional

EO data exploration, rapid mapping and AI-based risk assessment systems, as well as the co-design and deployment of EO services with public and private stakeholders. Currently, she is focused on advancing a Cognitive Earth vision through applied Artificial Intelligence and Large Multimodal Models for explicable environmental monitoring. She is also a recipient of a Fulbright-RAF Scholar Award for 2025–2026, supporting her research and collaboration activities at the University of Georgia (UGA), USA, focused on integrating Earth Observation and AI solutions into agricultural extension services.



Dragoş-Ioan SĂCĂLEANU is a lecturer at the Faculty of Electronics, Telecommunications and Information Technology of the National University of Science and Technology POLITEHNICA Bucharest, and co-founder of the Geospatial and Smart Sensors for Environmental Applications research laboratory (GEOSENSE) within the Campus Research Institute. He holds a Bachelor of Engineering in Electronics, Computer Systems Engineering, and a Ph.D. in Electronics and Telecommunications from POLITEHNICA Bucharest. He also holds a Bachelor of Economic Sciences in Business from Bucharest University of Economic Studies, Faculty of Commerce, and a Master of Ecological Horticulture Sciences at the University of Agronomic Sciences and Veterinary Medicine of Bucharest, Faculty of Horticulture. In 2024, he received the Fulbright-RAF Scholar Award in the field of Agricultural Extension Services at the University of Georgia, USA. His teaching activities include courses and laboratories in Sensor Networks, Information Transmission in Wireless Networks, Programmable Electronic Systems, and Systems with Microprocessors. His research fields include wireless sensor networks and IoT systems with applications in the agricultural field.