French-Lebanese Summer School on Remote Sensing

American University of Beirut
May 30th to June 3rd, 2022

Dissemination and capacity-building using Copernicus as well as Theia data and value-added products

Workshop & Summer School Program >>
Detailed Outlines, Prerequisites & Lecturers' Profiles

American University of Beirut
Faculty of Agricultural and Food Sciences| Beirut, Lebanon

Sponsors

Copernicus — Framework Partnership Agreement for Copernicus User Uptake

AUB — American University of Beirut — Faculty of Agricultural and Food Sciences

AgHive

Theia

www.copernicus.eu   www.aub.edu.lb   www.theia-land.fr

Day 1 | Monday, May 30th, 2022 >>Workshop on 'Application of Remote Sensing for Water, Environment and Land'

» 30 min for each presentation (20 min for presentation, 10 min questions)

» The program schedules as follow:

09:00-09:30	Registration
09:30–09:35	Welcome from the AUB -FAFS by Dean Ammar Olabi
09:35-09:40	Welcome from THEIA by Dr. Nicolas Baghdadi
09:40-09:45	Welcome from AgHive-Department of Agriculture by Dr. Hadi Jaafar
09:45-10:10	Summer School: Information and Program
	Dr. Hadi Jafaar & Dr. Nicolas Baghdadi
10:10-10:30	Morning Break
10:30-11:00	HSEB Global ET at sub-field scales - AgHive
	Dr. Hadi Jaafar
11:00-11:30	Estimation of Soil Parameters in Agricultural Aeras
	Dr. Hassan Bazzi & Dr. Nicolas Baghdadi
11:30-12:00	Disaster Rapid Mapping at ICube-SERTIT within the EMS Copernicus Service and the International Space and Major Disaster Charter frameworks
	Dr. Hervé Yésou
12:00-12:30	Urban Heat Island Effect - LDEM, AUB
	Dr. Yaser Abunnasr
12:30-13:30	Lunch
13:30-14:00	Drought Estimation and Mapping
	Dr. Mehrez Zribi & Dr. Michel Le Page
14:00-14:30	Landslides using remote sensing - CNRS
	Dr. Chadi Abdallah
14:30-14:45	Afternoon Break
14:45-15:15	Mapping Buildings from Spot-6/7 Imagery using Deep Learning
	Rémi Cresson
15:15-15:45	SEEDS for Recovery (CEDIL) – Deep learning for evaluating humanitarian interventions – Syria - AgHive
	Lara Sujud & Dr. Hadi Jaafar
15:45	Closure of Workshop Day 1

Days 2, 3, & 4 | May 31ᵗʰ to June, 2ⁿᵈ, 2022 >> French-Lebanese Summer School on Remote-Sensing

Summer School General Schedule

» Each day, courses will start at 9:30 AM and finish at 16:30. Lunch breaks will be held from 12:30 to 14:00. All sessions will run in parall.

» An initiation to remote-sensing and Image processing open to any participant is proposed. A detailed program is to be found in the following pages.

» The other sessions are thematic and designed for participants already possessing basic understandings and practices in remote-sensing and imagery processing. Outlines and prerequisites for each tutorial session are detailed in the following pages.

» Each participant will select only one session among the followings:

Presenter	Parallel Tutorial Session
Dr. Ibrahim Fayad	Initiation to Remote Sensing Image Processing
Rémi Cresson	Mapping Buildings from Spot-6/7 Imagery Using Deep Learning
Dr. Hassan Bazzi & Dr. Nicolas Baghdadi	Estimation of soil moisture in agricultural areas using Sentinel-1/2 images
Dr. Hervé Yésou	Disaster rapid mapping from space
Dr. Michel Le Page & Dr. Mehrez Zribi	Drought mapping

Day 5 | Friday, June 3rd, 2022 >> Cultural Tour

Initiation to Remote-Sensing Image Processing

OUTLINE

» Physics of measurement, radiation, satellite imaging: optical remote sensing
» Physics of measurement, radiation, satellite imaging: Radar remote sensing
» Download and Preprocessing of Sentinel-2 and Sentinel-1 images
» Practical work on image processing using open access software (QGIS and OTB)

PREREQUISITE

» Computers: PC Windows or Linux, 4Gb RAM and 20 Gb HD.
» Software: QGis, Excel or equivalent
» Ideally, an internet connection
» The lecturer will bring with him the necessary setups + data.

LECTURER

Ibrahim Fayad received the Engineering degree in computer and telecommunications in 2011 and the Ph.D. degree in automatic and microelectronic systems both from the University of Montpellier, Montpellier, France in 2015.

He is currently a Research Engineer with the National Research Institute for Agriculture, Food and the Environment, Montpellier, France.

His research interests include machine learning for the retrieval of environmental parameters using remote sensing data.

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DAY 2 | TUESDAY, MAY 31ᵀᴴ, 2022 >> PHYSICS OF MEASUREMENT, RADIATION, SATELLITE IMAGING

09:30–12:30 (with a morning break)	Physics of Measurement, Radiation, Satellite Imaging: Optical Remote-Sensing
14:00-16:30 (with an afternoon break)	Physics of Measurement, Radiation, Satellite Imaging: Radar Remote-Sensing

DAY 3 | WEDNESDAY, JUNE 1ˢᵀ, 2022 >> DOWNLOAD AND PREPROCESSING OF SENTINEL IMAGES | PRACTICAL WORK ON IMAGE PROCESSING

09:30–12:30 (with a morning break)	Sentinel-2 (Optical): Download and preprocessing. Atmospheric correction Sentinel-1 (Radar): Download and preprocessing. Radiometric correction
14:00-16:30 (with an afternoon break)	Practical work on image processing using open access software such as QGIS and OTB » Import/Export, visualisation, contrast » Interpretation of Optical Images » Interpretation of Radar Images

DAY 4 | THURSDAY, JUNE 2ᴺᴰ, 2022 >> PRACTICAL WORK ON IMAGE PROCESSING USING OPEN ACCESS SOFTWARE SUCH AS QGIS AND OTB

09:30–12:30 (with a morning break)	» Creating Map Layout » Digitizing/vectorising » Mathematical operations
14:00-16:30 (with an afternoon break)	» Segmentation » Classification

Mapping Buildings from Spot-6/7 Imagery Using Deep Learning

Outline

The tutorial focus on the semantic segmentation of Spot-6/7 images using convolutional neural networks (CNN), to map buildings over large areas. After a short introduction of deep learning theory, we will move to its technical application on satellite imagery. The practice session covers the entire process, from the preparation of the data, to the generation of maps from entire Spot-6/7 images.

We show how CNNs can deal with panchromatic and multispectral channels at their native scale, avoiding traditional pre-processing, and still classify pixels at the highest spatial resolution (i.e. panchromatic at 1.5m spacing).

The following open-source softwares will be at the core of the practice session: QGIS, Orféo Tool-Box, and TensorFlow/Keras.

» Theory behind semantic segmentation and its application to remote sensing images
» How to prepare the ground truth from existing vector data
» How to build and train the first network
» Generate some maps using our trained network
» Improve the network to avoid pre-processing of Spot-6/7 images

Prerequisite

» Basic knowledge of Command lines running, QGIS, Remote Sensing and Imagery Processing
» Software: QGIS, Orféo ToolBox, TensorFlow/Keras, Python
» Data: Spot-6/7 and vector layers (OpenStreetMap or BDTOPO).

Lecturer

Rémi CRESSON works as a Research Engineer with the French National Research Institute for Agriculture, Food and Environment, INRAE, in Montpellier, France.

His research and engineering fields include remote sensing images processing at scale, high performance computing, machine learning, and geospatial data interoperability.

He is an active member of the Orfeo ToolBox (OTB) Project Steering Committee and charter member of the OSGeo foundation.

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Research Engineer,
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ESTIMATION OF SOIL MOISTURE IN AGRICULTURAL AREAS USING SENTINEL-1/2 IMAGES

OUTLINE

The following points will be approached:

» Sensitivity of radar signal to soil parameters

» Modeling of radar backscattering coefficient

» Inversion of radar signal for mapping soil moisture in agricultural areas using the operational algorithm S^2MP

» Practical course for estimating soil moisture over agricultural areas using Sentinel-1 and Sentinel-2 data on free open access software

PREREQUISITE

» Basic knowledge about radar and optical images

» Basic knowledge about satellite image processing

» Software: QGIS, OrfeoToolbox, Python and SNAP ESA

» The lecturers will bring with them the necessary software setups and the database

» A computer with at least 6 GB RAM is required

Lecturers

Nicolas BAGHDADI received his Ph.D. degree from the University of Toulon, France in 1994. From 1995 to 1997, he was a postdoctoral researcher at INRS Ete – Water Earth Environment Research Centre, Quebec University, Canada. From 1998 to 2008, he was with the French geological Survey (BRGM), Orleans, France. Since 2008, he is a Research Director at the French Research Institute of Science and Technology for Environment and Agriculture (IRSTEA, now INRAE).

DR. Nicolas BAGHDADI
Research Director,
INRAE, France

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He is the editor of two series of books: *Land Surface Remote Sensing* set and *QGIS in remote sensing* set
http://www.iste.co.uk/subject.php?id=NJNK

His main field of interest is the analysis of remote sensing data (mainly radar and lidar) and the retrieval of environmental parameters (e.g. soil moisture content, soil roughness, canopy height, forest biomass, etc.). From 2013 to 2022, Nicolas Baghdadi has been the Scientific Director of the French Land Data Center Theia
https://www.theia-land.fr/en.

Hassan BAZZI received the Bachelor's degree in Geomatics Engineering from Lebanon in 2017 and the master's degree in Information System for Land Management from AgroParisTech, France in 2018.

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Research Engineer,
INRAE, France

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He has just completed his Ph.D. degree at the University of AgroParisTech (INRAE-TETIS research unit) focusing on radar and optical techniques for water resource management in agricultural area.

OUTLINE

» Copernicus Emergency Service at Global scale (Forest fire and flood monitoring with EFFIS EF-FAS)
» Copernicus Emergency at local/regional level (Rapid mapping, Risk and Recovery) and Charter International Space and major Disaster
» Practical cases on forest fire and flood in Lebanon exploiting Sentinel imagery

PREREQUISITE

» Basic knowledge about remote sensing is necessary
» Software: SNAP ESA version 7 and QGIS
» The lecturer will bring with him the necessary setups + data

Lecturer

Hervé YÉSOU received his PH.D. Degree from the University of Strasbourg in 1993. Since he is a core member of the SERTIT Unit, a specialized lab in remote sensing operational applications in the field of Environment (natural resources and territories monitoring, disaster rapid mapping).

Since more than 20 years he is involved in rapid mapping activities, mainly within the framework of the International Charter "Space and Major Disasters" and since December 2015 within the Emergency- Mapping Service of Copernicus. In this Copernicus service, he acts as Officer on Duty (ODO), taking in charge answer to the request of activation, ordering adequate images and monitoring the activities between different

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production centres being in contact with Authorized Users all the time during the activation. Another main field of interest is wetland and water bodies' characterization and monitoring, he is member the Science Team of the future Altimetric mission, SWOT.

Since 2000 he has been an external expert for CNES on the definition of VHR future sensors, participating to the OR-FEO thematic groups, as well as to the definition of potential new missions, 3S2, Pleiades HR, GEO HR, Arctos and their validation for the risk and environmental domains. Since 2016 he is member of the MENFIS think tank, working on the definition of USERS requirement for the new coming CO3D project.

OUTLINE

» The process of evapotranspiration and its estimation from Earth observations
» Practical exercises on the estimation of evapotranspiration and irrigation management
» Basis of drought analysis
» Estimation and mapping of drought indices from Earth observations

PREREQUISITE

» Computers: PC Windows or Linux, 4Gb RAM and 20 Gb HD.
» Software: QGis Ideally, an internet connection. Excel or equivalent
» Ideally, an internet connection
» The lecturer will bring with him the necessary setups + data.

LECTURERS

Michel LE PAGE received a technical degree in computing (1986) and a master degree in Urban Geography (1998). He is currently an engineer at CES-BIO, Toulouse, France, working on the development of tools based on remote-sensing imagery for the end user.

He has 25 years of experience in GIS and remote-sensing research in developing countries, particularly in the field of integrated water management at the watershed scale

DR. Michel LE PAGE
Engineer, French Institute of Research for Development (IRD), France

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(Mexico, Tunisia and Morocco).

In recent years, he has devoted to the development of tools based on optical remote sensing for estimating evapotranspiration on irrigated land in semi-arid areas. His current interests are in the way to transfer those decision making tools to farmers and managers of irrigation systems.

Mehrez ZRIBI is a Research Director with Centre National de Recherche Scientifique (CNRS). He received the B.E. degree in signal processing from the École Nationale Supérieure d'Ingénieurs en Constructions Aéronautiques, Toulouse, France, and the Ph.D. degree from the Université Paul Sabatier, Toulouse. In 1995, he joined the Centre d'Etude des Environnements Terrestre et Planétaires Laboratory/Institut Pierre Simon Laplace, Vélizy, France. In 2001, he joined CNRS organism. Since October 2008, he has been with the Centre

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d'Etudes Spatiales de la Biosphère (CESBIO), Toulouse, France.

He is responsible of the team of observation systems in CESBIO. His research interests include microwave remote sensing applied to hydrology, microwave modelling for land surface parameters estimations and finally airborne microwave instrumentation. He has published more than 100 articles in refereed journals. He is editor of twenty books about remote sensing theory and applications.

Sponsors

This event is supported by the European Union's **Caroline Herschel Framework Partnership Agreement on Copernicus User Uptake** under grant agreement N° FPA 275/G/GRO/COPE/17/10042, project FPCUP (Framework Partnership Agreement on Copernicus User Uptake), Action 2019-1-40 «Dissemination and capacity-building using Copernicus data and the algorithms and value-added products from the French Land data center Theia».

The **FPCUP European program** supports this initiative as pursuing the six following Copernicus objectives:

1. Increase socio-economic benefits by promoting the use of Earth observation in applications and services;
2. Foster the development of a competitive European space and services industry ;
3. Increase demand for Copernicus data and Copernicus information
4. Promote the use of Copernicus data and Copernicus information by institutions and bodies, international organisations and European, national, regional or local authorities,
5. Increase market penetration, including the expansion of the existing markets and creation of new markets and competitiveness of the European downstream operators;
6. Demonstrate European added value.

www.copernicus.eu

The American University of Beirut (AUB) is a top-ranked institution in the Middle East and North Africa (MENA) region that prides itself on cutting-edge research and interdisciplinary innovation to advance knowledge on a wide range of issues such as the development of renewable energy resources, strategies for a sustainable environment in arid climates, peace mediation and dialogue, and treatments for human diseases.

www.aub.edu.lb

AqHive The **Faculty of Agricultural and Food Science (FAFS)** at AUB is one of the oldest and most established faculties of agriculture in the MENA region. Through research, education, and community engagement, FAFS inspires minds, trains future leaders, and promotes sustainable environment, water, livelihoods, and food systems in Lebanon, the region, and beyond. The Department of Agriculture trains future agricultural engineers to optimize crop production only after securing the requirements of sound policy in terms of water, energy, and renewable resources. This summer school is co-organized by AgHive, the unit for the Remote Sensing and Geospatial Lab and the Smart Irrigation Lab at the Department of Agriculture at AUB.

sites.aub.edu.lb/aghive/

Created in 2012 and supported by 10 French research organizations, **Theia**, the French consortium for continental surfaces data, pursues four main objectives:

1. Promoting and facilitating access to spatial Earth observation data;
2. Developing value-added products for the scientific community and public stakeholders;
3. Networking scientists and users;
4. Promoting French research on a European and international scale.

www.theia-land.fr