UCLouvain

lbrat2104 Land monitoring by advanced earth observation

2020

Due to the COVID-19 crisis, the information below is subject to change, in particular that concerning the teaching mode (presential, distance or in a comodal or hybrid format).

3 credits	22.5 h + 15.0 h	Q2

Teacher(s)	Bontemps Sophie (compensates Defourny Pierre) ;Defourny Pierre ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	This course aims to develop in-depth understanding and professional skills to process and interpret very high resolution UAV (drone) imagery and Earth Observation satellite time series. Advanced concepts related to signal acquisition, time series quality control and uncertainty characterization are introduced. Radiative transfer modeling and methods for biophysical variables estimation (Leaf Area Index, biomass, nitrogen status, surface temperature, evapotranspiration, soil moisture, height, etc.) and change detection methods are explained and illustrated through practical applications and the European Copernicus Services. Finally, open source tools and systems supporting already operational and forthcoming monitoring systems, including flood monitoring, fire monitoring, forest monitoring and crop monitoring, are discussed in details. The objective of this course is to develop the necessary knowledge and technical skills to use advanced image processing methods (including machine learning and artificial intelligence) and to implement workflow for UAV or satellite monitoring applications in the field of agriculture, forestry, land use land cover change, and water resources management.
Aims	1 — a. Contribution of the activity to the program learning outcomes Consistency of LO courses with those of the program M1.1., M2.1., M4.4., M4.5 b. Specific formulation for this AA activity of the program (maximum 10) At the end of this activity, the student is able to: - practically mobilize the advanced concepts and methods of airborne and satellite remote sensing applied to the monitoring and the management of natural resources, to regional planning and to the environment in general; - understand and critize in depth the operational services, the available products and the existing tools to get the best out of each; - mastering specialized open source remote sensing softwares and developping processing chains including several tools; - design and conduct rigorous digital analyzes of optical and radar time series to respond to specific issues belonging to the bioengineer fields and to formulate the related hypotheses and limits; - be able to grasp technological developments in the field of remote sensing applied to the fields of the bioengineers. - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Written examination based on a case study.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** The teachnig introduces the concepts and advanced methods while the praticals in computer lab mobilise them in the context of specific applications. The lessons are quite interactive and partly relies on an inductive approach. The course and the praticals aims to develop on one hand advanced technical skills in Earth 0bservation data processing and on the other hand, the ability of critical analysis with regards existing solutions, services and products. The student learns not only to use open source packages and Google Earth Engine environment but also to assess the quality and to review the validity of the proposed algorithms and datasets for a given application. The practical training is closely linked to the course and includes the use of several open source libraries (including QGIS, SNAP, GDAL, ORFEO, Sen4CAP), the exploitation of the Jupyter notebook environment for quality control et time series analysis, and the workflow coding in Python or R.
Content	The course combines lessons and practicals in computing lab mainly based on open source softwares used in the professional sector. The lessons address the following topics: - signal acquisition and preprocessing steps, including quality flags and uncertainty management;

	- radiative transfer modelling and retrieval of various biophysical variables; - optical and SAR time series analysis, features extraction and pixel-based / object-based metrics; - advanced radar processing including polarimetric and interferometric variables; - introduction to machine learning and artificial intelligence algorithms for Earth observation mapping, monitoring and change detection; - critical review of operational monitoring systems (drought, flooding, fire, forest, crop, locust) and of Copernicus Services freely available. - EO applications related to the environment, agriculture, forestry, water resources and land use planning.
Inline resources	Training material on Moodle and open source libraries available in the computer lab.
Other infos	This course is part of the Certificate in Applied Geomatics accessible to professionals as part of continuing training. The theoretical knowledge and practical of this course are mobilized in many other courses in different programs and different faculties. This course can be given in English.
Faculty or entity in charge	AGRO

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Agricultural Bioengineering	BIRA2M	3		
Master [120] in Forests and Natural Areas Engineering	BIRF2M	3		
Master [120] in Environmental Bioengineering	BIRE2M	3		
Certificat d'université : Géomatique appliquée	GEOM2FC	3		