UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Sensing and Vision for Industry and Environment

2425-1-F9102Q029

Aims

This is a module of the “Sensing and vision for industry and environment” course. The aim of this module is to make the student achieve solid knowledge on basic concepts of Remote Sensing for Earth Observation, understanding of data produced by the various remote sensing systems, and how to leverage such data for real-world applications. The student will understand how to use different types of remotely sensed data to solve a problem related to the phenomenon observed on the Earth surface.

Contents

This course teaches Remote Sensing for Earth Observation at an introductory level. It is designed to teach the students a range of processing and analysis techniques commonly applied in various contexts to remotely sensed data, with special regards to optical data. Students will learn how different types of data can be managed and used effectively to obtain the desired information about the monitored phenomenon on the Earth surface. A mention of the European “Copernicus” initiative and its environmental implications is included in the course.

Detailed program

Basic concepts

- Remote sensing and its physical principles
- Sensors and platforms

Sensors

- Types of sensors and their features
- Sensor networks

Data processing

- Remotely sensed data: characteristics and organisation
- Radiometric and geometric correction, enhancement

Processing and analysis

- Statistical/spatial/spectral analysis
- Information extraction
- Supervised and unsupervised approaches
- Contextual and object-based analysis
- Machine Learning and Artificial Intelligence approaches

Applications

- Examples of applications
- Copernicus and Big Data from Space

Prerequisites

The student should possess basic knowledge on physics, chemistry, mathematical analysis, usually acquired from Bachelor-level courses.

Teaching form

The course is based on classroom lectures, possibly integrated with seminars. Whenever possible, hands-on sessions will be organised on processing of spaceborne optical datasets. Although not required, attendance to the lectures and practical sessions is strongly recommended. Lectures will be generally held in presence, unless further COVID-19 related restrictions are imposed. Some exercises may be held online. Course slides will be made available through the institutional channels.

Textbook and teaching resource

Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman: Remote Sensing and Image Interpretation, 7th Edition. Wiley, January 2015, 736 pages. ISBN: 978-1-118-91947-7

Aaron E. Maxwell, Timothy A. Warner & Fang Fang (2018) Implementation of machine-learning classification in remote sensing: an applied review, International Journal of Remote Sensing, 39:9, 2784-2817, DOI: 10.1080/01431161.2018.1433343

Holloway, J.; Mengersen, K. Statistical Machine Learning Methods and Remote Sensing for Sustainable Development Goals: A Review. Remote Sens. 2018, 10, 1365. https://doi.org/10.3390/rs10091365

G. Cheng, X. Xie, J. Han, L. Guo and G. -S. Xia, "Remote Sensing Image Scene Classification Meets Deep Learning: Challenges, Methods, Benchmarks, and Opportunities," in IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 13, pp. 3735-3756, 2020, doi: 10.1109/JSTARS.2020.3005403.

Qiangqiang Yuan, Huanfeng Shen, Tongwen Li, Zhiwei Li, Shuwen Li, Yun Jiang, Hongzhang Xu, Weiwei Tan, Qianqian Yang, Jiwen Wang, Jianhao Gao, Liangpei Zhang, “Deep learning in environmental remote sensing: Achievements and challenges”, Rem. Sens. of Envir. Vol. 241, 2020, 111716, ISSN 0034-4257, https://doi.org/10.1016/j.rse.2020.111716.

Semester

Second

Assessment method

The exam consists of an oral discussion on at least three different topics in the course, aimed at assessing the candidate's level of knowledge and understanding of the subject. Students who attended at least 70% of lectures may access an alternate option consisting of in-depth reading and discussion on a scientific work, identified in agreement with the lecturer.

The mark is expressed with a number between 18 (barely sufficient) and 30 with honours (excellent).

Office hours

9-18, by appointment only.

Sustainable Development Goals

QUALITY EDUCATION