Universitat Autònoma de Barcelona

2021/2022

Advanced Remote Sensing

Code: 43382
ECTS Credits: 9

Degree	Type	Year	Semester
4314828 Remote Sensing and Geographical Information Systems	OT	0	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: spanish (spa)

Other comments on languages

Approximately 100% of the classes are in Spanish. Most of the bibliography is in English.

Teachers

Pere Serra Ruíz

External teachers

Bernat Codina

Carolina Gabarró

Joan Bech

Jordi Isern

Ricardo Díaz-Delgado

Prerequisites

Prerequisites are not required

Objectives and Contextualisation

This optional module, expands the knowledge acquired in the module of obtaining geographic information of this same master's degree from the study of techniques and applications specific to remote sensing in fields such as meteorology, oceanography, geology and the study of vegetation.

At the end of the course, the student will be able to:

1. Apply the methodologies to alleviate the different sources of error in order to visualize and extract physical parameters of the received data.
2. Apply remote sensing techniques to different fields of research and applied.

Competences

- Apply different methodologies for the primary processing of images obtained by remote sensors in order to subsequently extract geographic information.
- Continue the learning process, to a large extent autonomously.
- Identify and propose innovative, competitive applications based on the knowledge acquired.
- Take a holistic approach to problems, offering innovative solutions and taking appropriate decisions based on knowledge and judgement.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use the different techniques for obtaining information from remote images.
- Write up and publicly present work done individually or in a team in a scientific, professional context.

Learning Outcomes

1. Apply remote sensing techniques to different research and applied-research fields.
2. Continue the learning process, to a large extent autonomously.
3. Correctly apply methodologies to mitigate the different sources of error in order to visualise and extract physical parameters from the data received.
4. Identify and propose innovative, competitive applications based on the knowledge acquired.
5. Take a holistic approach to problems, offering innovative solutions and taking appropriate decisions based on knowledge and judgement.
6. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
7. Write up and publicly present work done individually or in a team in a scientific, professional context.

Content

RS & METEOROLOGY. TECHNIQUES & EXAMPLES

1. Introduction
2. Classical meteorology
3. Interpretation of satellite images
3.1 Images in the visible spectrum
3.2 Images in the thermal infrared
3.3 Images of water vapor
3.4 Compositions RGB
4. The weather radar
4.1 Propagation of the microwave into the atmosphere
4.2 The radar equation
4.3 Observations of the Doppler radar

RS & OCEANOGRAPHY. TECHNIQUES & EXAMPLES

1. Introduction
2. Fundamentals of Oceanography
2.1 Descriptive oceanography
2.2 Dynamic oceanography
2.3 Remotely observable phenomena
3. Observation with passive sensors
3.1 Observation in the visible spectrum
3.2 Observation in the infrared spectrum
3.3 Observation in the microwave spectrum
4. Observation with active sensors
4.1 Generalities
4.2 The dispersometer
4.3 The SAR
4.4 The altimeter
5. Application: sea currents

RS & GEOLOGY. TECHNIQUES & EXAMPLES

Contents based on a series of guided practical exercises dedicated to showing examples of the use of Remote Sensing in the monitoring of volcanoes, episodes of floods, monitoring of the evolution of snow and ice, etc.

RS & VEGETATION. TECHNIQUES & EXAMPLES

1. The problematic thematic/spectral classes. Land uses and land coverings.
2. Specific techniques.
2.1 Spectral separability
2.2 Vegetation indexes
2.3 Tasseled Cap Transformation.
3. Prevention of forest fires.
4. Active fire.
5. Techniques of analysis of changes in time.
5.1 Assessment of burnt surfaces.
5.2 Studies of regeneration of vegetation after forest fires.
6. Analysis and multitemporal classification of roofs (example of crops)
6.1 Spectral signatures
6.2 Phenology and temporary signatures
6.3 Classification
6.4 Analysis of changes
6.5 Enrichment of databases
7. Examples of practical applications

Methodology

In this module there are 3 groups of learning activities:

Targeted activities consist of classes of theory and practices that will be carried out in a specialized computer room. At the beginning of each of the subjects that make up the module, the teachers will explain the structure of the theoretical-practical contents, as well as the evaluation method.

Supervised activities consist of classroom practices that will allow you to prepare the work and exercises of each subject, as well as tutorial sessions with the teachers in case the students request it.

Autonomous activities are a set of activities related to the elaboration of works, exercises and exams, such as the study of different material in the form of journal articles, reports, data, etc., defined according to the needs of autonomous work of each student.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Master classes / exhibitions	48	1.92	3, 1, 5, 4, 2, 7, 6
Type: Supervised			
Classroom practices	60	2.4	3, 1, 5, 4, 2, 7, 6

Tutorials	4	0.16	3, 1, 5, 4, 2, 7, 6
Type: Autonomous			
Personal study	22	0.88	3, 1, 5, 4, 2, 7, 6
Personal study	90	3.6	3, 1, 5, 4, 2, 7, 6

Assessment

The evaluation of this subject consists of the following system:

a) The realization of 1 exam, that will be between 10 % and 20 % of the final mark and that will include the theoretical and practical contents carried out. An exam not reaching the minimum mark of 5 out of 10 must be repeated the day assigned by the teacher of the subject.

b) The accomplishment of different practical works proposed throughout the teaching of the module and delivered within the fixed term, that will be between 80 % and 90 % of the final mark. A correct formal presentation and careful preparation will be taken to account.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Practical works	80 %- 90 %	0	0	3, 1, 5, 4, 2, 7, 6
Theoretical exam	10 %- 20 %	1	0.04	3, 1, 5, 4, 2, 7, 6

Bibliography

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Software

MiraMon, ArcGIS, QGIS, BILKO, SNAP, Office Microsoft