VNIVERSITAT DE VALÈNCIA

Course Guide
36446 Spatial and geographical analysis

COURSE DATA

Data Subject	
Code	36446
Name	Spatial and geographical analysis
Cycle	Grade
ECTS Credits	4.5
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1406 - Degree in Data Science	School of Engineering	4	First term

Subject-matter

Degree	Subject-matter	Character
1406 - Degree in Data Science	23 - Spatial and Geographical Analysis	Optional

Coordination

Name	Department
LOPEZ QUILEZ, ANTONIO MANUEL	130 - Statistics and Operational Research

SUMMARY

The subject Spatial and Geographic Analysis provides the necessary knowledge to address the analysis of geographic information and the inference and prediction in spatial statistical models. The main purpose is to distinguish the type of spatial data, classified into geostatistical data, point patterns and lattice data. The representation and treatment of geographic information are essential tools for the professional specialized in spatial data. For each type of data, specific objectives are raised, models are designed and appropriate methods are used.
The theory classes will be taught in Spanish and the practical and laboratory classes will be taught according to the subject description available in the web page of the Degree.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

The previous training in probability, simulation, inference, Bayesian methods, linear models and time series provided by various compulsory subjects various compulsory subjects allows the students to follow the contents of the program adequately.

OUTCOMES

1406 - Degree in Data Science

- (CG03) Capability to elaborate models, calculations, reports, to plan tasks and other works analogous to the specific field of data science.
- (CG05) Analysis and synthesis capability in the preparation of reports and in the defence of ideas.
- (CG07) Ability to autonomously make decisions and to properly and originally elaborate reasoned arguments, in order to obtain reasonable and contrastable hypotheses.
- (CT05) Ability to evaluate the advantages and disadvantages of different methodological and / or technological alternatives in different fields of application.
- (CE05) To understand the most relevant fields of application of data science and understand how data science is used to base and perform decision-making based on data
- (CE15) Ability to model and analyse the uncertainty in data-based studies, as well as to know how to interpret and contextualise the results obtained.
- (CB2) Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- (CB4) Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- (CB5) Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.

LEARNING OUTCOMES

To know how to organize, store, model and analyze spatial data (CG03, CG07, CT05).
To understand data with different spatial distributions (CG05, CB5, CE05).
To identify complete spatial randomness (CB2, CB4, CE05).
To understand variograms (CB2, CB4, CE05).
To understand hierarchical Bayesian models with spatial smoothing for mapping disease or other relevant events (CB2, CB4, CE05).

DESCRIPTION OF CONTENTS

1. Types of spatial data

Geostatistical data.
Point patterns.
Lattice data.

2. Spatial representation

Spatial variability.
Spatial relationships.
Exploratory analysis of spatial data.
Elaboration of maps.
Geographical projections.
Integration of spatial elements.

3. Geographic Information Systems

Geographic Information.
GIS functionality.
Types of geographic data.
Statistical integration in GIS.

4. Geostatistics

Continuous stationary processes.
Variogram estimation.
Structure of spatial variability.
Spatial prediction.
Bayesian Kriging.

5. Point patterns

Exploration of point patterns.
Point processes.
Models of point processes.
Inference in point patterns.
Bayesian Cox processes.

6. Lattice data

Exploratory analysis of lattice data.
Markov random fields.
Automodels.
Inference in Markovian random fields.
Spatial smoothing models.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	24,00	100
Laboratory practices	15,00	100
Classroom practices	6,00	100
Development of group work	20,00	0
Development of individual work	10,00	0
Study and independent work	10,00	0
Readings supplementary material	2,50	0
Preparation of evaluation activities	10,00	0
Preparing lectures	5,00	0
Preparation of practical classes and problem	5,00	0
Resolution of case studies	5,00	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

MD1 - Theoretical activities. Expository development of the subject with the participation of the students in the resolution of specific questions. (CG05, CG07, CB5, CE05).
MD2 - Practical activities. Learning by solving problems, exercises and case studies through which competences on the different aspects of the subject are acquired (CG03, CB4, CE15).
MD4 - Laboratory and/or computer classroom work. Learning through the realization of activities developed individually or in small groups and carried out in laboratories and/or computer classrooms (CT05, CE05, CE15).

EVALUATION

SE2 - Evaluation of the practical activities based on the elaboration of the results reports. This section of the evaluation will count for 80% of the final grade of the course. (CG03, CG05, CG07, CB4, CB5, CT05, CE05, CE15).
SE3 - Continuous evaluation, based on the participation and degree of involvement of the student in the teaching-learning process, based on the resolution of questions proposed periodically. This section of the

evaluation will count for 20% of the final grade of the course and is not recoverable. (CG03, CG05, CG07, CB4, CB5, CT05, CE05, CE15).

REFERENCES

Basic

- Banerjee S, Carlin BP, Gelfand AE (2014) Hierarchical Modeling and Analysis for Spatial Data, Second Edition. Chapman & Hall
- Bivand RS, Pebesma EJ, Gómez-Rubio V (2013) Applied Spatial Data Analysis with R, Second Edition. Springer
- Cressie N (2015) Statistics for spatial data, Revised Edition. Wiley
- Diggle P. (2013) Statistical Analysis of Spatial and Spatio-Temporal Point Patterns, Third Edition. Chapman & Hall.

Additional

- Blangiardo M., Cameletti M. (2015) Spatial and Spatio-temporal Bayesian Models with R-INLA. Wiley.
- Lawson A.B. (2001) Statistical methods in spatial epidemiology. Wiley.
- Schabenberger O., Gotway C.A. (2004) Statistical Methods for Spatial Data Analysis. Chapman & Hall.