Course guide
200633 - EE - Spatial Epidemiology

Last modified: 09/06/2023

Unit in charge:	School of Mathematics and Statistics
Teaching unit:	1004 - UB - (ENG)Universitat de Barcelona.

Degree:	MASTER'S DEGREE IN STATISTICS AND OPERATIONS RESEARCH (Syllabus 2013). (Optional subject).

Academic year: 2023   **ECTS Credits:** 5.0   **Languages:** English

LECTURER

Coordinating lecturer:	ROSA Mª ABELLANA SANGRÀ
Others:	Primer quadrimestre:
	ROSA Mª ABELLANA SANGRÀ - A
	JOSEP LLUÍS CARRASCO JORDAN - A

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

4. CE-1. Ability to design and manage the collection of information and coding, handling, storing and processing it.

5. CE-2. Ability to master the proper terminology in a field that is necessary to apply statistical or operations research models and methods to solve real problems.

6. CE-5. Ability to formulate and solve real problems of decision-making in different application areas being able to choose the statistical method and the optimization algorithm more suitable in every occasion.
Translate to english

7. CE-6. Ability to use appropriate software to perform the necessary calculations in solving a problem.

8. CE-7. Ability to understand statistical and operations research papers of an advanced level. Know the research procedures for both the production of new knowledge and its transmission.

9. CE-8. Ability to discuss the validity, scope and relevance of these solutions and be able to present and defend their conclusions.

10. CE-9. Ability to implement statistical and operations research algorithms.

Transversal:

1. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

2. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

3. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

The main concepts of each topic will be treated in the classes and illustrated by real data examples. Furthermore, supplementary stuff will be available for students to complement the concepts treated in the classes.

LEARNING OBJECTIVES OF THE SUBJECT

When the student finishes the course, he or she should be able to:
- Identify the spatial structure type of a data set.
- Use the tools for exploratory spatial data analysis.
- Interpolate geostatistical data.
- Adjust models for lattice data with spatial correlation.
- Identify the pattern of spatial structure in point data.

STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	12.00
Hours large group	30,0	24.00
Self study	80,0	64.00

Total learning time: 125 h

CONTENTS

1. GEOSTATISTICS

Description:
1.1. Introduction. Various Examples.
1.2. Exploratory Analysis for Geostatsitical Data.
1.3. Variograms: Modelization and Estimates.
1.4. Spatial Prediction and Kriging.

Full-or-part-time: 41h 40m
Theory classes: 10h
Practical classes: 5h
Self study : 26h 40m

2. LATTICE DATA

Description:
2.1. Introduction. Examples.
2.2. Definitions of the proximity matrix
2.3. Exploratory Data Analysis: definitions of the proximity matrix, measurements of spatial association
2.4. Autoregressive models and heterogeneity spatial models. Definition, specifications and Properties
2.7. Bayesian Estimation, Gibbs Sampling Algorithm. Convergence diagnostic.

Full-or-part-time: 41h 40m
Theory classes: 10h
Practical classes: 5h
Self study : 26h 40m

3. SPATIAL POINT PROCESSES

Description:
3.1. Introduction. Various Examples.
3.2. Basic Theory of Point Processes
3.3. Exploratory Data Analysis (EDA) for Point Processes
3.4. Models of Point Processes

Full-or-part-time: 41h 40m
Theory classes: 10h
Practical classes: 5h
Self study : 26h 40m

GRADING SYSTEM

Continuous evaluation

The evaluation of the subject is done through several activities:

-Exercises (70% of the final grade): In each of the blocks that make up the subject, students have to solve some exercises, which must be completed within a certain period that will be announced during the course. The exercises are scored between 0 and 10, and the average of these qualifications is the exercise grade.

-Summary exam (30% of the final grade). The test is a multiple-choice test on theoretical and practical concepts of the entire programme of the subject. The exam consists of 15 questions, and incorrect answers are penalized. The test receives a score between 0 and 10.

The final grade for the course is calculated as the weighted average between the grade of the exercises (70%) and the grade of the summary test (30%).
To pass the subject, the final mark must be higher than 5.

Single evaluation

Students who want to take the single assessment must notify the coordinator of the subject during the first 15 days of class those of the subject.
The single assessment consists of a summary test that encompasses the entire syllabus of the subject. The test receives a score between 0 and 10 and corresponds to the final grade for the subject.
To pass the subject, the final mark must be higher than 5.

BIBLIOGRAPHY

Basic:
- Gelfand, Alan. Handbook of spatial statistics. Boca Raton: CRC Press, cop. 2010. ISBN 9781420072877.
- Banerjee, Sudipto; Carlin, Bradley P.; Gelfrand, Alan E. Hierarchical modelling and analysis for spatial data. Boca Raton: Chapman & Hall/CRC, 2004. ISBN 158488410X.
- Bivand, Roger; Pebesma, Edzer J.; Gómez-Rubio, Virgilio. Applied spatial data analysis with R [on line]. New York: Springer, cop. 2008 [Consultation: 07/06/2023]. Available on: https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007/978-1-4614-7618-4. ISBN 9780387781709.
- Cressie, Noel A. C. Statistics for spatial data. Rev. ed. New York: John Wiley and Sons, cop. 1993. ISBN 0471002550.
- Diggle, Peter. Statistical analysis of spatial point patterns. 2nd ed. Hodder Arnold, 2003. ISBN 0340740701.
- Elliott, P. [et al.]. Spatial epidemiology : methods and applications. Oxford University Press, 2000. ISBN 0192629417.
- Baddeley, Adrian; Rubak, Ege; Turner, Rolf. Spatial point patterns : methodology and applications with R. CRC Press, 2016. ISBN 9781482210200.

RESOURCES

Computer material:
- WinBUGS. WinBUGS is part of the BUGS project, which aims to make practical MCMC methods available to applied statisticians.
http://www.mrc-bsu.cam.ac.uk/bugs/winbugs/contents.shtml- R. R is a free software environment for statistical computing and graphics.
http://www.r-project.org/