Course guides
200633 - EE - Spatial Epidemiology

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: 2020  ECTS Credits: 5.0  Languages: English

LECTOR
Coordinating lecturer: JOSEP LLUÍS CARRASCO JORDAN
Others: Primer quadrant: 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.
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

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>30.0</td>
<td>24.00</td>
</tr>
<tr>
<td>Self study</td>
<td>80.0</td>
<td>64.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15.0</td>
<td>12.00</td>
</tr>
</tbody>
</table>

Total learning time: 125 h

CONTENTS

1. GEOSTATISTICS

Description:
1.1. Introduction. Various Examples.
1.2. Exploratory Analysis for Geostatistical 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

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

Students must solve some exercises at the end of each of the three blocks that make up the subject. These exercises must be delivered within a certain period to be announced during the course. The three exercises will be scored between 0 and 10, and the average of these three qualifications will be the exercise mark (NEJ).

Additionally, a test will be programmed with multiple choice questions at the end of the course that will include the complete syllabus of the subject. The qualification of this test (NPE) will be between 0 and 10.

The final grade of the subject will be calculated as the average of NPE and NEJ.

The subject is considered approved if the final grade is higher than 5.

BIBLIOGRAPHY

Basic:
- Gelfand, Alan; Diggle, Peter; Fuentes, Montserrat; Guttorp, Peter. Handbook of spatial statistics. CRC Press, 2010.

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/