Course guide
295601 - AB - Biostatistical Learning

Unit in charge: Barcelona East School of Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR’S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Optional subject).

Academic year: 2023  ECTS Credits: 6.0  Languages: Spanish

LECTURER

Coordinating lecturer: JOSE JULIAN RODELLAR BENEDE

Others: Segon quadrimestre:
ANDREA MILENA ACEVEDO LIPES - M11
FRANCESC POZO MONTERO - M11
JOSE JULIAN RODELLAR BENEDE - M11
YOLANDA VIDAL SEGUI - M11

PRIOR SKILLS

Programming course. Basic statistical concepts and tools.

REQUIREMENTS

None

TEACHING METHODOLOGY

The course is developed through four hours per week: half correspond to theoretical lectures and half to laboratory sessions, supervised works and a final exam.
The teaching activities are distributed as follows:
- Theory lectures: 20%
- Computer sessions and works: 20%
- Autonomous learning: 60%

LEARNING OBJECTIVES OF THE SUBJECT

Objectives proposed for the course:
Understand the basic theory of machine learning
Formulate statistical learning problems related to different biomedical applications
Understand a wide range of statistical learning algorithms along with their advantages and limitations
Implement statistical learning algorithms to solve biomedical problems with moderate complexity
Compare the performance of several techniques and recommend those that better fit to the proposed problems
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours small group</td>
<td>30,0</td>
<td>20.00</td>
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<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>90,0</td>
<td>60.00</td>
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</tbody>
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Total learning time: 150 h

CONTENTS

1. Introduction

Description:

Specific objectives:
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Related activities:
Theory lectures 1 and 2
Lab 1: Introduction to Python, Numpy and Pandas

Full-or-part-time: 12h
Theory classes: 4h
Laboratory classes: 2h
Self study: 6h

2. Linear regression

Description:
Linear regression model. Least squares. Statistical significance.

Specific objectives:
.

Related activities:
Theory lecture 3
Lab 2: linear regression with Python

Full-or-part-time: 8h
Theory classes: 2h
Laboratory classes: 2h
Self study: 4h
3. Classification

Description:

Specific objectives:

Related activities:
Theory lectures 4 and 5
Lab 3: logistic regression and linear discriminant analysis
Work 1

Full-or-part-time: 21h
Theory classes: 4h
Laboratory classes: 2h
Guided activities: 2h
Self study: 13h

4. Re-sampling methods

Description:
Cross validation. Bootstrap

Specific objectives:

Related activities:
Theory lecture 6
Lab 6: Cross validations and bootstrap

Full-or-part-time: 8h
Theory classes: 2h
Laboratory classes: 2h
Self study: 4h

5. Linear model selection and regularization

Description:

Specific objectives:

Related activities:
Theory lectures 7 and 8
Lab 5: regression and nearest neighbours method
Lab 6: dimension reduction

Full-or-part-time: 16h
Theory classes: 4h
Laboratory classes: 4h
Self study: 8h
### 6. Tree-based methods

**Description:**

**Specific objectives:**

**Related activities:**
Theory lectures 9 and 10
Lab 7: Tree methods for classification and regression
Work 2

**Full-or-part-time:** 21h
Theory classes: 4h
Laboratory classes: 2h
Guided activities: 2h
Self study : 13h

### 7. Support vector machines

**Description:**
Maximal margin classifier. Support vector machines (SVM). Classification of more than two classes.

**Related activities:**
Theory lectures 11 and 12
Lab 8: Applications of SVM
Work 3

**Full-or-part-time:** 20h
Theory classes: 4h
Laboratory classes: 2h
Guided activities: 2h
Self study : 12h

### 8. Neural networks

**Description:**

**Specific objectives:**

**Related activities:**
Theory lectures 13 and 14
Lab 9: Implementation of neural networks
Work 4

**Full-or-part-time:** 20h
Theory classes: 4h
Laboratory classes: 2h
Guided activities: 2h
Self study : 12h
9. Non-supervised learning

Description:

Specific objectives:
.

Related activities:
Theory lecture 15
Lab 10: Applications of clustering methods
Exam

Full-or-part-time: 24h
Theory classes: 16h
Laboratory classes: 2h
Guided activities: 2h
Self study: 4h

GRADING SYSTEM
Continuous evaluation along the course by means of practical works. By the end of the course the student will pass a final complementary exam.

EXAMINATION RULES.
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BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

Other resources:
Materials available in ATENEA by the instructors