Course guides
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: 2019  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 recomend those that better fit to the proposed problems
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>20.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>90,0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

1. Introduction

Description:

Specific objectives: 
.

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.

BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

Other resources:
Materials available in ATENEA by the instructors