Course guide
270216 - IPA - Introduction to Audiovisual Processing

Unit in charge: Barcelona School of Informatics
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.
Degree: BACHELOR'S DEGREE IN DATA SCIENCE AND ENGINEERING (Syllabus 2017). (Compulsory subject).
Academic year: 2022 ECTS Credits: 6.0 Languages: Catalan

LECTURER
Coordinating lecturer: FERNANDO MARQUES ACOSTA
Others: Segon quadrimestre:
FERNANDO MARQUES ACOSTA - 11, 12, 13
FRANCESC REY MICOULAU - 11, 12, 13

PRIOR SKILLS
The knowledge acquired in the subjects of the degree in previous semesters

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE5. Design and apply techniques of signal processing, choosing between different technological tools, including those of Artificial vision, speech recognition and multimedia data processing.

General:
CG1. To design computer systems that integrate data of provenances and very diverse forms, create with them mathematical models, reason on these models and act accordingly, learning from experience.
CG2. Choose and apply the most appropriate methods and techniques to a problem defined by data that represents a challenge for its volume, speed, variety or heterogeneity, including computer, mathematical, statistical and signal processing methods.
CG5. To be able to draw on fundamental knowledge and sound work methodologies acquired during the studies to adapt to the new technological scenarios of the future.

Transversal:
CT6. Autonomous Learning. Detect deficiencies in one’s own knowledge and overcome them through critical reflection and the choice of the best action to extend this knowledge.

Basic:
CB4. That the students can transmit information, ideas, problems and solutions to a specialized and non-specialized public.
CBS. That the students have developed those learning skills necessary to undertake later studies with a high degree of autonomy

TEACHING METHODOLOGY
The subject is based on classroom theory classes, problems and laboratory. The theory classes follow the program defined in this teaching guide. Within the lectures, the dialogue between professors and students is promoted by proposing exercises and activities to be carried out jointly based on particular aspects of the topic being dealt with. The laboratory classes exemplify the contents developed in the theory classes.
LEARNING OBJECTIVES OF THE SUBJECT

1. Know how to characterize stochastic processes
2. Understand and know how to use the most common signal transforms and their application
3. To obtain basic optimal and adaptive filtering background for audiovisual data applications

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>90.0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>30.0</td>
<td>20.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30.0</td>
<td>20.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

**Statistical Signal modelling**

**Description:**

**Estimation Theory**

**Description:**
(1) Parameter Estimation: Concept, quality measures and types of estimators

(2) Function estimators: Autocorrelation and Power Density Espectral estimation

**Optimal filter and adaptive filter**

**Description:**

**Transforms**

**Description:**
Frequency analysis: (1) Discrete Cosinus transform (DCT), (2) Short-time Fourier Transform. Interpretation as a filter bank. Window effect. Reconstruction. Spectrogram.

## ACTIVITIES

### Unit 1

**Description:**
Theory, exercise and laboratory classes corresponding to Unit 1

**Specific objectives:**
1

**Related competencies:**
CG5. To be able to draw on fundamental knowledge and sound work methodologies acquired during the studies to adapt to the new technological scenarios of the future.

CG1. To design computer systems that integrate data of provenances and very diverse forms, create with them mathematical models, reason on these models and act accordingly, learning from experience.

CE5. Design and apply techniques of signal processing, choosing between different technological tools, including those of Artificial vision, speech recognition and multimedia data processing.

CB4. That the students can transmit information, ideas, problems and solutions to a specialized and non-specialized public.

CB5. That the students have developed those learning skills necessary to undertake later studies with a high degree of autonomy

**Full-or-part-time:** 42h 12m

- Theory classes: 10h 18m
- Practical classes: 3h 42m
- Laboratory classes: 2h 18m
- Guided activities: 2h 18m
- Self study: 23h 36m

### Unit 2

**Description:**
Theory, exercise and laboratory classes corresponding to Unit 2

**Specific objectives:**
2

**Related competencies:**
CG2. Choose and apply the most appropriate methods and techniques to a problem defined by data that represents a challenge for its volume, speed, variety or heterogeneity, including computer, mathematical, statistical and signal processing methods.

CE5. Design and apply techniques of signal processing, choosing between different technological tools, including those of Artificial vision, speech recognition and multimedia data processing.

CT6. Autonomous Learning. Detect deficiencies in one’s own knowledge and overcome them through critical reflection and the choice of the best action to extend this knowledge.

CB4. That the students can transmit information, ideas, problems and solutions to a specialized and non-specialized public.

CB5. That the students have developed those learning skills necessary to undertake later studies with a high degree of autonomy

**Full-or-part-time:** 63h 30m

- Theory classes: 15h 24m
- Practical classes: 5h 36m
- Laboratory classes: 3h 24m
- Guided activities: 3h 42m
- Self study: 35h 24m
Unit 3

Description:
Theory, exercise and laboratory classes corresponding to Unit 3

Specific objectives:
3

Related competencies:
CG5. To be able to draw on fundamental knowledge and sound work methodologies acquired during the studies to adapt to the new technological scenarios of the future.
CE5. Design and apply techniques of signal processing, choosing between different technological tools, including those of Artificial vision, speech recognition and multimedia data processing.
CT6. Autonomous Learning. Detect deficiencies in one’s own knowledge and overcome them through critical reflection and the choice of the best action to extend this knowledge.
CB4. That the students can transmit information, ideas, problems and solutions to a specialized and non-specialized public.
CB5. That the students have developed those learning skills necessary to undertake later studies with a high degree of autonomy.

Full-or-part-time: 42h 12m
- Theory classes: 10h 18m
- Practical classes: 3h 42m
- Laboratory classes: 2h 18m
- Guided activities: 2h 18m
- Self study: 23h 36m

GRADING SYSTEM

The final mark is obtained from the partial marks:
- Mid-term exam: M (25%)
- Final exam: F (60%)
- Laboratory assignments: L (15%)

Mark = max (0.6F+0.25P+0.15L ; 0.85F+0.15L; 0.75F+0.25P; 1.0F)

In the case of a re-evaluation exam (R), the final mark is

Mark = max(0.85R+0.15L; 1.0R)

BIBLIOGRAPHY

Basic:

Complementary:
- Marqués, F.; Rey, F. Introduction to Audiovisual Processing. Notes de classe.