

30379 - Digital Signal Processing Applications

Syllabus Information

Academic year: 2023/24

Subject: 30379 - Digital Signal Processing Applications

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 581 - Bachelor's Degree in Telecommunications Technology and Services Engineering

ECTS: 6.0

Year: 4

Semester: First semester

Subject type: Optional

Module:

1. General information

The purpose of this subject is that the student acquires knowledge and advanced methodologies for the development and evaluation of statistical signal processing systems and neural networks. Emphasis is placed on the use of the systems studied in concrete applications, as well as practical considerations of their implementation. The fundamental applications considered are signal processing in communications systems, speech processing systems, biomedical signal processing, radar and image processing.

These approaches and objectives are aligned with some of the Sustainable Development Goals (SDGs) of the Agenda 2030 (<https://www.un.org/sustainabledevelopment/es/>). The acquisition of the learning results of the subject will contribute, to some extent, to the achievement of target 8.2 of Goal 8 and target 9.5 of Goal 9.

2. Learning results

- Know the peculiarities, similarities and differences of various types of one-dimensional and multidimensional signals (visual information signals, voice, sound, radar, biological signals...).
- Know several fields of application of digital signal processing and understand the problems that arise in each of them, identifying the basic signal processing tasks that can help to solve them.
- Know how to apply basic methods of signal modeling and parameter estimation.
- Know how to apply basic event detection methods.
- Know how to apply optimal linear filtering systems.
- Know how to implement and apply on signals the studied techniques of digital signal processing as well as how to interpret the results obtained.

3. Syllabus

The following contents will be worked on in the classroom classes:

1. Signal modeling and optimal parameter estimation.
2. Optimal event detection methods.
3. Signal processing using neural networks.

In the practical classes the following contents will be worked on, using different types of signals (image, voice, audio, radar, biomedical signals), and there may be modifications from one year to another.

- Sequence comparison and detection with Dynamic Time Warping.
- LPC voice coding.
- Parameter estimation and detection.
- Optimal linear filtering.
- Neural networks for signal processing.
- Preprocessing of the ECG signal and study of heart rate variability.
- Time-frequency processing.

4. Academic activities

A1. Participative lectures (26 hours).

A2. Problem solving and case studies (10 hours).

A3. Laboratory practices (24 hours). This activity will be carried out in a computer classroom. It will comprise 12 sessions of 2 hours each. Prior to each session, students will conduct and will submit a pre-study to familiarize themselves with the concepts that will be covered in practice. After the completion of the practice, students will be asked to answer a questionnaire to evaluate it.

A4: Tutoring.

A5: Work and personal study. (85 hours)

A6. Assessment (5 hours).

5. Assessment system

Ordinary assessment

- **E1: Written tests (65%).** Final exam, consisting of open-ended questions and multiple-choice questions . In order to pass the subject a minimum of 4 out of 10 will be required in this part. During the term partial tests may be taken, which in the case of being approved, will exempt the student from taking the corresponding part of the final exam, incorporating the grade of the partial test to the final exam grade.
- **E2: Practices assessment (35%)** This will be done through the requested documentation (previous studies, results reports) and the observation of the performance and attitude in the laboratory.

Single global test. Students are entitled to be evaluated in a single global test that will take place on the date assigned by the center for the final exam and in which the aspects evaluated in E2 will also be evaluated.

The assessment of the second call will consist of a single overall written test that will take place in the period established for this purpose.