

69320 - Advanced treatment of biomedical signals

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	547 - Master's in Biomedical Engineering
ECTS	3.0
Course	1
Period	Second semester
Subject Type	Optional
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

The course combines theoretical and practical activities in the classroom, computer room and through personal work. Classroom activities consist of 22 hours of participatory lectures, where theoretical aspects are presented as well as practical examples, demonstrations and problems. The course also has 6 hours of practical exercises in the computer room. In addition, a practical supervised work will be done, consisting in the programming, analysis and study of methods for biomedical signal processing on a set of biomedical signals.

5.2.Learning activities

69320 - Advanced treatment of biomedical signals

The learning process is based on the following activities:

A01 Participative lectures (22 hours). Presentation by the lecturer of the main contents of the course. This activity will take place in the classroom. They will include practical examples, demonstrations and problem solving.

A03 Computer lab sessions (6 hours). Three two-hour practical sessions are held in a computer room. The students must submit a report of the practical work, which will be evaluated (E3).

A05 Supervised practical assignment or research application (20 hours). A task will be assigned consisting on programming, studying and analysing biomedical signal processing methods on a set of signals provided to the student. The student will show the degree of acquisition of skills relevant to the subject and provide interpretations of the results. The evaluation (E2) will take into account the submitted report as well as the suitability and originality of the proposed solution.

A06 Office tutor hours . Time for personalized attention to students with the aim of reviewing and discussing the materials and topics presented in both theoretical and practical classes.

A08 Evaluation (2 hours). Final written test and presentation of assignments and tasks. The details can be found in the section on evaluation activities.

5.3.Program

1. Basics of statistical signal processing.

2. Parameter estimation and detection of events. Applications: Averaging, EMG analysis, delays, heart rate variability, event detection, detection of T-wave alternans ... Methods: Parameter estimation. Bias and variance. Optimal estimation (maximum likelihood, least squares, Bayesian methods). optimal detection. MAP criterion. GLRT.

3. Optimal and adaptive filtering. Applications: filtering and noise cancellation, source separation, adaptive estimation. Methods: Wiener Filtering, Adaptive Filtering Algorithms (LMS).

4. Signal processing methods (PCA, ICA). Applications: single-trial EP Analysis, Separation of fetal ECG. Methods: Principal component analysis (PCA and transformed KL), Independent component analysis (ICA).

5. Time-frequency representation. Applications: Removing noise, signal segmentation, cardiorespiratory coupling. Methods: Short-time Fourier Transform, Spectrogram, wavelet transform.

5.4.Planning and scheduling

The schedule of the course, both of the sessions in the classroom and the computer laboratory sessions, will be determined by the academic calendar established by the EINA. The schedule for submission of reports shall be announced at the beginning of the course.

5.5.Bibliography and recommended resources

BB

Rangayyan, R.M . Biomedical signal analysis: A case-study approach / Rangayyan, R.M Wiley-Interscience, 2002

BB

Sörnmo, Leif. Bioelectrical signal processing in cardiac and neurological

69320 - Advanced treatment of biomedical signals

- applications / Leif Sörnmo, Pablo Laguna
Burlington [Massachusetts] : Elsevier,
Academic Press, cop. 2005
- BC** Hayes, Monson H.. Statistical digital signal
processing and modeling / Monson H.
Hayes New York [etc.] : John Wiley and
Sons, cop. 1996
- BC** Kay, Steven M.. Fundamentals of
statistical signal processing : Estimation
theory / Steven M. Kay Englewood Cliffs,
New Jersey : Prentice Hall International,
cop. 1993
- BC** Manolakis, Dimitris G.. Statistical and
adaptive signal processing : spectral
estimation, signal modeling, adaptive
filtering and array processing / Dimitris G.
Manolakis, Vinay K. Ingle, Stephen M.
Kogon Boston [etc.] : McGraw Hill, 2000
- BC** Zelniker, Glenn. Advanced digital signal
processing : Theory and applications /
Glenn Zelniker, Fred J. Taylor New York
[etc.] : Marcel Dekker, cop. 1994