Academic Year/course: 2021/22

69720 - Advanced biomedical signal processing

Syllabus Information

Academic Year: 2021/22
Subject: 69720 - Advanced biomedical signal processing
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 633 -
ECTS: 3.0
Year: 2 and 1
Semester: Second semester
Subject Type: Optional
Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures where the main contents are presented and discussed; practice sessions with practical examples, demonstrations and problems; autonomous work; and an assignment consisting on the programming, analysis and study of methods for biomedical signal processing on a set of biomedical signals.

4.2. Learning tasks

The course will address the following topics:

1. Basics of statistical signal processing.
2. Parameter estimation and detection of events. Applications: Averaging, EMG analysis, delays, heart ratevariability, 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, adaptiveestimation. 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, cardiorespiratorycoupling. Methods: Short-time Fourier Transform, Spectrogram, wavelet transform

4.3. Syllabus

The course will address the following topics:

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

4.4. Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website.

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=69720