Last update: 06-05-2019

230375 - GSP - Graph Signal Processing

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 739 - TSC - Department of Signal Theory and Communications

Academic year: 2019

Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Teaching unit Optional)

ECTS credits: 3 Teaching languages: English

Teaching staff

Coordinator: Alba Pagès zamora

Others: Alba Pagès Zamora

Prior skills

Basic knowledge of matrix analysis, Fourier transform, and signal filtering.
Basic knowledge of programming in Matlab.

Degree competences to which the subject contributes

Specific:

CE1. Ability to apply information theory methods, adaptive modulation and channel coding, as well as advanced techniques of digital signal processing to communication and audiovisual systems.

Transversal:

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

Teaching methodology

- Theoretical lectures.
- Practical sessions in Matlab, and presentation of proposed problems.
- Preparation and presentation of a final project.

Learning objectives of the subject

Graphs are useful for representing data obtained in numerous applications such as, for example, traffic evolution in a transport network, temperature values in different geographic locations, information dissemination in social networks or functional activities in the brain. The representation, analysis and compression of such data is a challenging task and requires the development of new tools that can identify and adequately exploit the structure of the data.
In this course, students will become familiar with the framework of "Graph Signal Processing", a discipline useful for processing data lying on a graph and that extends basic concepts of signal processing to graphs, such as frequency domain and filtering. Hand-out sessions will provide students with practical skills in the analysis of data in graphs.

Last update: 06-05-2019

230375 - GSP - Graph Signal Processing

Study load

Total learning time: 75h	Hours large group:	16h	21.33%
	Hours small group:	8h	10.67%
	Self study:	51h	68.00%

Last update: 06-05-2019

230375 - GSP - Graph Signal Processing

Content

Introduction

Learning time: 2h
Theory classes: 1h
Self study : 1h

Description:
Course organization. Motivation and main applications of graph signals.

Graph Theory

Learning time: 9h 30m
Theory classes: 2h 30m
Practical classes: 1h
Self study : 6h

Description:
Graph Definition. Laplacian matrix and spectral properties.

Related activities:
Practical session: spectral clustering

Graph Signals

Learning time: 9h
Theory classes: 1h 30m
Practical classes: 1h 30m
Self study : 6h

Description:
Definition of graph signals. Graph Fourier Transform. Convolution of two graph signals.

Related activities:
Practical session: Frequency domain in graphs.

Graph Systems and Filtering of Graph Signals

Learning time: 11h 30m
Theory classes: 2h 30m
Practical classes: 2h
Self study : 7h

Description:
Graph linear systems and graph filters. Examples of graph filters: Shift Operator and Polynomial graph filters.

Related activities:
Practical session: denoising in graph signals.

Last update: 06-05-2019

230375 - GSP - Graph Signal Processing

Applications of graph signal processing	Learning time: 15h Theory classes: 3h Practical classes: 2h Self study : 10h

Description:
Random processes in graphs. Graph sampling. Topology learning.

Related activities:
Practical session: topology learning.

Final Project	Learning time: 28h Theory classes: 4h Practical classes: 3h Self study : 21h

Description:
Personal work of one application.

Related activities:
Guided practical session. Presentation of project results

Qualification system

- Attendance is mandatory.
- Participation in class (20%).
- Problems and/or group or individual presentation (80%).

Regulations for carrying out activities

There is no final exam.

Bibliography

Others resources:

Lecture slides.
Matlab graph toolbox and practical session guide.