Last update: 06-05-2019

230620 - DIVP - Digital Image and Video 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 ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Teaching unit Optional)
MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
MASTER'S DEGREE IN INFORMATION AND COMMUNICATION TECHNOLOGIES (Syllabus 2009). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: PHILIPPE SALEMBIER

Others: Philippe Salembier

Prior skills

Basic knowledge in signal and systems and signal processing.

Degree competences to which the subject contributes

Specific:

1. 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.
2. Ability to design and dimension transport, broadcast and distribution networks for multimedia signals
3. Ability to integrate Telecommunication Engineering technologies and systems, as a generalist, and in broader and multidisciplinary contexts, such as bioengineering, photovoltaic conversion, nanotechnology and telemedicine.
4. Ability to model, design, implement, manage, operate, administrate and maintain networks, services and contents

Transversal:

5. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.
6. 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.
7. 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

- Lectures
- Individual work (distance)
- Exercises
- Short answer test (Control)
- Extended answer test (Final Exam)

Learning objectives of the subject

Last update: 06-05-2019

230620 - DIVP - Digital Image and Video Processing

Learning objectives of the subject:

This course provides a general view of basic techniques for digital image and video processing. The study of these techniques is based on different models of the image and the type of applications targeted by each model. Topics covered in the course are linear and non-linear filtering, enhancement and restoration, coding as well as vision systems and industrial and biomedical applications. The analysis of still images is considered first and, then, it is extended to the case of image sequences (video).

Learning results of the subject:

- Ability to understand, use, design or specify basic image or video processing algorithm in the context of a complete application.
- Knowledge about the most popular image processing tools.

Study load

Total learning time: 125h	Hours large group:	39h	31.20%
	Hours medium group:	0h	0.00%
	Hours small group:	0h	0.00%
	Guided activities:	0h	0.00%
	Self study:	86h	68.80%

Last update: 06-05-2019

230620 - DIVP - Digital Image and Video Processing

Content

1. Introduction

Learning time: 8h
Theory classes: 4h
Self study : 4h

Description:
- Digital images definition & formation,
- Human visual system

2. Low-level image representation - the Pixel

Learning time: 7h
Theory classes: 3h
Self study : 4h

Description:
Pixel-based model: Luminance and color,
Practical study 1: Visualisation Equalisation
Practical study 2: Image search

3. Space-frequency representation of images

Learning time: 26h 40m
Theory classes: 10h
Self study : 16h 40m

Description:
Image filtering, 2D convolution and correlation. Practical study: Restoration
Fourier analysis DCT, DFT. Practical study 2: Resolution
Multiresolution: Pyramid & Wavelet. Practical study: Noise reduction

4. Shape and image - geometric structures

Learning time: 26h
Theory classes: 11h
Self study : 15h

Description:
Geometrical transforms, Practical study 1: Image registration
Hough transform, Practical study 2: Road detection in remote sensing, Soccer field analysis
Mathematical morphology, Practical study 3: Biomedical and industrial applications.

230620 - DIVP - Digital Image and Video Processing

5. Region-based processing	Learning time: 22h 20m Theory classes: 13h 20m Self study : 9h

Description:
Contour-texture image model, Segmentation
Practical study: Biomedical applications, Photography, Unsupervised segmentation, object interaction

6. Video processing	Learning time: 23h Theory classes: 8h Self study : 15h

Description:
Pixel-based model. Practical study 1: Surveillance system.
Space-frequency model. Practical study 2: Mosaic creation.
Geometrical model. Practical study 3: Video restoration
Region-based model. Practical study 4: Shot detección, object tracking.

Last update: 06-05-2019

230620 - DIVP - Digital Image and Video Processing

Planning of activities

Homework	Hours: 10h Theory classes: 10h

Description:
- Pixel-based processing
- Transformed domain and linear filters
- Multi-frequency analysis & coding
- Mathematical morphology
- Segmentation

Exercise done in class	Hours: 4h Theory classes: 4h

Description:
Exercises to strengthen the theoretical knowledge on each course section.

Short answer test (Control)	Hours: 1h Theory classes: 1h

Description:
Mid term control.

Final exam	Hours: 2h Theory classes: 2h

Description:
Final examination.

Qualification system

Final examination: from 50%
Partial examinations and controls:25%
Individual assessments: 25%

Last update: 06-05-2019

230620 - DIVP - Digital Image and Video Processing

Bibliography

Basic:

González, R.C.; Woods, R.E. Digital image processing. 3rd ed. Harlow: Pearson Prentice Hall, 2008. ISBN 9780131687288.

Complementary:

Pratt, W.K. Digital image processing: PIKS scientific inside. 4th ed. New York: John Wiley, 2007. ISBN 9780471767770.

Others resources:

Lectures notes and Problems collection.