Course guide
230024 - PIV - Image and Video Processing

Last modified: 15/01/2024

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.

Degree: BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura

Others: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma

REQUIREMENTS

INTRODUCCIÓ AL PROCESSAMENT AUDIOVISUAL - Precorequisit

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Generical:
10 ECI N3. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.

TEACHING METHODOLOGY

Theoretical Lecture
Lab session
Group work
Individual work
Mid-term control
Final exam

LEARNING OBJECTIVES OF THE SUBJECT

The goal of this course is to introduce the most important image and video processing techniques.
The Processing techniques are presented building from concepts that the students have encountered in previous courses (in particular "Signals and Systems" and "Introduction to AV signal processing") . The course presents a wide range of real applications. Moreover, the students will also have the opportunity to design and develop a complete image processing applications.

STUDY LOAD

Type	Hours	Percentage
Hours small group	26,0	17.33
Self study	85,0	56.67
Hours large group	39,0	26.00

Total learning time: 150 h

CONTENTS

Topic 1. Pixel-based image representation

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

Full-or-part-time: 12h
Theory classes: 6h
Self study : 6h

Topic 2. Space-frequency representation of images

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

Full-or-part-time: 22h 20m
Theory classes: 5h
Laboratory classes: 4h
Self study : 13h 20m

Topic 3. Geometric model for images

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.

Full-or-part-time: 26h 20m
Theory classes: 9h
Laboratory classes: 2h
Self study : 15h 20m

Topic 4. Region-based image representation

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

Full-or-part-time: 17h 20m
Theory classes: 5h 20m
Laboratory classes: 2h
Self study : 10h

Topic 5. Video processing

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.

Full-or-part-time: 32h 40m
Theory classes: 12h 20m
Laboratory classes: 2h
Self study : 18h 20m

Topic 6. Design and implementation of an image processing system

Description:
Design and implementation of an image processing system

Full-or-part-time: 33h 30m
Laboratory classes: 14h
Self study : 19h 30m

ACTIVITIES

Short answer test (Control)

Description:
Continous evaluation

Full-or-part-time: 1h
Theory classes: 1h

Lab session

Description:
Low-level image representation - the Pixel

Full-or-part-time: 2h
Theory classes: 2h

Lab session

Description:
Space-frequency representation of images

Full-or-part-time: 2h
Theory classes: 2h

Lab session

Description:
Shape and image - geometric structures

Full-or-part-time: 2h
Theory classes: 2h

Lab session

Description:
Region-based processing

Full-or-part-time: 2h
Theory classes: 2h

Lab session

Description:
Video processing

Full-or-part-time: 2h
Theory classes: 2h

Lab session

Description:
Design and implementation of an image processing system

Full-or-part-time: 6h
Laboratory classes: 6h

Final Exam

Description:
Final exam

Full-or-part-time: 2h
Theory classes: 2h

GRADING SYSTEM

Final exam: 40%
Control: 20%
Lab session: 40%

BIBLIOGRAPHY

Complementary:
- González, R.C.; Woods, R.E. Digital image processing [on line]. 4th ed., global ed.. New York: Pearson, 2018 [Consultation: 03/07/2020]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=5573669. ISBN 1292223049.

RESOURCES

Other resources:
Lectures notes and Problems collection.