Course guide
270713 - AVPR - Artificial Vision and Pattern Recognition

Last modified: 22/07/2025

Unit in charge: Barcelona School of Informatics
Teaching unit: 1042 - URV - Universitat Rovira i Virgili.

Degree: MASTER'S DEGREE IN ARTIFICIAL INTELLIGENCE (Syllabus 2017). (Optional subject).

Academic year: 2025 **ECTS Credits:** 4.5 **Languages:** English

LECTURER

Coordinating lecturer: DOMENEC SAVI PUIG VALLS

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEA14. Capability to understand the advanced techniques of Vision, Perception and Robotics, and to know how to design, implement and apply these techniques in the development of intelligent applications, services or systems.
CEA6. Capability to understand the basic operation principles of Computational Vision main techniques, and to know how to use in the environment of an intelligent system or service.
CEP1. Capability to solve the analysis of information needs from different organizations, identifying the uncertainty and variability sources.
CEP5. Capability to design new tools and new techniques of Artificial Intelligence in professional practice.
CEP6. Capability to assimilate and integrate the changing economic, social and technological environment to the objectives and procedures of informatic work in intelligent systems.

Generical:
CG1. Capability to plan, design and implement products, processes, services and facilities in all areas of Artificial Intelligence.

Transversal:
CT5. APPROPIATE ATTITUDE TOWARDS WORK: Capability to be motivated for professional development, to meet new challenges and for continuous improvement. Capability to work in situations with lack of information.

Basic:
CB7. Ability to integrate knowledges and handle the complexity of making judgments based on information which, being incomplete or limited, includes considerations on social and ethical responsibilities linked to the application of their knowledge and judgments.

TEACHING METHODOLOGY

Introductory activities: Introduction to the course: motivation, objectives, contents, teaching methods, bibliography and evaluation.
IT-based practicals in computer rooms: Practical use of simulators related to course content and developing new functionalities.
Presentations / oral communications: Students perform oral presentation of their work going in depth into specific topics of the subject. Assessment by the teacher.
Lecture: Explanation of theoretical contents by the teacher.
Problem solving, exercises in the classroom: Students perform in groups of 2 people some analyses and research tasks related to the main themes of the course. Preparation of a report. Final evaluation by the teacher.
Personal attention: Personal attention to each student by the teacher during the teacher's office hours.

WARNING: this year due to COVID19, the course will start fully online, including IT-based practicals, lectures and the rest of activities.

LEARNING OBJECTIVES OF THE SUBJECT

1.To learn and practise the main algorithms and methods for image feature extaction.
2.To learn and understand the main concepts of image processing.
3.To learn and practise the principal color and texture analysis methods.
4.To learn and practise the main image segmetation and classification techniques.
5.To know some basics about stereoscopic vision and 3D models.
6.To be able to analyze a real computer vision problem, and propose effective solutions.

STUDY LOAD

Type	Hours	Percentage
Hours small group	22,5	25.42
Guided activities	9,0	10.17
Self study	48,0	54.24
Hours large group	9,0	10.17

Total learning time: 88.5 h

CONTENTS

Chapter 1. Image Processing.

Description:
Filtering and smoothing operations. Morphological techniques.

Chapter 2. Feature Extraction.

Description:
Lines and corners detection. Identification of basic geometrical structures.

Chapter 3. Color and texture analysis.

Description:
Color models, kinds of texture, texture feature extraction, geometrical methods.

Chapter 4. Image Segmentation and Image Classification.

Description:
Unsupervised segmentation based on regions and edges. Supervised classification, theoretical decision methods, statistical methods, neural networks.

Chapter 5. Stereoscopic Vision.

Description:
Camera calibration and camera systems, epipolar geometry, image rectification, search for correspondences, triangulation.

Chapter 6. Perception and 3D Modeling.

Description:
Range images generation, extraction of geometric elements, automatic scene generation, scene recognition, geometrical hashing.

ACTIVITIES

Master class

Description:
Theoretical and practical explanation of the main concepts of this course

Specific objectives:
1, 2, 3, 4, 5, 6

Related competencies :
CG1. Capability to plan, design and implement products, processes, services and facilities in all areas of Artificial Intelligence.
CEP5. Capability to design new tools and new techniques of Artificial Intelligence in professional practice.
CEP6. Capability to assimilate and integrate the changing economic, social and technological environment to the objectives and procedures of informatic work in intelligent systems.
CEA14. Capability to understand the advanced techniques of Vision, Perception and Robotics, and to know how to design, implement and apply these techniques in the development of intelligent applications, services or systems.
CEP1. Capability to solve the analysis of information needs from different organizations, identifying the uncertainty and variability sources.
CEA6. Capability to understand the basic operation principles of Computational Vision main techniques, and to know how to use in the environment of an intelligent system or service.
CT5. APPROPIATE ATTITUDE TOWARDS WORK: Capability to be motivated for professional development, to meet new challenges and for continuous improvement. Capability to work in situations with lack of information.
CB7. Ability to integrate knowledges and handle the complexity of making judgments based on information which, being incomplete or limited, includes considerations on social and ethical responsibilities linked to the application of their knowledge and judgments.

Full-or-part-time: 70h
Theory classes: 30h
Self study: 40h

Lab

Description:
Implementation of practical cases

Specific objectives:
1, 2, 3, 4, 6

Related competencies :
CG1. Capability to plan, design and implement products, processes, services and facilities in all areas of Artificial Intelligence.
CEP5. Capability to design new tools and new techniques of Artificial Intelligence in professional practice.
CEP6. Capability to assimilate and integrate the changing economic, social and technological environment to the objectives and procedures of informatic work in intelligent systems.
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Full-or-part-time: 43h
Laboratory classes: 15h
Self study: 28h

GRADING SYSTEM

IT-based practicals in computer rooms:
Elaboration by the students of practical work related to the main topics of the course using the tools of computer vision explained in the practical classes. Elaboration of a report. 40%

Presentations / oral communications:
Students perform in groups of 2 people some analyses and research tasks related to the main themes of the course. Preparation of a report. Oral presentation. Final evaluation by the teacher. 20%

Extended-answer tests:
Extended-answer tests. 20%

Short-answer objective tests:
Objective short-answer tests. 20%

BIBLIOGRAPHY

Basic:
- Forsyth, David A; Ponce, Jean. Computer vision : a modern approach. 2nd ed. Pearson Education, cop. 2012. ISBN 9780273764144.
- Chen, C.H. (ed.). Handbook of pattern recognition and computer vision. 6th ed. Toh Tuck Link, Singapore: World Scientific, 2020. ISBN 9789811211065.