Course guide
270701 - CV - Computational Vision

Last modified: 22/07/2025

Unit in charge: Barcelona School of Informatics
Teaching unit: 1004 - UB - (ENG)Universitat de Barcelona.

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

Academic year: 2025 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: PETIA IVANOVA RADEVA

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
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.
CEA7. Capability to understand the problems, and the solutions to problems in the professional practice of Artificial Intelligence application in business and industry environment.
CEP3. Capacity for applying Artificial Intelligence techniques in technological and industrial environments to improve quality and productivity.
CEP5. Capability to design new tools and new techniques of Artificial Intelligence in professional practice.

Generical:
CG1. Capability to plan, design and implement products, processes, services and facilities in all areas of Artificial Intelligence.
CG3. Capacity for modeling, calculation, simulation, development and implementation in technology and company engineering centers, particularly in research, development and innovation in all areas related to Artificial Intelligence.

Transversal:
CT3. 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.

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.

CT6. REASONING: Capability to evaluate and analyze on a reasoned and critical way about situations, projects, proposals, reports and scientific-technical surveys. Capability to argue the reasons that explain or justify such situations, proposals, etc..
CT7. ANALISIS Y SINTESIS: Capability to analyze and solve complex technical problems.

TEACHING METHODOLOGY

The course will be divided in a series of theory and practical sessions:

- Participatory theory sessions in which new concepts are introduced and discussed between students. Group discussion is strongly encouraged. Textbook chapters and research papers will be provided to facilitate debate and exchange of ideas.

- Practical sessions are devoted to solve problems, designing methods and developing prototypes. These sessions allow students to put into practice previously introduced concepts to gain further insight.

In principle, we expect to follow the in-person teaching model for the 2022-23 academic year.

Moreover, class material should use an inclusive language and include bibliographical references authored by women (and make them visible).

LEARNING OBJECTIVES OF THE SUBJECT

1.Develop practicum of computational vision.
2.Reach the basic and advanced knowledge of computational vision.

STUDY LOAD

Type	Hours	Percentage
Hours small group	8,0	6.40
Guided activities	5,0	4.00
Hours medium group	16,0	12.80
Self study	80,0	64.00
Hours large group	16,0	12.80

Total learning time: 125 h

CONTENTS

Introduction to Computational Vision

Image Processing

Edges and contours detection

Feature detection

Feature Matching

Face detection

Face recognition

Segmentation

Classificiation by CNNs

Visualization and interpretability

Detection by CNNs

Atention and transformers

Segmentation by CNNs

ACTIVITIES

Practicum deliverable 1

Description:
This activity consists of delivering the code and reprt corresponding to a serie of exercices posed during the first bloc of the course.

Specific objectives:
1

Related competencies :
CEP3. Capacity for applying Artificial Intelligence techniques in technological and industrial environments to improve quality and productivity.
CEP5. Capability to design new tools and new techniques of Artificial Intelligence in professional practice.
CT3. 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.

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.

CT6. REASONING: Capability to evaluate and analyze on a reasoned and critical way about situations, projects, proposals, reports and scientific-technical surveys. Capability to argue the reasons that explain or justify such situations, proposals, etc..

Full-or-part-time: 18h
Self study: 9h
Laboratory classes: 9h

Practicum deliverable 2

Description:
This activity consists of delivering the code and reprt corresponding to the problem posed during the second bloc of the course.

Specific objectives:
1, 2

Related competencies :
CEA7. Capability to understand the problems, and the solutions to problems in the professional practice of Artificial Intelligence application in business and industry environment.
CEP3. Capacity for applying Artificial Intelligence techniques in technological and industrial environments to improve quality and productivity.
CEP5. Capability to design new tools and new techniques of Artificial Intelligence in professional practice.
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.
CG1. Capability to plan, design and implement products, processes, services and facilities in all areas of Artificial Intelligence.
CG3. Capacity for modeling, calculation, simulation, development and implementation in technology and company engineering centers, particularly in research, development and innovation in all areas related to Artificial Intelligence.
CT3. 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.

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.

CT7. ANALISIS Y SINTESIS: Capability to analyze and solve complex technical problems.
CT6. REASONING: Capability to evaluate and analyze on a reasoned and critical way about situations, projects, proposals, reports and scientific-technical surveys. Capability to argue the reasons that explain or justify such situations, proposals, etc..

Full-or-part-time: 18h
Self study: 9h
Laboratory classes: 9h

Practicum deliverable 2

Description:
This activity consists of delivering the code and reprt corresponding to the problem posed during the third bloc of the course.

Specific objectives:
1, 2

Related competencies :
CEA7. Capability to understand the problems, and the solutions to problems in the professional practice of Artificial Intelligence application in business and industry environment.
CEP3. Capacity for applying Artificial Intelligence techniques in technological and industrial environments to improve quality and productivity.
CEP5. Capability to design new tools and new techniques of Artificial Intelligence in professional practice.
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.
CG1. Capability to plan, design and implement products, processes, services and facilities in all areas of Artificial Intelligence.
CG3. Capacity for modeling, calculation, simulation, development and implementation in technology and company engineering centers, particularly in research, development and innovation in all areas related to Artificial Intelligence.
CT3. 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.

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.

CT7. ANALISIS Y SINTESIS: Capability to analyze and solve complex technical problems.
CT6. REASONING: Capability to evaluate and analyze on a reasoned and critical way about situations, projects, proposals, reports and scientific-technical surveys. Capability to argue the reasons that explain or justify such situations, proposals, etc..

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GRADING SYSTEM

Students will be assessed based on their work in practical tasks (delivery of practices in groups of 2 students) and a final exam of theory. The weighting of the final mark will be proportional to the respective workloads of the practical tasks and the exam of theory. The theory exam will be divided in two midterm exams. Students who fail the first midterm exam will be examined on the entire course during the second part. Final grade: 50% practicum grade and 50% exam grade. To pass the subject, it is necessary to pass the theoretical and practical parts separately, as well as each partial exam separately. If any of the partial exams are failed, the student will take a final exam on all the material.

BIBLIOGRAPHY

Basic:
- Forsyth, D.A.; Ponce, J. Computer vision: a modern approach. 2nd ed. Pearson Education, cop. 2012. ISBN 9780273764144.
- Szeliski, R. Computer vision: algorithms and applications. 2nd ed. Cham, Switzerland: Springer, 2022. ISBN 9783030343712.