COURSE MODULE – COMPUTER VISION

COURSE CODE	COSI CV
COURSE LEVEL	Master
ECTS CREDITS	5
COURSE INSTRUCTOR/S	Nicolás Pérez-de-la-Blanca Capilla
EDUCATION PERIOD	SEMESTER 2
EXPECTED PRIOR-KNOWLEDGE	Matrix algebra; Fundamentals of Image Processing; Fundamentals of Human Vision and Perception
LANGUAGE OF INSTRUCTION	English

AIM

The challenge of computer vision is to develop computer-based systems to mimic the capabilities of the human eye-brain system. Therefore, it is primarily concerned with the problems associated with image processing to provide an understanding of the theirs semantics and geometry. The field relies heavily on many subjects, including digital image processing, machine learning, computer graphics, and psychology.

This course will explore some of the basic principles and techniques from these areas which are currently being used in the research and development of computer vision systems:

- to develop the students' understanding of the basic principles and techniques of image formation and image modelling;
- to develop the students' skills to analyse and design a range of algorithms for image processing and computer vision ;
- to develop the students' understanding of the fundamentals of image understanding;
- to develop the students' skills to compare these techniques, to evaluate solutions to problems in computer vision, and to design the most appropriate one relative to image acquisition constraints, expected accuracy and expected processing time;
- to develop the students' skills to put into practice these techniques by acquiring and processing images.

COURSE OUTLINE

- Introduction to computer vision: Aim, goals, and difficulties. Image formation: Light, Shading, and camera models.
- Low level image processing: Linear Filtering and Image representation models. Local feature detection and representation. Two images: Feature matching and motion 2D. Applications.
- Feature combination techniques for geometric and semantic problems. Pixel and features grouping techniques. High-level descriptors.
- Stereo vision and 3D reconstruction.
- Deep Learning for Semantic image classification, object detection and object recognition.

PRACTICAL ACTIVITIES

- Camera calibration from a plane pattern
- Mosaic building
- Dense motion estimation in video sequences
- Applying transfer learning for image classification / Object detection.

FORM/S OF ASSESSMENT

Written Exam: 30% ; Assigments: 60% ; Class work: 10%

ASSESSMENT CRITERION

Written exam lab sessions and Homework/seminar presentations

Excellent - outstanding performance	A
Very Good - above the average standard but with some errors	B
Good - generally sound work with a number of notable errors	C
Satisfactory - fair but with significant shortcomings	D
Sufficient - performance meets the minimum criteria	E
Fail - some more work required before the credit can be awarded	FX
Fail - considerable further work is required	F

Detail of criteria used to assess acquired skills :
• Activities and questionnaires giving evidence of knowing (5%)
• Activities and questionnaires giving evidence of comprehension/understanding (5%)
• Activities and questionnaires giving evidence of analysis (5%)
• Activities and questionnaires giving evidence of synthesis (5%)
• Activities and questionnaires giving evidence of evaluation (5%)

The evaluation of informal learning outcomes will be based on questionnaires and laboratory notebook (self-evaluation, learning diary).

LITERATURE AND STUDY MATERIALS

- R. Szieliski, Computer Vision, Springer, 2018
- D. Forsyth & J. Ponce, Computer Vision: A Modern Approach, 2nd Edition, Pearson 2012.
- R. Hartley & A. Zisserman, Multiple View Geometry in Computer Vision, 2nd Edition. Cambridge Press, 200
- F. Li et col, Convolutional Neural Networks for Visual Recognition, http://cs231n.stanford.edu/

CONTACT DETAILS

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