

Course Specification Document

Title	Computer Vision
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Credits	2.5 ECTS
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Aims	This course aims to provide the student with the knowledge and skills related to methods of images acquisition and the digital representation of images on the computer, and introducing the most famous algorithms for digital image processing, up to methods of three-dimensional reconstruction of the scene, so that he will be able to analyze the images and invest these algorithms in control and robotics applications.
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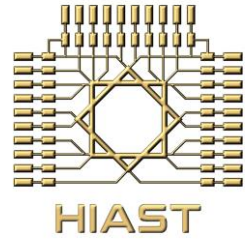
Intended learning outcomes

On successful completion of this course, the student will be able to:

- Recognize the methods of images acquisition and their digital representation on the computer.
- Discuss the methods of image pre-processing, such as improving contrast and noise filtering.
- Understand the methods of images segmentation, edge detection, and the most popular algorithms.
- Understand the morphological operations and their applications.
- Understand the cameras calibration methods and the algorithms of 3D scene reconstruction.
- Apply theoretical concepts in the field of specialization to industrial practices.
- Implement digital image processing algorithms for image enhancement, image analysis and object detection.

Syllabus

- **Introduction:** The history of image processing and its most famous applications, introducing the basic stages in image processing.
- **Image acquisition and their digital representation on the computer:** Methods of acquiring grayscale and color images, representing images on a computer.
- **Perceiving and representing images on the computer:** Basic functions and procedures defined in the MATLAB environment within the image processing toolkit.
- **Image pre-processing:** The tools used in image processing (histogram, convolution and Fourier transform), the investment of the tools in improving image contrast and noise reduction.
- **Image processing in the spatial domain:** The initial processing of the image from image enhancement, noise filtering in the spatial domain.
- **Segmentation:** Introducing the most popular algorithms used in edges detection and region segmentation.



- **Image processing in the frequency domain:** Processing the image in the frequency domain by taking advantage of the discrete Fourier transform and its most important applications in image processing.
- **Morphological operations:** Definition of morphological functions as nonlinear processing of the image and its applications.
- **Edge detection and morphological functions:** Detection of edges and morphological functions in the MATLAB environment.
- **Camera calibration:** Introducing the geometrical model of the camera, and the most popular methods for camera calibration.
- **3D Reconstruction:** Introducing the methods used in 3D Scene Reconstruction and their classifications.