IMAGE PROCESSING AND COMPUTER VISION

Mestrado em Engenharia Eletrónica e de Computadores

Code: 21301

Main Scientific Area: Intelligent Systems and Control

Lecturer: João Luís Araújo Martins Vilaça

Language of Instruction: Portuguese

Regime: S1

Contact Hours: 30h Total Workload: 130h

ECTS: 6,0

Objectives

This course aims to provide students with the theoretical knowledge of basic computer vision and imageprocessing, as well as develop the ability to understand and analyze practical problems and conceive, plan andimplement solutions.

Learning Outcomes

It is expected that students who successfully complete this course are able to:

- Understand the fundamentalconcepts and technologies of computer vision systems;

- implementing processing techniques and image analysistechniques specifically image enhancement, segmentation, image analysis, texture analysis, motion analysis;

-Analyze a specific problem of computer vision and identify, evaluate and design the different technologicalsolutions, both in terms of hardware solutions both in terms of algorithms.

Course Contents

General Concepts: Light and Color; Electromagnetic Spectrum; Human Vision;Computer Vision: Sensors, ImageAcquisition, Scanning (Sampling and Quantization); Resolution, Color Depth;

Image Analysis and Processing:Digital Imaging; Color Spaces: Binary, Grayscale, RGB; nRGB; HSV; Color Scales; Threshold Segmentation;

Morphological Operators for Binary Images: Dilation, Erosion, Opening, Closing;Morphological Operators in Grayscale Images: Dilation, Erosion, Opening, closing; Blobs; Labeling; Calculation:Area, Perimeter, Centre of Gravity;

Histograms (Shades of Grey, RGB), Histogram Equalization; Edge Detection:Roberts, Prewitt, Sobel;

Filters in the Spatial Domain - low-pass filters: mean, Median, Gaussian,high Pass Filters;

Filters in the Frequency Domain: DFT, low-pass filters, high-pass filters;

MotionDetection: Difference between images; Background subtraction

Recommended Bibliography

Rafael C. Gonzalez; Richard E. Woods; “Digital Image Processing”, 4th edition ,Prentice Hall, 2018

Intel Corporation, “OpenCV Reference Manual”, v2.1, Intel, 2010

Intel Corporation, ”Open Source Computer Vision Library, Reference Manual”, Intel, 2000

Material de apoio do docente.

Learning and Teaching Methods

The syllabus of this course will enable the student to acquire a set of skills in an area of a constant growth, withmajor opportunities in the industrial sector. Thus, this course will enable students to know and understand theprocess of image formation in different conditions and with different means. To understand how these images arestored and transported through the use of the existing standards. After this theoretical study,students will be confronted with a set of real problems, and will be encouraged to find solutions to solve them.Through the discussion on these problems, different processing techniques and image analysis tools will be presented to the students,allowing them to achieve a solution. Simultaneously, the students will also be stimulated to autonomously search for moreadvanced approaches in the literature.

Assessment Methods

The assessment consists of two parts: theoretical and practical:

• 80% - The theoretical component consists of one written test to be held at the end of the semester;

• 20% - The practical component consists of different practical work.

The written test will focus predominantly on theoretical aspects, theoretical and practical, and individualachievement.