DeCAIR Course Syllabus Form

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Activity Number & Title	Activity 6.1: Developing syllabi and content for added/modified courses in existing bachelor programs in universities of partner countries.		
WP Leader	Jorge Casillas, UGR		
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Revision History

Version	Date	Author	Description	Action *	Page(s)
1	20/9/2021	Joumana Farah and Clovis Francis	Updated Syllabus of BE courses in Electrical Eng'g	U	1-6
2	22/10/2021	Joumana Farah and Clovis Francis	Version 2	U	
3	10/12/2021	Joumana Farah and Clovis Francis	Version 3	U	
4	8/02/2022	Joumana Farah and Clovis Francis	Version 4	U	

(*) Action: C = Creation, I = Insert, U = Update, R = Replace, D = Delete

Disclaimer

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Course title	Computer Vision
Course number	INFO540
Credit hours (lecture and lab)	2
ECTS (weekly contact and self-study load)	2 (2 contact hours per week)
Prerequisites/co-requisites	Signal processing
Prerequisites by topic	Students are assumed to have good background in continuous and digital signal processing. Additionally, the students should have good programming skills, preferably, using Python and MatLab.
Level and type (compulsory, elective)	BE compulsory course
Year of study and semester	Fifth year, first semester
Description	This BE course concentrates on the different techniques of images enhancement and pattern recognition. It starts with basic spatial-domain and frequency-domain image filtering techniques, as well as histogram processing methods. Estimation and correction of image degradation is then studied, as well as de-noising methods. Morphological processing and image segmentation is considered. Then, several object recognition techniques are studies, from the basic minimum distance classifier to deep learning methods.
Objectives	1. Introduce students to the different types of cameras and mainly those used for mobile robot's development. 2. Introduce students to the methods and techniques for image enhancement 3. Introduce students to pattern recognition methods and techniques. 4. Develop a robots complete perception system
Intended learning outcomes	Upon successful completion of this course, students will be able to:

No	Intended learning Outcome (ILO)	Program learning outcome (PLO)*
1	Demonstrate a sound understanding of the main techniques for images processing	1
2	Solve an signal image enhancement problem by developing an appropriate perception and sensing system.	3
3	Communicate the development of a perception system through a detailed technical report and a short presentation.	4
4	Use Python and MatLab and their specialized libraries to develop programs for solving image acquisition problems.	3

<table>
<tr><td></td><td>(*) The PLOs are listed in the appendix</td></tr>
<tr><td>Teaching and learning methods</td><td>Development of ILOs is promoted through the following teaching and learning methods:
Lectures will be delivered through Microsoft Teams and will be recorded for later access. Lectures could be delivered in class also depending on the local situation.
The signal and image processing lab is open for the students to practice the practical aspects and solve the programming homework assignments.
The student attends the class presentations and participates in the discussions.
The student joins the related online team/group and participates in its discussions.
The student studies the reference material, including books and videos.
The student carries out a term project for solving a problem using data acquisition techniques.
The student develops a professional report for the term report.
The student presents the term project in class.</td></tr>
<tr><td>Learning material</td><td>Textbook, class handouts, some instructor keynotes, selected YouTube videos, and access to a personal computer and the internet.</td></tr>
<tr><td>Resources and references</td><td>Recommended book(s), material and media:
Lecture notes developed by the instructor
Digital Image Processing. Rafael C. Gonzalez, Richard E. Woods, Prentice Hall</td></tr>
<tr><td>Topic outline and schedule</td><td>
<table>
<tr><th>Week</th><th>Topic</th><th>ILO</th><th>Resources</th></tr>
<tr><td>1</td><td>Acquisition and Digitization of images,</td><td>1</td><td>1, 2</td></tr>
<tr><td>2</td><td>Cameras calibration</td><td>4</td><td>1, 2</td></tr>
<tr><td>3</td><td>Perception and colors representation</td><td>1, 2, 4</td><td>1, 2</td></tr>
<tr><td>4</td><td>Images transformation and restauration</td><td>1, 2, 4</td><td>1, 2</td></tr>
<tr><td>5</td><td>Image enhancement in the Spatial domain</td><td>1, 2</td><td>1, 2</td></tr>
<tr><td>6</td><td>Image enhancement in the Frequency domain</td><td>1</td><td>1, 2</td></tr>
<tr><td>7</td><td>Morphological processing</td><td>1, 2</td><td>1, 2</td></tr>
<tr><td>8</td><td>Contour detection and images segmentation</td><td>1, 2</td><td>1, 2</td></tr>
<tr><td>9</td><td>Shape recognition</td><td>1, 2</td><td>1, 2</td></tr>
<tr><td>10</td><td>Stereo Multi-view</td><td>1</td><td>1, 2</td></tr>
<tr><td>11</td><td>3D reconstruction</td><td>1, 2</td><td>1, 2</td></tr>
<tr><td>12</td><td>Object recognition</td><td>1, 2</td><td>1, 2</td></tr>
<tr><td>13</td><td>Pattern recognition</td><td>1, 2</td><td>1, 2</td></tr>
<tr><td>14</td><td>Applications and programming</td><td>1, 2</td><td>1, 2</td></tr>
<tr><td>15</td><td>Case study</td><td>3, 4</td><td>1, 2</td></tr>
</table>
</td></tr>
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<table>
<tr><td>Evaluation tools</td><td>Opportunities to demonstrate achievement of the ILOs are provided through the following assessment tools:
<table>
<tr><th>Assessment tool</th><th>Mark</th><th>Topic(s)</th><th>Time</th></tr>
<tr><td>Homework assignments</td><td>10%</td><td>Images processing aspects</td><td>W2-W14</td></tr>
<tr><td>Midterm exam</td><td>30%</td><td>Introduction through classical computer vision techniques</td><td>W8</td></tr>
<tr><td>Term project report and presentation</td><td>20%</td><td>Practical and presentation aspects</td><td>W15</td></tr>
<tr><td>Final exam</td><td>40%</td><td>All material</td><td>W16</td></tr>
<tr><td>Total</td><td>100%</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Student requirements</td><td>The student should have a computer and internet connection.</td></tr>
<tr><td>Course policies</td><td>A- Attendance policies:
Attendance is required. Class attendance will be taken every class and the university polices will be enforced in this regard.
B- Absences from exams and submitting assignments on time:
A makeup exam can be arranged for students with acceptable absence causes.
Assignments submitted late, but before announcing or discussing the solution can be accepted with 25% penalty.
The project report must be handed in in time.
C- Health and safety procedures:
All health and safety procedures of the university and the school should be followed.
D- Honesty policy regarding cheating, plagiarism, misbehavior:
Open-book exams
All submitted work must be of the submitting student.
Other text or code must be properly quoted with clear source specification.
Cheating will not be tolerated.
E- Available university services that support achievement in the course:
Microsoft Teams team and Moodle course page
AI Lab for practicing the practical aspects and solving the programming assignments.
Program announcements Facebook group</td></tr>
<tr><td>Additional information</td><td>None</td></tr>
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Appendix

Learning Outcomes for the MSc in Artificial Intelligence and Robotics

Students who successfully complete the MSc in Artificial Intelligence and Robotics (AIR) will be able to:

1. Demonstrate a sound understanding of the main areas of AIR including artificial neural networks, machine learning, data science, industrial and service robots, and intelligent and autonomous robots.

2. Apply a critical understanding of essential concepts, principles and practices of AIR, and critically evaluate tools, techniques and results using structured arguments based on subject knowledge.

3. Apply the methods and techniques of the AIR fields in the design, analysis and deployment of AIR solutions and solving practical problems.

4. Demonstrate the ability to produce a substantial piece of research work from problem inception to implementation, documentation and presentation.

5. Demonstrate life-long learning, independent self-learning and continuous professional development skills in the AIR fields.

6. Demonstrate a sound understanding of the ethical, safety and social impact issues of AIR solutions and products.