| Teaching Guide | | | | |
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| Identifying Data | | | | 2020/21 |
| Subject (*) | Fundamentals of Image Processing and Analysis | | Code | 614535001 |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | | | | |
| Cycle | Period | Year | Type | Credits |
| Official Master's Degree | 1st four-month period | First | Obligatory | 6 |
| Language | English | | | |
| Teaching method | Hybrid | | | |
| Prerequisites | | | | |
| Department | Ciencias da Computación e Tecnoloxías da Información | | | |
| Coordinador | Barreira Rodriguez, Noelia | E-mail | noelia.barreira@udc.es | |
| Lecturers | Barreira Rodriguez, Noelia<br>Rouco Maseda, Jose | E-mail | noelia.barreira@udc.es<br>jose.rouco@udc.es | |
| Web | | | | |
| General description | This curricular unit addresses the most fundamental topics in image processing and analysis and presents itself as the first in a sequence with another curricular unit where the advanced topics are presented. In addition to the study and application of fundamental techniques of image processing and analysis, applications in this area are studied that aim to solve real problems. This approach gives students the necessary tools to apply the algorithms studied in practical cases, as well as the basis for developing new algorithms and pursue the study for more advanced methods. | | | |
| Contingency plan | 1. Modifications to the contents<br><br>- There are no changes<br><br>2. Methodologies<br>*Teaching methodologies that are maintained<br>Objective test<br>Laboratory practice<br>Research project<br>Guest lecture<br><br>*Teaching methodologies that are modified<br><br>3. Mechanisms for personalized attention to students<br>- Email: daily to answer questions, schedule virtual meetings and do a follow-up of the assignments<br>- Moodle: daily, depending on the needs of the students<br>- Teams: two weekly session in group to assess the learning progress and the development of the exercises and the assignments.<br><br>4. Modifications in the evaluation<br>- There are no changes<br>*Evaluation observations:<br><br>5. Modifications to the bibliography or webgraphy<br>- There are no changes | | | |

| Study programme competences / results | |
|---|---|
| Code | Study programme competences / results |
| A1 | CE1 - To know and apply the concepts, methodologies and technologies of image processing |

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| A3 | CE3 - To know and apply the concepts, methodologies and technologies of image and video analysis |
| B7 | CG2 - Ability to analyze a company's needs in the field of computer vision and determine the best technological solution for it |
| B9 | CG4 - Ability to critically analyze and rigorously evaluate technologies and methodology |
| B10 | CG5 - Ability to identify unsolved problems and provide innovative solutions |
| B12 | CG7 - Ability to learn autonomously for specialization in one or more fields of study |
| C1 | CT1 - Practice the profession with a clear awareness of its human, economic, legal and ethical dimensions and with a clear commitment to quality and continuous improvement |

| Learning outcomes | | | |
|---|---|---|---|
| Learning outcomes | Study programme competences / results | | |
| Understand the basic concepts and techniques of digital image processing. | AC1 | BC12 | |
| Understand the basic concepts and techniques of digital image analysis. | AC3 | BC12 | |
| Ability to apply different basic techniques for computer vision problems. | | BC7<br>BC10 | CC1 |
| Know how to assess the adequacy of the methodologies applied in specific problems. | | BC9 | |

| Contents | |
|---|---|
| Topic | Sub-topic |
| Digital image fundamentals | |
| Human perception and color | |
| Preprocessing: normalization and enhancement | |
| Image denoising | |
| Edge detection | |
| Image transformations | |
| Morphological operators | |
| Template matching | |
| Extraction of global features | |
| Extraction of  scale-invariant features | |
| Hough transform | |
| Image thresholding | |
| Region growing and split-and-merge | |
| Other segmentation techniques | |

| Planning | | | | |
|---|---|---|---|---|
| Methodologies / tests | Competencies / Results | Teaching hours (in-person & virtual) | Student?s personal work hours | Total hours |
| Objective test | A1 A3 B10 | 3 | 0 | 3 |
| Laboratory practice | A1 A3 B10 | 15 | 44 | 59 |
| Research (Research project) | A1 A3 B7 B9 B10 B12 C1 | 10 | 40 | 50 |
| Guest lecture / keynote speech | A1 A3 C1 | 14 | 24 | 38 |
| Personalized attention | | 0 | | 0 |
| (*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. | | | | |

| Methodologies | |
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| Methodologies | Description |
| Objective test | Test with questions about the theoretical contents of the subject as well as practical problems. |
| Laboratory practice | Analysis and resolution of practical cases using techniques learned in lectures. |

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|---|---|
| Research (Research project) | Proposal of two assignments in image analysis that require to identify the problem, to formulate it precisely, to develop suitable procedures, to interpret the results and to extract appropriate conclusions about the work. |
| Guest lecture / keynote speech | Oral presentation using audiovisual material and student interaction designed to transmit knowledge and encourage learning. |

| Personalized attention | |
|---|---|
| **Methodologies** | **Description** |
| Research (Research project)<br>Laboratory practice | Teachers will answer the doubts during the laboratory practice and they will provide personal advising for the supervised projects. |

| Assessment | | | |
|---|---|---|---|
| **Methodologies** | **Competencies / Results** | **Description** | **Qualification** |
| Research (Research project) | A1 A3 B7 B9 B10 B12 C1 | Two assignments that consist of the development of image processing and computer vision applications. It will be assessed the suitability of the proposed solutions and the quality of the obtained results. | 60 |
| Objective test | A1 A3 B10 | Written test with theoretical questions and practical problems to be solved. | 40 |
| Laboratory practice | A1 A3 B10 | Practical exercises about the topics learned in the lectures. It will be assessed the suitability of the proposed solutions and the quality of the obtained results. | 0 |

| Assessment comments |
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| The objective test is 40% of the final grade. However, students can achieve this percentage of the final grade with the laboratory exercises during the year. This way, if the laboratory exercises are presented, the exam is optional.<br>If a student presents the laboratory exercises and attends the objective test, the grade obtained in the objective test will prevail over the grade achieved in the laboratory exercises. |

| Sources of information | |
|---|---|
| **Basic** | - David A. Forsyth, Jean Ponce (2003). Computer vision. Prentice - Hall<br>- Rafael González, Richard Woods (2008). Digital Image Processing. Pearson<br>- Carsten Steger, Markus Ulrich, Christian Wiedemann (2018). Machine Vision Algorithms and Applications. Wiley |
| **Complementary** | |

| Recommendations |
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| **Subjects that it is recommended to have taken before** |
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| **Subjects that are recommended to be taken simultaneously** |
| Image Description and Modeling/614535004 |
| **Subjects that continue the syllabus** |
| Advanced Image Processing and Analysis/614535002 |
| **Other comments** |
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**(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.**