| Teaching Guide | | | | |
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| Identifying Data | | | | 2023/24 |
| Subject (*) | Computer Vision II | | Code | 614544018 |
| Study programme | Máster Universitario en Intelixencia Artificial | | | |
| Descriptors | | | | |
| Cycle | Period | Year | Type | Credits |
| Official Master's Degree | 2nd four-month period | First | Optional | 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>Ramos García, Lucia | E-mail | noelia.barreira@udc.es<br>l.ramos@udc.es | |
| Web | | | | |
| General description | The main objective of this subject is to study in more detail the computer vision techniques, in particular, advanced image segmentation, classification, detection and tracking techniques, as well as the applications of AI in the field of vision. Moreover, applications to solve real problems in this field will be studied. This subject will also provide the tools to apply the algorithms to practical cases and to develop new algorithms. | | | |

| Study programme competences | |
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| Code | Study programme competences |
| A24 | CE23 - Understanding and command of basic concepts and techniques of digital image processing |
| A25 | CE24 - Ability to apply different techniques to computer vision problems |
| A26 | CE25 - Knowledge and ability to design systems for detecting, classifying and tracking objects in images and video |
| A27 | CE26 - Understanding and command of the multiple ways to represent images and signals in terms of their associated data and their main features |
| B1 | CG01 - Maintaining and extending theoretical foundations to allow the introduction and exploitation of new and advanced technologies in the field of AI |
| B3 | CG03 - Searching and selecting that useful information required to solve complex problems, with a confident handling of bibliographical sources in the field |
| B5 | CG05 - Working in teams, especially of multidisciplinary nature, and being skilled in the management of time, people and decision making |
| B6 | CB01 - Acquiring and understanding knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, frequently in a research context |
| B7 | CB02 - The students will be able to apply the acquired knowledge and to use their capacity of solving problems in new or poorly explored environments inside wider (or multidisciplinary) contexts related to their field of study |
| B10 | CB05 - The students will acquire learning abilities to allow them to continue studying in way that will mostly be self-directed or autonomous |
| C3 | CT03 - Use of the basic tools of Information and Communications Technology (ICT) required for the student's professional practice and learning along her life |
| C4 | CT04 - Acquiring a personal development for practicing a citizenship under observation of the democratic culture, the human rights and the gender perspective |
| C8 | CT08 - Appreciating the importance of research, innovation and technological development in the socioeconomic and cultural progress of society |

| Learning outcomes | |
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| Learning outcomes | Study programme competences |

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| To know and to know how to use advanced image analysis techniques | AC24<br>AC25 | BC1<br>BC3<br>BC6<br>BC10 | CC4<br>CC8 |
| To know and to know how to use advanced image processing techniques | AC23<br>AC24 | BC1<br>BC3<br>BC6<br>BC10 | CC4<br>CC8 |
| To know how to analyse, design and develop solutions based on advances image processing and analysis techniques | AC24<br>AC26 | BC5<br>BC7 | CC3 |
| To know how to evaluate the suitability of the methodologies applied in specific problems | AC24<br>AC25 | BC6<br>BC7 | CC3 |

| Contents | |
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| **Topic** | **Sub-topic** |
| Image classification | |
| Image segmentation | |
| Object detection | |
| Visual search | |
| Video processing | Optical flow<br>Object tracking |
| Aspects of 3D | Skeletonization<br>Symmetry |
| Structure from motion | 3D depth estimation<br>SLAM |

| Planning | | | | |
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| **Methodologies / tests** | **Competencies** | **Ordinary class hours** | **Student?s personal work hours** | **Total hours** |
| Laboratory practice | A25 B1 B3 B7 C3 | 14 | 42 | 56 |
| Research (Research project) | A25 A26 B5 B7 C3 | 7 | 35 | 42 |
| Mixed objective/subjective test | A24 A27 B1 B7 | 2 | 0 | 2 |
| Guest lecture / keynote speech | A24 A27 B1 B6 B10 C4 C8 | 21 | 21 | 42 |
| Personalized attention | | 8 | 0 | 8 |
| **(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.** | | | | |

| Methodologies | |
|---|---|
| **Methodologies** | **Description** |
| Laboratory practice | Analysis and resolution of practical cases using techniques learned in lectures. |
| Research (Research project) | Proposal of 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. |
| Mixed objective/subjective test | Test with questions about the theoretical contents of the subject as well as practical problems. |
| Guest lecture / keynote speech | Oral presentation using audiovisual material and student interaction designed to transmit knowledge and encourage learning. |

| Personalized attention | |
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| **Methodologies** | **Description** |

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| Laboratory practice<br>Research (Research project) | Teachers will answer the doubts during the laboratory practice.<br><br>Teachers will provide personal advising for the supervised projects. |

| Assessment | | | |
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| **Methodologies** | **Competencies** | **Description** | **Qualification** |
| Laboratory practice | A25 B1 B3 B7 C3 | 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. | 40 |
| Research (Research project) | A25 A26 B5 B7 C3 | 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 |
| Mixed objective/subjective test | A24 A27 B1 B7 | Written test with theoretical questions and practical problems to be solved. | 0 |

| Assessment comments |
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| The laboratory practice during the year is 40% of the final grade. However, students can achieve this percentage of the final grade with mixed test. This way, if the laboratory exercises are submitted, the exam is optional. If a student submits the laboratory practice and takes the mixed test, the mark obtained in the mixed test will prevail over the mark got in the laboratory practice. If the student does not deliver any of the assignments or takes the exam, he/she will be considered as "absent". In the second chance: In case of an "absent" student in the first chance, the assessment will comprise the research projects (up to 60%) and the mixed text (up to 40%). If the student has summited the laboratory practice and/or any research project but he/she has not passed the subject, the first chance marks in both parts will be kept. To pass the subject, the student should submit the non-delivered/failed research projects and/or take the mixed test. |

| Sources of information | |
|---|---|
| **Basic** | - M. Sonka, V. Hlavac, R. Boyle (2015). Image Processing, Analysis and Machine Vision. Cengage Learning<br>- M. Elgendy (2020). Deep Learning for Vision Systems. Manning<br>- R. Szeliski (2010). Computer vision: algorithms and applications. Springer |
| **Complementary** | - I. Goodfellow, Y, Bengio, A. Courville (2016). Deep Learning. MIT Press |

| Recommendations |
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| **Subjects that it is recommended to have taken before** |
| Computer Vision I/614544017 |
| **Subjects that are recommended to be taken simultaneously** |
| Deep Learning /614544013 |
| **Subjects that continue the syllabus** |
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| **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.**