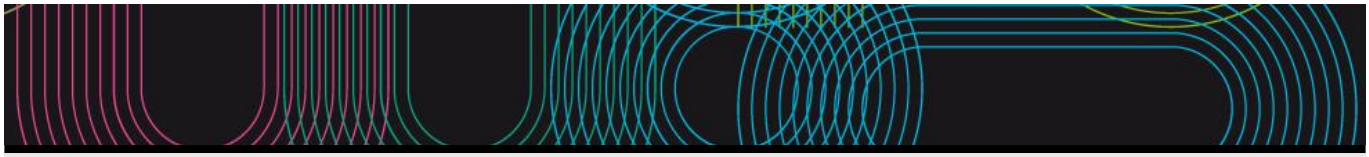

# (*)Escola de Enxeñaría de Telecomunicación

## (*)Páxina web

(*)

www.teleco.uvigo.es

## (*)Presentación

The School of Telecommunication Engineering (EET) is a higher education school of the University of Vigo that offers Bachelor's degrees, Master's degrees and Doctoral programs in the fields of Telecommunications Engineering.

**Bachelor's Degree in Telecommunication Technologies Engineering (EUR-ACE®).**

The mail goal of the Bachelor's Degree in Telecommunication Technologies Engineering is to form professionals at the forefront of technological knowledge and professional competences in telecommunication engineering. This Bachelor has been recognized with the best quality seals, like the EUR-ACE's. **It has a bilingual option: up to 80% of the degree credits can be taken in English**.

http://teleco.uvigo.es/images/stories/documentos/gett/degree_telecom.pdf

www: http://teleco.uvigo.es/index.php/es/estudios/gett

**Master in Telecommunication Engineering**

The Master in Telecommunication Engineering is a Master's degree that qualifies to exercise the profession of Telecommunication Engineer, in virtue of the established in the Order CIN/355/2009 of 9 of February.

http://teleco.uvigo.es/images/stories/documentos/met/master_telecom_rev.pdf

www: http://teleco.uvigo.es/index.php/es/estudios/mit

**Interuniversity Masters**

The current academic offer includes interuniversity master's degrees that are closely related to the business sector:

Master in Cybersecurity: www: https://www.munics.es/

Master in Industrial Mathematics: www: http://m2i.es

International Master in Computer Vision: www: https://www.imcv.eu/

## (*)Equipo directivo

MANAGEMENT TEAM

Directora: Rebeca Pilar Díaz Redondo ( teleco.direccion@uvigo.gal)

Secretaría e Subdirección de Novas Titulacións: Pedro Rodríguez Hernández

(teleco.subdir.secretaria@uvigo.gal;teleco.subdir.novastitulacions@uvigo.gal)

Subdirección de Organización Académica: Pedro Comesaña Alfaro (teleco.subdir.academica@uvigo.gal)

Subdirección de Relaciones Internacionais e Subdirección de Infraestructuras: María Verónica Santalla del

Río (teleco.subdir.internacional@uvigo.gal; teleco.subdir.infraestructuras@uvigo.gal)

Subdirección Difusión e Captación: Laura Docio Fernández (teleco.subdir.captacion@uvigo.gal)

Subdirección de Calidade: Ana María Cao Paz(teleco.subdir.calidade@uvigo.gal)

BACHELOR□SDEGREE IN TELECOMMUNICATION TECHNOLOGIES ENGINEERING

Generalcoordinator: Lucía Costas Pérez (teleco.grao@uvigo.gal)

https://teleco.uvigo.es/es/documentos/acordos-es/comisions-academicas-es/miembros-de-la-comision-academica-del-gett/

MASTER IN TELECOMMUNICATION ENGINEERING

Generalcoordinator: Manuel García Sánchez (teleco.master@uvigo.gal)

https://teleco.uvigo.es/es/documentos/acordos-es/comisions-academicas-es/miembros-de-la-comision-academica-del-met/

MASTER INCYBERSECURITY

General coordinator:Ana Fernández Vilas (teleco.munics@uvigo.gal)

https://teleco.uvigo.es/es/documentos/acordos-es/comisions-academicas-es/miembros-de-la-comision-academica-del-munics/

MASTER ININDUSTRIAL MATHEMATICS

Generalcoordinator: Elena Vázquez Cendón (USC)

UVigo coordinator:José Durany Castrillo (durany@dma.uvigo.es)

http://www.m2i.es/?seccion=coordinacion

INTERNATIONALMASTER IN COMPUTER VISION

General coordinator: Xose Manuel Pardo López (USC)

UVigo coordinator:José Luis Alba Castro (jalba@gts.uvigo.es)

https://www.imcv.eu/legal-notice/

MASTER'S DEGREE IN QUANTUM INFORMATION SCIENCE AND TECHNOLOGIES (MQIST)

General coordinator: Javier Mas (USC)

Coordinador UVIGO: Manuel Fernández Veiga(teleco.mqist@uvigo.es)

https://quantummastergalicia.es/info

# Máster Universitario en Visión por Computador

| **Subjects** | | | |
|---|---|---|---|
| **Year 1st** | | | |
| Code | Name | Quadmester | Total Cr. |
| V05M185V01101 | Fundamentals of image analysis and processing | 1st | 6 |
| V05M185V01102 | Image description and modeling | 1st | 6 |
| V05M185V01103 | Fundamentals of machine leaming for computer vision | 1st | 6 |

| | | | |
|---|---|---|---|
| V05M185V01104 | Instrumentation and processing for machine vision | 1st | 6 |
| V05M185V01105 | Instrumentation and processing for biomedical applications | 1st | 6 |
| V05M185V01201 | Advanced image processing and analysis | 2nd | 6 |
| V05M185V01202 | Three-dimensional modeling and recognition | 2nd | 3 |
| V05M185V01203 | Visual recognition | 2nd | 6 |
| V05M185V01204 | Human action recognition | 2nd | 3 |
| V05M185V01205 | Advanced machine learning for computer vision | 2nd | 6 |
| V05M185V01206 | Photogrametrics and robot vision | 2nd | 6 |
| V05M185V01207 | Real time machine vision | 2nd | 3 |
| V05M185V01208 | Biomedical image analysis | 2nd | 6 |
| V05M185V01209 | Biometrics | 2nd | 3 |
| V05M185V01210 | External practices | 2nd | 3 |

| **Year 2nd** | | | |
|---|---|---|---|
| Code | Name | Quadmester | Total Cr. |
| V05M185V01301 | Master dissertation | 1st | 30 |

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Fundamentals of image analysis and processing** | | | | |
| Subject | Fundamentals of image analysis and processing | | | |
| Code | V05M185V01101 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Mandatory | 1st | 1st |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Alba Castro, José Luis | | | |
| Lecturers | Alba Castro, José Luis | | | |
| E-mail | jalba@gts.uvigo.es | | | |
| Web | http://https://www.imcv.eu/guide/2025-2026/fipa/ | | | |
| General description | This subject covers the fundamental topics of image processing and analysis and is presented as the first part of another subject that introduces more advanced topics. In addition to the study and application of fundamental techniques, practical applications of these techniques will be studied to solve real problems. This course provides the necessary tools to apply the algorithms used in practical cases, as well as the bases to develop new algorithms and continue studying more advanced methods.<br>Learning outcomes:<br>* Understand the basic concepts and techniques of digital image processing<br>* Understand the basic concepts and techniques of digital image analysis<br>* Ability to apply different basic techniques to computer vision problems<br>* Knowing how to assess the adequacy of methodologies applied to specific problems | | | |

| Training and Learning Results |
|---|
| Code |

| Expected results from this subject | |
|---|---|
| Expected results from this subject | Training and Learning Results |

| Contents |
|---|
| Topic |

| Planning | | | |
|---|---|---|---|
| | Class hours | Hours outside the classroom | Total hours |
| *The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. | | | |

| Methodologies | |
|---|---|
| | Description |

| Personalized assistance |
|---|

| Assessment | | |
|---|---|---|
| Description | Qualification | Training and Learning Results |

| Other comments on the Evaluation |
|---|

| Sources of information |
|---|
| **Basic Bibliography** |
| **Complementary Bibliography** |

| Recommendations |
|---|

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Image description and modeling** | | | | |
| Subject | Image description and modeling | | | |
| Code | V05M185V01102 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Mandatory | 1st | 1st |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Fernández Álvarez, Antonio | | | |
| Lecturers | Fernández Álvarez, Antonio | | | |
| E-mail | antfdez@uvigo.gal | | | |
| Web | http://https://www.imcv.eu/guide/2025-2026/idm/ | | | |
| General description | The aim of this course is to become familiar with the fundamental characteristics of the digital image and its forms of representation, the description of visual content through local features of colour, shape and texture, and the practical application of these concepts to problems of image processing and analysis. | | | |

| Training and Learning Results | |
|---|---|
| Code | |
| A1 | CB6 Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context |
| A2 | CB7 Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study |
| B1 | Capacity for analysis and synthesis of knowledge |
| B3 | Ability to develop computer vision systems depending on the existent needs and apply the most suitable technological tools |
| C1 | To know and apply the concepts, methodologies and technologies of image processing |
| D1 | To 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 |
| D2 | Capacity for teamwork, organization and planning |

| Expected results from this subject | |
|---|---|
| Expected results from this subject | Training and Learning Results |
| To know the fundamental characteristics of digital image and its forms of representation | A1<br>A2<br>B1<br>B3<br>C1<br>D1<br>D2 |
| Description of visual content through local characteristics of colour, shape and texture | A1<br>A2<br>B1<br>B3<br>C1<br>D1<br>D2 |
| To apply image modelling and representation techniques to image processing and analysis problems | A1<br>A2<br>B1<br>B3<br>C1<br>D1<br>D2 |

| Contents | |
|---|---|
| Topic | |
| Image representation and modeling | Space-frequency, orientation and phase, space-scale |

| | |
|---|---|
| Wavelets and filter banks | - Wavelets<br>- Filter banks |
| Image coding and reconstruction | - Coding<br>- Reconstruction |
| Image descriptors | - Colour<br>- Shape<br>- Texture |
| Applications | - Image modelling applications<br>- Image description applications |

**Planning**

| | Class hours | Hours outside the classroom | Total hours |
|---|---|---|---|
| Lecturing | 10 | 20 | 30 |
| Case studies | 4 | 16 | 20 |
| Laboratory practical | 16 | 32 | 48 |
| Project based learning | 10 | 40 | 50 |
| Objective questions exam | 2 | 0 | 2 |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

**Methodologies**

| | Description |
|---|---|
| Lecturing | Participatory lessons with the aim of learning the theoretical content of the subject |
| Case studies | Elaboration and presentation of selected state-of-the-art methodologies related to the subject |
| Laboratory practical | Analysis and resolution of practical cases with the aim of strengthening the practical application of the theoretical content. Practice in computer classrooms, learning based on the resolution of practical cases, autonomous work and independent study of the students, and group work and cooperative learning. |
| Project based learning | Learning based on the resolution of practical cases, autonomous work and independent study of the students, and group work and cooperative learning. |

**Personalized assistance**

| Methodologies | Description |
|---|---|
| Case studies | Individualized advice during case studies |
| Laboratory practical | Resolution of doubts during laboratory practices |
| Project based learning | Individualized advice during research projects |

**Assessment**

| | Description | Qualification | Training and Learning Results | | | |
|---|---|---|---|---|---|---|
| Case studies | Elaboration and presentation of works on selected state-of-the-art methodologies | 15 | A1<br>A2 | B1<br>B3 | C1 | D1<br>D2 |
| Laboratory practical | Analysis and resolution of practical cases with the aim of strengthening the practical application of theoretical content | 40 | A1<br>A2 | B1<br>B3 | C1 | D1<br>D2 |
| Project based learning | Resolution of practical cases of application of the subject through autonomous work of the student, and using the techniques learned during the course | 20 | A1<br>A2 | B1<br>B3 | C1 | D1<br>D2 |
| Objective questions exam | Continuous self-evaluation tests during the course. Evaluation by examination at the end of the course as an alternative. | 25 | A1<br>A2 | B1<br>B3 | C1 | D1<br>D2 |

**Other comments on the Evaluation**

The evaluation corresponding to the objective test may be passed by means of the tests scheduled during the course or by means of the final exam.

**Sources of information**

**Basic Bibliography**


Bovik, Alan, **The essential guide to image processing**, 1, Elsevier, 2009

Bovik, Alan, **Handbook of image and video processing**, 2, Elsevier, 2005

Mallat, Stephane, **A wavelet tour of signal processing: The sparse way**, 3, Elsevier, 2009

Nixon, Mark S.; Aguado, Alberto S., **Feature extraction and image processing for computer vision**, 3, Elsevier, 2012

Sonka, M.; Hlavac, V.; Boyle, R., **Image Processing, Analysis, and Machine Vision**, 3, Thomson Learning, 2009

Forsyth, David A.; Ponce, Jean, **Computer Vision: A Modern Approach**, 2, Pearson, 2012
Szeliski, Richard, **Computer Vision: Algorithms and Applications**, 1, Springer, 2010
Petrou, Maria; García-Sevilla, Pedro, **Image processing: Dealing with texture**, 1, Wiley, 2006
9. Mirmehdi, M.; Xie, X.; Suri, J., **Handbook of texture analysis**, 1, Imperial College Press, 2008

**Complementary Bibliography**

## Recommendations

**Subjects that are recommended to be taken simultaneously**

Fundamentals of machine leaming for computer vision/V05M185V01103
Fundamentals of image analysis and processing/V05M185V01101

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Fundamentals of machine leaming for computer vision** | | | | |
| Subject | Fundamentals of machine leaming for computer vision | | | |
| Code | V05M185V01103 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Mandatory | 1st | 1st |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Alba Castro, José Luis | | | |
| Lecturers | Alba Castro, José Luis | | | |
| E-mail | jalba@gts.uvigo.es | | | |
| Web | http://https://www.imcv.eu/guide/2025-2026/fmlcv/ | | | |
| General description | The aim of the course is to present some of the topics which are at the core of modern Machine Learning, from fundamentals to state-of-the-art methods. Emphasis will be put both on the essential theory and on practical examples and lab projects. Each exercise has been carefully chosen to reinforce concepts explained in the lectures or to develop and generalize them in significant ways. | | | |

| Training and Learning Results |
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| Code |

| Expected results from this subject | |
|---|---|
| Expected results from this subject | Training and Learning Results |

| Contents |
|---|
| Topic |

| Planning | | | |
|---|---|---|---|
| | Class hours | Hours outside the classroom | Total hours |
| *The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. | | | |

| Methodologies | |
|---|---|
| | Description |

| Personalized assistance |
|---|

| Assessment | | |
|---|---|---|
| Description | Qualification | Training and Learning Results |

| Other comments on the Evaluation |
|---|

| Sources of information |
|---|
| **Basic Bibliography** |
| **Complementary Bibliography** |

| Recommendations |
|---|

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Instrumentation and processing for machine vision** | | | | |
| Subject | Instrumentation and processing for machine vision | | | |
| Code | V05M185V01104 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Mandatory | 1st | 1st |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Alba Castro, José Luis | | | |
| Lecturers | Alba Castro, José Luis | | | |
| E-mail | jalba@gts.uvigo.es | | | |
| Web | http://https://www.imcv.eu/guide/2025-2026/ipmv/ | | | |
| General description | To understand the basics and fundamentals of a computer vision system for different types of sensors and their corresponding applications. | | | |

| Training and Learning Results |
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| Code |

| Expected results from this subject | |
|---|---|
| Expected results from this subject | Training and Learning Results |

| Contents |
|---|
| Topic |

| Planning | | | |
|---|---|---|---|
| | Class hours | Hours outside the classroom | Total hours |
| *The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. | | | |

| Methodologies |
|---|
| Description |

| Personalized assistance |
|---|

| Assessment | | |
|---|---|---|
| Description | Qualification | Training and Learning Results |

| Other comments on the Evaluation |
|---|

| Sources of information |
|---|
| **Basic Bibliography** |
| **Complementary Bibliography** |

| Recommendations |
|---|

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Instrumentation and processing for biomedical applications** | | | | |
| Subject | Instrumentation and processing for biomedical applications | | | |
| Code | V05M185V01105 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Mandatory | 1st | 1st |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Alba Castro, José Luis | | | |
| Lecturers | Alba Castro, José Luis | | | |
| E-mail | jalba@gts.uvigo.es | | | |
| Web | http://https://www.imcv.eu/guide/2025-2026/ipbma/ | | | |
| General description | General objectives: To introduce the student to the basic aspects of computer applications related to medical imaging.<br><br>Learning outcomes: Each student will demonstrate his or her ability to<br><br> Understand the basic concepts related to the different biomedical imaging modalities and the physical factors that influence their properties.<br><br> Know the statistical techniques currently used for the validation of biomedical applications.<br><br> Apply different processing and analysis techniques in biomedical imaging applications.<br><br> To learn about image recording techniques and their applications in biomedical imaging. | | | |

| Training and Learning Results |
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| Code |

| Expected results from this subject | |
|---|---|
| Expected results from this subject | Training and Learning Results |

| Contents |
|---|
| Topic |

| Planning | | | |
|---|---|---|---|
| | Class hours | Hours outside the classroom | Total hours |
| *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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| Description |

| Personalized assistance |
|---|

| Assessment | | |
|---|---|---|
| Description | Qualification | Training and Learning Results |

| Other comments on the Evaluation |
|---|

| Sources of information |
|---|
| **Basic Bibliography** |
| **Complementary Bibliography** |

## Recommendations

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Advanced image processing and analysis** | | | | |
| Subject | Advanced image processing and analysis | | | |
| Code | V05M185V01201 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Mandatory | 1st | 2nd |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Alba Castro, José Luis | | | |
| Lecturers | Alba Castro, José Luis | | | |
| E-mail | jalba@gts.uvigo.es | | | |
| Web | http://https://www.imcv.eu/guide/2025-2026/aipa/ | | | |
| General description | -Study and application of advanced digital image processing techniques.<br>-Study and application of advanced techniques of digital image analysis.<br>-Analysis of real problems, and design and development of solutions based on advanced image processing and analysis technologies.<br>-Evaluation of the adequacy of the methodologies applied in specific problems.<br><br>This curricular unit addresses the most advanced topics in image processing and analysisand presents itself as a sequence of a curricular unit where the fundamental topics arepresented. It is designed to provide the essential foundation for students wishing topursue research in this area. In addition to the study and application of advancedtechniques of image processing and analysis, applications in this area are studied thataim 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. | | | |

| Training and Learning Results |
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| Code |

| Expected results from this subject | |
|---|---|
| Expected results from this subject | Training and Learning Results |

| Contents |
|---|
| Topic |

| Planning | | | |
|---|---|---|---|
| | Class hours | Hours outside the classroom | Total hours |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

| Methodologies | |
|---|---|
| | Description |

| Personalized assistance |
|---|

| Assessment | | |
|---|---|---|
| Description | Qualification | Training and Learning Results |

| Other comments on the Evaluation |
|---|

| Sources of information |
|---|
| **Basic Bibliography** |
| **Complementary Bibliography** |

| Recommendations |
|---|

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Three-dimensional modeling and recognition** | | | | |
| Subject | Three-dimensional modeling and recognition | | | |
| Code | V05M185V01202 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 3 | Optional | 1st | 2nd |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Alba Castro, José Luis | | | |
| Lecturers | Alba Castro, José Luis | | | |
| E-mail | jalba@gts.uvigo.es | | | |
| Web | http://https://www.imcv.eu/guide/2025-2026/tdmr/ | | | |
| General description | At the end of the course the student must understand the development of interactive graphic applications focused on polygonal modeling, volumetric image representation and ray-marching. | | | |

| Training and Learning Results |
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| Code |

| Expected results from this subject | |
|---|---|
| Expected results from this subject | Training and Learning Results |

| Contents |
|---|
| Topic |

| Planning | | | |
|---|---|---|---|
| | Class hours | Hours outside the classroom | Total hours |
| *The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. | | | |

| Methodologies | |
|---|---|
| | Description |

| Personalized assistance |
|---|

| Assessment | | |
|---|---|---|
| Description | Qualification | Training and Learning Results |

| Other comments on the Evaluation |
|---|

| Sources of information |
|---|
| **Basic Bibliography** |
| **Complementary Bibliography** |

| Recommendations |
|---|

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Visual recognition** | | | | |
| Subject | Visual recognition | | | |
| Code | V05M185V01203 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Mandatory | 1st | 2nd |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Alba Castro, José Luis | | | |
| Lecturers | Alba Castro, José Luis | | | |
| E-mail | jalba@gts.uvigo.es | | | |
| Web | http://https://www.imcv.eu/guide/2025-2026/vr/ | | | |
| General description | Visual recognition tasks range from object detection in images and videos, object classification, and instance recognition, to human action recognition. In the course we will undertake a study of the first tasks, as action recognition is the main topic of Human Action Recogniton subject.<br><br>The objective is for students to acquire knowledge and skills that allow them to design systems for video motion detection, motion-based segmentation and tracking, classification and detection of objects in images and video, as well as visual tracking of objects.<br>O obxectivo é que o alumnado adquira coñecementos e habilidades que lles permitan deseñar sistemas de detección de movemento de vídeo, segmentación e rastreamento baseados en movementos, clasificación e detección de obxectos en imaxes e vídeo, así como rastrexo visual de obxectos. | | | |

| Training and Learning Results |
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| Code |

| Expected results from this subject | |
|---|---|
| Expected results from this subject | Training and Learning Results |

| Contents |
|---|
| Topic |

| Planning | | | |
|---|---|---|---|
| | Class hours | Hours outside the classroom | Total hours |

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| Methodologies | |
|---|---|
| | Description |

| Personalized assistance |
|---|

| Assessment | | |
|---|---|---|
| Description | Qualification | Training and Learning Results |

| Other comments on the Evaluation |
|---|

| Sources of information |
|---|
| **Basic Bibliography** |
| **Complementary Bibliography** |

| Recommendations |
|---|

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Human action recognition** | | | | |
| Subject | Human action recognition | | | |
| Code | V05M185V01204 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 3 | Optional | 1st | 2nd |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Alba Castro, José Luis | | | |
| Lecturers | Alba Castro, José Luis | | | |
| E-mail | jalba@gts.uvigo.es | | | |
| Web | http://https://www.imcv.eu/guide/2024-2025/har/ | | | |
| General description | -Knowledge of recognition techniques applied to the recognition of people, and body parts.<br><br>-Analysis and evaluation of human action recognition applications<br><br>-Development of tools based on advanced technologies for recognition of human actions<br>-Análisis y evaluación de aplicaciones de reconocimiento de acciones humanas<br><br>-Desarrollo de herramientas basadas en tecnologías avanzadas de reconocimiento de acciones humanas | | | |

| Training and Learning Results |
|---|
| Code |

| Expected results from this subject | |
|---|---|
| Expected results from this subject | Training and Learning Results |

| Contents |
|---|
| Topic |

| Planning | | | |
|---|---|---|---|
| | Class hours | Hours outside the classroom | Total hours |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

| Methodologies | |
|---|---|
| | Description |

| Personalized assistance |
|---|

| Assessment | | |
|---|---|---|
| Description | Qualification | Training and Learning Results |

| Other comments on the Evaluation |
|---|

| Sources of information |
|---|
| **Basic Bibliography** |
| **Complementary Bibliography** |

| Recommendations |
|---|

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Advanced machine learning for computer vision** | | | | |
| Subject | Advanced machine learning for computer vision | | | |
| Code | V05M185V01205 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Mandatory | 1st | 2nd |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Alba Castro, José Luis | | | |
| Lecturers | Alba Castro, José Luis | | | |
| E-mail | jalba@gts.uvigo.es | | | |
| Web | http://https://www.imcv.eu/guide/2025-2026/amlcv/ | | | |
| General description | The objective of this subject is to know and apply advanced neural models, to know the techniques of the state of the art of deep learning, with end-to-end training approaches, and minimizing the use of tagged data, to solve computer vision applications using the methodologies covered in the subject. | | | |

| Training and Learning Results | |
|---|---|
| Code | |
| A1 | CB6 Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context |
| A2 | CB7 Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study |
| A5 | CB10 Students should possess the learning skills to enable them to continue studying in a largely self-directed or autonomous manner. |
| B1 | Capacity for analysis and synthesis of knowledge |
| B3 | Ability to develop computer vision systems depending on the existent needs and apply the most suitable technological tools |
| B5 | Ability to identify unsolved problems and provide innovative solutions |
| B6 | Ability to identify theoretical results or new technologies with innovative potential and turn them into products and services useful to society |
| C2 | To know and apply automatic learning and pattern recognition techniques applied to computer vision |
| D1 | To 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 |
| D2 | Capacity for teamwork, organization and planning |

| Expected results from this subject | |
|---|---|
| Expected results from this subject | Training and Learning Results |
| To know, apply and evaluate advanced neural models. | A1<br>A2<br>A5<br>B1<br>B3<br>B5<br>B6<br>C2<br>D1<br>D2 |
| To know deep learning techniques with end-to-end training approaches, and minimizing the use of labelled data. | A1<br>A2<br>A5<br>B1<br>B3<br>B5<br>B6<br>C2<br>D1 |

| | |
|---|---|
| To solve computer vision applicationsusing advanced machine learning methods | A1<br>A2<br>A5<br>B1<br>B3<br>B5<br>B6<br>C2<br>D1<br>D2 |

| **Contents** |
|---|
| Topic |
| Multilayer perceptron and backpropagation |
| Convolutional neural networks and recurrent networks |
| Principles of deep learning |
| Self-supervides learning and autoencoders. |
| Advanced Neural models for computer vision. |
| Advanced paradigms of supervision |
| Selected subjects in machine learning for computer vision. |
| Advanced Applications in computer vision. |

**Planning**

| | Class hours | Hours outside the classroom | Total hours |
|---|---|---|---|
| Laboratory practical | 16 | 32 | 48 |
| Case studies | 4 | 16 | 20 |
| Project based learning | 10 | 40 | 50 |
| Lecturing | 10 | 20 | 30 |
| Objective questions exam | 2 | 0 | 2 |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

**Methodologies**

| | Description |
|---|---|
| Laboratory practical | Analysis and resolution of practical cases with the objective of reinforce the practical application of the theoretical contents. Practices in computing labs, learning based in the resolution of practical cases, autonomous work and independent study of the students, and work in group and cooperative learning. |
| Case studies | Elaboration and presentation of works on selected and related state of the art methodologies. |
| Project based learning | Learning based on the resolution of practical cases, autonomous work and independent study of the students, and group work and cooperative learning. |
| Lecturing | Participatory lessons aimed at learning the theoretical contents of the subject |

**Personalized assistance**

| **Methodologies** | **Description** |
|---|---|
| Laboratory practical | Resolution of doubts during laboratory practices. |
| Case studies | Individualized advice during the case study. |
| Project based learning | Individualized advice during the realization of the projects |

**Assessment**

| | Description | Qualification | Training and Learning Results | | | |
|---|---|---|---|---|---|---|
| Laboratory practical | Analysis and resolution of practical cases with the objective of affirming the practical application of theoretical contents | 40 | A1<br>A2<br>A5 | B1<br>B3<br>B5<br>B6 | C2 | D1<br>D2 |
| Case studies | Elaboration and presentation of works on selected state-of-the-art methodologies | 15 | A1<br>A2<br>A5 | B1<br>B3<br>B5<br>B6 | C2 | D1<br>D2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Project based learning | Resolution of practical cases of application of the subject by means of autonomous work of the student, and using the techniques learned during the course | 20 | A1<br>A2<br>A5 | B1<br>B3<br>B5<br>B6 | C2 | D1<br>D2 |
| Objective questions exam | Tests for continuous assessment during the course. Evaluation by means of a final examination of the course as an alternative | 25 | A1<br>A2<br>A5 | B1<br>B3<br>B5<br>B6 | C2 | D1<br>D2 |

**Other comments on the Evaluation**

The evaluation corresponding to the objective test can be passed by means of the programmed tests during the course or by means of a final exam.

**Sources of information**

**Basic Bibliography**

**Complementary Bibliography**

Ian Goodfellow, Yoshua Bengio, Aaron Courville., **Deep Learning.**, MIT Press., 2017

Artigos recentes en revistas e conferencias científicas relevantes: NIPS, ICML, IJCAI, AAAI, ECML, C,

**Recommendations**

**Subjects that are recommended to be taken simultaneously**

Visual recognition/V05M185V01203

**Subjects that it is recommended to have taken before**

Image description and modeling/V05M185V01102

Fundamentals of machine leaming for computer vision/V05M185V01103

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Photogrametrics and robot vision** | | | | |
| Subject | Photogrametrics and robot vision | | | |
| Code | V05M185V01206 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Optional | 1st | 2nd |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Martínez Sánchez, Joaquín | | | |
| Lecturers | Balado Frías, Jesús<br>Martínez Sánchez, Joaquín | | | |
| E-mail | joaquin.martinez@uvigo.es | | | |
| Web | http://https://www.imcv.eu/guide/2025-2026/prv/ | | | |
| General description | In this subject students will learn to:<br>1.- Accurately model an image acquisition system from a geometric point of view;<br>2.- Model the relative orientation between images and the acquisition and processing methodologies to obtain a local system 3D model<br>3.- Select and collect 3D data from different LiDAR sensors;<br>4.- Process and analyze 3D point clouds based on geometric and radiometric information. | | | |

| Training and Learning Results | |
|---|---|
| Code | |
| A1 | CB6 Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context |
| A4 | CB9 Students should be able to communicate their findings - and the ultimate knowledge and reasons behind them - to specialist and non-specialist audiences in a clear and unambiguous manner |
| A5 | CB10 Students should possess the learning skills to enable them to continue studying in a largely self-directed or autonomous manner. |
| C1 | To know and apply the concepts, methodologies and technologies of image processing |
| C3 | To know and apply the concepts, methodologies and technologies of image and video analysis |
| C5 | To analyze and apply state-of-the-art methods in computer vision |
| C6 | To know and apply the fundamentals of image acquisition and machine vision systems |
| C9 | To know and apply the concepts, methodologies and technologies for the recognition of visual patterns in real scenes |
| D2 | Capacity for teamwork, organization and planning |

| Expected results from this subject | Training and Learning Results |
|---|---|
| Know howto precisely modelling image acquisition systems from a geometrical point of view | A1<br>A4<br>A5<br>C6<br>C9<br>D2 |
| Understand and apply the methodologies for image acquisition and processing oriented to obtain their relative orientation | A1<br>A4<br>A5<br>C1<br>C3<br>C5<br>C9<br>D2 |
| Understand and apply orientation techniques aimed at obtaining georeferenced 3D models | A1<br>A4<br>A5<br>C1<br>C6<br>C9<br>D2 |

| | |
|---|---|
| Understand and apply mapping and navigation techniques based on sensor fusion in a multimodal vision-laser system | A1<br>A4<br>A5<br>C1<br>C3<br>C6<br>C9<br>D2 |

| Contents | |
|---|---|
| Topic | |
| Photogrammetric Computer Vision. Calibration of cameras and Geometrical transformations. | Fundamentals of photogrammetry<br><br>Interior, Relative, Absolute orientation<br><br>Bundle Adjustment, Spatial Transformations<br><br>GeoRectification |
| 3D Data Acquisition | Point Cloud data collection<br><br>Point Cloud structure and conversion<br><br>LiDAR data collection and sensor fusion |
| 3D Data Analysis and processing | Geometric and radiometric analysis<br>Visualization<br>Machine Learning applied to 3D data |
| Advanced Techniques in Spatial Computing | Mixed Reality in 3D scenarios<br>Simulated Point Clouds with HELIOS++<br>Visual Odometry and SLAM<br>Real Applications and Case Studies. |

| Planning | | | |
|---|---|---|---|
| | Class hours | Hours outside the classroom | Total hours |
| Lecturing | 10 | 20 | 30 |
| Practices through ICT | 25 | 40 | 65 |
| Mentored work | 0.5 | 20 | 20.5 |
| Seminars | 4 | 6 | 10 |
| Objective questions exam | 0.5 | 5 | 5.5 |
| Problem and/or exercise solving | 1 | 7.5 | 8.5 |
| Report of practices, practicum and external practices | 0.5 | 10 | 10.5 |
| *The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. | | | |

| Methodologies | |
|---|---|
| | Description |
| Lecturing | It will consist of the collaborative discussion of contents of the course of way.<br><br>This includes discussion and solving problems and practical case studies in the classroom. |
| Practices through ICT | Methodology oriented to solving cases of study related with the thematic of the course using software of reference.<br><br>Practices and exercises focused on the implementation of the algorithms explained in the participatory classes.<br><br>Specific hardware will be used in the laboratory in sessions of mandatory face-toface attendance |
| Mentored work | Taking into account proposed practical case studies, this method is oriented to solving and documenting a complete photogrammetric project, including the definition of:3D data acquisition methodologies in the field, supporting data processing for modeling the main products obtained through the photogrammetric process. |
| Seminars | The description of a concrete practical case related with the professional practice of photogrammetry. |

| Personalized assistance | |
|---|---|
| **Methodologies** | **Description** |

| | |
|---|---|
| Lecturing | For all the modalities of teaching, tutorial session meetings could be held by telematic means (email, videoconference, forums in FAITIC, ...) Under the modality of previous agreement. |
| Practices through ICT | In the mandatory lab sessions there will be a continuous assesment of the student performance. For all the modalities of teaching, tutorial session meetings could be held by telematic means (email, videoconference, forums in FAITIC, ...) Under the modality of previous agreement. |
| Mentored work | For all the modalities of teaching, tutorial session meetings could be held by telematic means (email, videoconference, forums in FAITIC, ...) Under the modality of previous agreement. |

## Assessment

| | Description | Qualification | Training and Learning Results | | |
|---|---|---|---|---|---|
| Mentored work | The students will have to complete a case of study by means of the design of a methodology that include the steps seen in the course:<br><br>1.- Objectives, Requirements and Products analysis<br>2.- Definition of the image acquisition networks in the case study<br>3.- Image processing and analysis<br>4.- Obtaining key photogrammetric products | 30 | A1<br>A4<br>A5 | C1<br>C3<br>C5<br>C6<br>C9 | D2 |
| Objective questions exam | The students will have to answer individually a test with questions about the contents of the course. | 30 | A1<br>A4<br>A5 | C1<br>C3<br>C5<br>C6<br>C9 | |
| Problem and/or exercise solving | The students will have to resolve of individual form and in small groups a group of cases and concrete practical exercises. | 40 | A1<br>A4<br>A5 | C1<br>C3<br>C5<br>C6<br>C9 | D2 |

## Other comments on the Evaluation

For more information about the tests dates and schedule please visit the webpage of the programm: https://www.imcv.eu/

## Sources of information

### Basic Bibliography

Thomas Luhmann, **Close Range Photogrammetry**, Whittles Publishing, 2006

Richard Hartley, **Multiple view geometry in Computer Vision**, 2, Cambridge : Cambridge University Press, 2003

Karl Kraus, **Photogrammetry : geometry from images and laser scans**, 2, Berlin ; New York : Walter De Gruyter, cop., 2007

### Complementary Bibliography

Wolfgang FörstnerBernhard P. Wrobel, **Photogrammetric Computer Vision**, Springer, 2016

## Recommendations

### Subjects that are recommended to be taken simultaneously

Instrumentation and processing for machine vision/V05M185V01104
Real time machine vision/V05M185V01207

### Subjects that it is recommended to have taken before

Image description and modeling/V05M185V01102
Fundamentals of image analysis and processing/V05M185V01101

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Real time machine vision** | | | | |
| Subject | Real time machine vision | | | |
| Code | V05M185V01207 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 3 | Optional | 1st | 2nd |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Martín Herrero, Julio | | | |
| Lecturers | Martín Herrero, Julio | | | |
| E-mail | julio@uvigo.es | | | |
| Web | http://https://www.imcv.eu/guide/2025-2026/rtmv/ | | | |
| General description | Workshop for getting acquainted with machine vision cameras and hardware, their configuration, fine tuning and how to work with them in real time. | | | |

| Training and Learning Results | |
|---|---|
| Code | |
| A5 | CB10 Students should possess the learning skills to enable them to continue studying in a largely self-directed or autonomous manner. |
| B3 | Ability to develop computer vision systems depending on the existent needs and apply the most suitable technological tools |
| C6 | To know and apply the fundamentals of image acquisition and machine vision systems |

| Expected results from this subject | |
|---|---|
| Expected results from this subject | Training and Learning Results |
| The students will learn how to efficiently program real time acquisition and processing of images proper of machine vision applications. | A5<br>B3<br>C6 |

| Contents | |
|---|---|
| Topic | |
| Real time programming for machine vision | . |
| PC-frame-grabber communication | . |
| Memory management | . |
| Structure and usage of a typical machine vision SDK | . |
| Low-level programming for high speed industrial processes | . |

| Planning | | | |
|---|---|---|---|
| | Class hours | Hours outside the classroom | Total hours |
| Workshops | 75 | 0 | 75 |
| Systematic observation | 0.1 | 0 | 0.1 |
| *The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. | | | |

| Methodologies | |
|---|---|
| | Description |
| Workshops | Hands-on workshop working in pairs in the lab with a computer and machine vision hardware, using C and C++. On-site attendance is compulsory, except when any extraordinary circumstances may concur. |

| Personalized assistance | |
|---|---|
| **Methodologies** | **Description** |
| Workshops | Direct access to the teacher during the work at the lab. |

## Assessment

| | Description | Qualification | Training and Learning Results | | |
|---|---|---|---|---|---|
| Systematic observation | The teacher will follow closely the performance and progress of the students during the workshop, with timely individual feedback. | 100 | A5 | B3 | C6 |

## Other comments on the Evaluation

This is an optional experimental subject that requires in situ attendance of the students at the lab. Attendance to each of the four in situ sessions is compulsory. The classes' schedule is published before the enrolment period. Make sure that you will be able to attend the four sessions at UVigo before you enrol in this subject. If you are working, make sure that you get a commitment in writing from your employers allowing you to attend the four scheduled sessions at UVigo before you enrol. Otherwise, DO NOT ENROL, choose another optional subject that does not require in situ attendance. Job commitments are not a recognised cause for leave of absence. Porto students please note: UPorto's general 25% leave of absence DOES NOT APPLY at Uvigo. The only recognised causes for leave of absence at UVigo are the usual force majeure causes: death, serious illness, law enforcement, and acts of God, and they must be officially sanctioned by UVigo's administrative services by means of suitable documentary proof. If a leave of absence is officially sanctioned by UVigo, the evaluation of the missed session will be arranged on a case-per-case basis with consideration of the particular circumstances of the case.

## Sources of information

### Basic Bibliography

Davies, **Machine Vision**, 3, Elsevier, 2005

### Complementary Bibliography

Several, **Webinar series**, Basler, 2020

## Recommendations

### Other comments

Good working knowledge of C/C++ is essential. Note that this subject requires on-site attendance at the University of Vigo in the programmed dates and times.

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Biomedical image analysis** | | | | |
| Subject | Biomedical image analysis | | | |
| Code | V05M185V01208 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Optional | 1st | 2nd |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Alba Castro, José Luis | | | |
| Lecturers | Alba Castro, José Luis | | | |
| E-mail | jalba@gts.uvigo.es | | | |
| Web | http://https://www.imcv.eu/guide/2025-2026/bmia/ | | | |
| General description | -Knowledge of specific advanced techniques for biomedical image processing and analysis.<br>-Analysis of current biomedical imaging applications, and ability to evaluate existing solutions, as well as the development of new specific solutions<br> Evaluation of the adequacy of applied methodologies in a multidisciplinary context for biomedical environments.<br>-Ability to write documentation and reports on scientific and technical results. | | | |

| Training and Learning Results |
|---|
| Code |

| Expected results from this subject | |
|---|---|
| Expected results from this subject | Training and Learning Results |

| Contents |
|---|
| Topic |

| Planning | | | |
|---|---|---|---|
| | Class hours | Hours outside the classroom | Total hours |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

| Methodologies |
|---|
| Description |

| Personalized assistance |
|---|

| Assessment | | |
|---|---|---|
| Description | Qualification | Training and Learning Results |

| Other comments on the Evaluation |
|---|

| Sources of information |
|---|
| **Basic Bibliography** |
| **Complementary Bibliography** |

| Recommendations |
|---|

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Biometrics** | | | | |
| Subject | Biometrics | | | |
| Code | V05M185V01209 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 3 | Optional | 1st | 2nd |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Alba Castro, José Luis | | | |
| Lecturers | Alba Castro, José Luis | | | |
| E-mail | jalba@gts.uvigo.es | | | |
| Web | http://https://www.imcv.eu/guide/2025-2026/bm/ | | | |
| General description | This subject offers a general view of the biometric identification techniques based on image and video. It delves into the most common ones: face, fingerprint and iris recognition. | | | |

| Training and Learning Results | |
|---|---|
| Code | |
| A3 | CB8 Students should be able to integrate knowledge and deal with the complexity of making judgements based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with applying their knowledge and judgements |
| B4 | Capacity for critical analysis and rigorous evaluation of technologies and methodology |
| B7 | Autonomous learning ability for specialization in one or more fields of study |
| C2 | To know and apply automatic learning and pattern recognition techniques applied to computer vision |
| C4 | To conceive, develop and evaluate complex computer vision systems |
| D1 | To 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 |
| D4 | Ability to understand the meaning and application of the gender perspective in the different areas of knowledge and in professional practice with the aim of achieving a more just and egalitarian society |

| Expected results from this subject | Training and Learning Results |
|---|---|
| The students will have comprised the common characteristics of the technicians of biometric identification, the evaluation metrics, the problems of practical implementation, the peculiarities of each biometric modality and the best way to combine them. Besides, they will have developed a critical analysis on the best working point for a concrete application, as well as an understanding of the peculiarities been due to demographic factors (sex, age, race, culture) in the design, development, evaluation and deployment of a solution of biometric identification. | A3<br>B4<br>B7<br>C2<br>C4<br>D1<br>D4 |

| Contents | |
|---|---|
| Topic | |
| Basic principles of biometric identification | Identity versus biometric traits: Types of traits and biometric signatures. Variance intra-class and *nter-class of the biometric signatures. Influence of the sensors in the different signatures.<br>Mathematical modelling of the biometric data: Extraction of characteristics. Compression. Representation versus Discrimination. Recognition, Identification, Verification and Authentication. Types of errors: TER, ERR, FAR, FRR. |
| Current biometric technologies | Physiological characteristics: fingerprints, iris, face, palm, retina, voice. Behavioural characteristics: signature (static and dynamic), keystrokes. Detection of alive sample.<br>Pros and conts in the use of each biométric trait. |
| Facial recognition | Global technics (eigenfaces, fisherfaces) versus local technics (template matching, NCC, Elastic Bunch Graph Matching). The problem of the variation of illumination and pose. The problem of the detection and normalisation.<br>Technicians of deep learning. Pros and cons. |
| Fingerprint recognition | Representation of minucias. Hausdorff distance. Gabor. filters. Tolerance to deformations. Types of sensors. |

| | |
|---|---|
| Iris recognition | Representation of the iris. Algorithm of Daugman. Algorithm of Wildes. Recognition at a distance. Pros and cons of iris recognition. |
| Multimodal recognition. Multibiometrics. | Combination of classifiers. Independent or correlated sources. Fusion of classifiers: intramodal, intermodal, algorithmic and scores-based. State of the art Systems using multimodal recognition and/or multibiometrics. |

**Planning**

| | Class hours | Hours outside the classroom | Total hours |
|---|---|---|---|
| Laboratory practical | 12 | 0 | 12 |
| Lecturing | 7 | 20 | 27 |
| Objective questions exam | 1 | 0 | 1 |
| Problem and/or exercise solving | 1 | 0 | 1 |
| Laboratory practice | 0 | 40 | 40 |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

**Methodologies**

| | Description |
|---|---|
| Laboratory practical | Practices of the concepts showed in the masterclasses. They will be made with software accessible to all the students. Learning based in the resolution of practical cases and in small projects. The work will be in general autonomous and with independent study of the students. Some practices will be done in group and by means of cooperative learning. Intensive use of the virtual classroom will be implemented. |
| Lecturing | Participatory master classes where the contents are exposed and the pros and cons that different options would have to solve practical cases will be advanced, leaving some open questions so that the students work them and arrive to their own conclusions. |

**Personalized assistance**

| Methodologies | Description |
|---|---|
| Lecturing | During the master class the debate between the students will be forced and open questions will hang in the air. |
| Laboratory practical | During the face-to-face part of the practices of laboratory there will be a personalized attention to solve doubts and to help in the advances. During the asynchronous part an extensive use of the Learning Management Systems and the forums of debate will be implemented |

**Assessment**

| | Description | Qualification | Training and Learning Results | | | |
|---|---|---|---|---|---|---|
| Objective questions exam | Test of short questions about the concepts studied with individual evaluation | 15 | A3 | B4 | C2 | D1 D4 |
| Problem and/or exercise solving | Examination of short problems on the concepts and practices carried out, with individual evaluation | 15 | A3 | B4 | C4 | |
| Laboratory practice | The laboratory practices will have a part that can be evaluated individually or in groups depending on the type of practice. | 70 | A3 | B4 B7 | C2 C4 | D4 |

**Other comments on the Evaluation**

**Sources of information**

**Basic Bibliography**

**Complementary Bibliography**

Wayman, J.L., Jain, A.K., Maltoni, D., Maio, D. (Eds.), **Biometric systems. Technology, Design and Performance Evaluation**, 1, Springer, 2005

Anil Jain, Ruud Bolle y Sarta Pankanti (Eds.), **Biometrics. Personal Identification in Networked Society**, 1, Kluwer Academic Publishers, 2006

John Daugman, **How iris recognition works**, IEEE Transactions on Circuits and Systems for Vide, 2004

**Recommendations**

**Subjects that are recommended to be taken simultaneously**

Advanced machine learning for computer vision/V05M185V01205
Advanced image processing and analysis/V05M185V01201

**Subjects that it is recommended to have taken before**

Image description and modeling/V05M185V01102
Fundamentals of machine leaming for computer vision/V05M185V01103
Fundamentals of image analysis and processing/V05M185V01101

**Other comments**

Big part of the material of study is based in scientific articles that will be left to student's disposal in the LMS.

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **External practices** | | | | |
| Subject | External practices | | | |
| Code | V05M185V01210 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 3 | Mandatory | 1st | 2nd |
| Teaching language | Spanish<br>Galician<br>English<br>Portuguese | | | |
| Department | | | | |
| Coordinator | Alba Castro, José Luis | | | |
| Lecturers | Alba Castro, José Luis | | | |
| E-mail | jalba@gts.uvigo.es | | | |
| Web | http://imcv.eu | | | |
| General description | External internships should provide students with direct contact with the reality of work. Although credits are limited, students will be integrated in ongoing projects, not only to learn the flows and dynamics of teamwork in the field of computer vision, but also to try to contribute in some part of the project the knowledge acquired in the Master to date.<br><br>This work should lead students to deepen in a topic related to the Master in Computer Vision, to internalize concepts, methods and techniques in the perspective of learning by doing, allowing them to develop reflection and synthesis, and to perform an applied work in the context of the area of specialization of computer vision. | | | |

| Training and Learning Results |
|---|
| Code |

| Expected results from this subject | |
|---|---|
| Expected results from this subject | Training and Learning Results |

| Contents | |
|---|---|
| Topic | |
| The practices will be agreed with the offering companies and with the centres of investigation (that they already have signed an agreement of collaboration), in such a way that it fulfil the requirement that the projects in which they integrate help to complete his training in some of the compulsory or elective subjects and that allow them have a direct contact with the reality of the market<br><br>Each student will have a program of individual work in the field of the educational, defined by the tutor in the host institution and validated by the academic tutor. The main steps can include a subset of the following, in accordance with the specific needs of the project.<br><br>At the end, the student will do a written report of the work developed. | -Review of the state of the art;<br><br>-Analysis of possible solutions;<br><br>-Proposed / Development of a solution;<br><br>-critical Analysis of the solution proposed / developed; |

| Planning | | | |
|---|---|---|---|
| | Class hours | Hours outside the classroom | Total hours |
| Practicum, External practices and clinical practices | 0 | 70 | 70 |
| Report of practices, practicum and external practices | 0 | 5 | 5 |
| *The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. | | | |

| Methodologies |
|---|

| | Description |
|---|---|
| Practicum, External practices and clinical practices | A working plan will be agreed with the offering entities that will have to be approved by the CAM. Each student will have an academic tutor and a tutor in the company/centre of investigation that will look after the correct development of the practice.<br><br>The main tasks of the work include the understanding of the problem, the formalisation of the problem, the study of appropriate methodologies, the development and design of a proposed / solution to the problem, an evaluation and a critical analysis of the results obtained, and conclusions. The External Practices will serve as adaptation of the students to the new surrounding work, or as a preamble for the realisation of the Master's thesis. In this case, more than providing solutions would look for doing proposals to develop in the Master's thesis.<br><br>Plan of Contingency for alternative stages:<br>Remote realisation of the practices could be a possibility |

## Personalized assistance

| Methodologies | Description |
|---|---|
| Practicum, External practices and clinical practices | Each student will have an academic tutor and a tutor in the company/centre of investigation that will look after the correct development of the practice. |

## Assessment

| | Description | Qualification | Training and Learning Results |
|---|---|---|---|
| Report of practices, practicum and external practices | System of evaluation<br>Inform of the tutor in the external entity (60%)<br>Report of the academic tutor (40%) | 100 | |

## Other comments on the Evaluation

## Sources of information

## Basic Bibliography

## Complementary Bibliography

## Recommendations

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Master dissertation** | | | | |
| Subject | Master dissertation | | | |
| Code | V05M185V01301 | | | |
| Study programme | Máster Universitario en Visión por Computador | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 30 | Mandatory | 2nd | 1st |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Alba Castro, José Luis | | | |
| Lecturers | Alba Castro, José Luis | | | |
| E-mail | jalba@gts.uvigo.es | | | |
| Web | http://imcv.eu | | | |
| General description | The main objective of the TFM is the analysis, design, implementation and validation of a project, carried out individually, related to computer vision. It can be developed in a company or entity with proven experience in R & D & i projects, being tutored by a professional in the field. The project must provide innovation components that go beyond the simple development of an application, service or standard line of business. The TFM must promote the contribution of added value by the student in innovative projects and their direct relationship with the labor market or with some cutting-edge research aspect. | | | |

| Training and Learning Results | |
|---|---|
| Code | |
| A4 | CB9 Students should be able to communicate their findings - and the ultimate knowledge and reasons behind them - to specialist and non-specialist audiences in a clear and unambiguous manner |
| B2 | Ability to analyse the needs of a company in the computer vision field and determine the best technical solution for it |
| B3 | Ability to develop computer vision systems depending on the existent needs and apply the most suitable technological tools |
| B4 | Capacity for critical analysis and rigorous evaluation of technologies and methodology |
| B5 | Ability to identify unsolved problems and provide innovative solutions |
| B6 | Ability to identify theoretical results or new technologies with innovative potential and turn them into products and services useful to society |
| C4 | To conceive, develop and evaluate complex computer vision systems |
| C8 | To communicate and disseminate research results and conclusions |
| D1 | To 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 |
| D2 | Capacity for teamwork, organization and planning |
| D3 | Development of the innovative and entrepreneurial spirit |

| Expected results from this subject | |
|---|---|
| Expected results from this subject | Training and Learning Results |
| New | A4<br>B2<br>B3<br>B4<br>B5<br>B6<br>C4<br>C8<br>D1<br>D2<br>D3 |

| Contents |
|---|
| Topic |

The Master's Thesis will consist of an original exercise carried out individually, consisting of a research or innovation project related to computer vision. The project may be carried out at the proposal of a company, public organization, university, research center or technology center that has signed a collaboration agreement with some of the universities participating in the master's degree or in a research group of the USC, UDC, UVigo or UPorto. In all cases, the TFM will be tutored by professors from the departments involved in the teaching of the Master, or by doctoral professors from the participating universities who have the authorization of the Interuniversity Academic Committee.

## Planning

| | Class hours | Hours outside the classroom | Total hours |
|---|---|---|---|
| Mentored work | 29 | 720 | 749 |
| Essay | 1 | 0 | 1 |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

## Methodologies

| | Description |
|---|---|
| Mentored work | The tutors will guide the work with face-to-face or on-line meetings. |

## Personalized assistance

| Methodologies | Description |
|---|---|
| Mentored work | |

## Assessment

| | Description | Qualification | | Training and Learning Results | | |
|---|---|---|---|---|---|---|
| Essay | Written work 70% | 100 | A4 | B2<br>B3 | C4<br>C8 | D1<br>D2 |
| | Presentation and defense 30% | | | B4<br>B5<br>B6 | | D3 |

## Other comments on the Evaluation

Plan of Contingency for alternative stages:

On-line meetings and final assessment can be done on-line due to exceptional causes

## Sources of information

## Basic Bibliography

## Complementary Bibliography

## Recommendations

## Other comments

Before the defense of the MT all the matters have to be surpassed