Universidade de Vigo

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	
Lecturers	Alba Castro, José Luis
E-mail	
Web	http://moovi.uvigo.gal
General description	This subject offers a general vision 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

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 B4 B7 C2 C4 D1 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. 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. Pros and cons 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. 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 B7	B4 C4	C2 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.