



POLITÉCNICA

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PR/CL/001



E.T.S. de Ingenieros
Informáticos

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

103000390 - Image Processing And Analysis

DEGREE PROGRAMME

10AK - Master Universitario En Software Y Sistemas

ACADEMIC YEAR & SEMESTER

2023/24 - Semester 2

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1. Description

1.1. Subject details

Name of the subject	103000390 - Image Processing And Analysis
No of credits	4 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AK - Master Universitario en Software y Sistemas
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2023-24

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Raul Alonso Calvo	2315	raul.alonso@upm.es	M - 10:00 - 13:00 W - 10:00 - 13:00 (Note: planned office hours. See possible changes in Moodle.)
Jose Crespo Del Arco (Subject coordinator)	5214	jose.crespo@upm.es	W - 14:30 - 20:30 (Note: planned office hours. See possible changes in Moodle.)

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Program development in a general purpose language such as C, C++, Java.
- Programming skills.

4. Skills and learning outcomes *

4.1. Skills to be learned

CEM7 - Evaluar y aplicar las diversas teorías matemáticas y estadísticas, y los procesos, métodos y técnicas disponibles para la extracción y descubrimiento de conocimiento a partir de grandes volúmenes de datos

CEM8 - Aplicar los fundamentos teóricos y matemáticos adecuados al procesamiento y análisis de funciones y datos de diversa naturaleza, y evaluar y diseñar los métodos relacionados para su aplicación en dominios prácticos

CG1 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio.

CG15 - Capacidad para contribuir al desarrollo futuro de la informática.

CG3 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades.

CG8 - Planteamiento y resolución de problemas también en áreas nuevas y emergentes de su disciplina

CGI22 - Capacidad para valorar la importancia de las fuentes documentales, manejarlas y buscar la información para el desarrollo de cualquier trabajo de investigación.

4.2. Learning outcomes

RA67 - Ser capaz de aplicar y evaluar comparativamente métodos de análisis en imágenes para segmentar zonas de interés y obtener parámetros característicos, considerando su implementación eficiente

RA66 - Ser capaz de aplicar y evaluar comparativamente técnicas de procesamiento de imágenes, considerando su implementación eficiente, y conocer las problemáticas de los sistemas de almacenamiento de los datos tipo imagen

RA65 - Comprender los fundamentos teóricos del procesamiento y análisis de datos tipo imagen

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

Outline

This subject covers techniques for image processing and analysis techniques, as well as methods for image classification.

Morphological approaches will be covered within the image processing and analysis,

For image classification, relevant features for clustering and learning will be treated. Approaches and applications for image indexation and image searching will be studied.

Learning Goals

Be aware of the foundations of image processing and analysis

Learn filtering techniques, and segmentation methods for separating regions of interest

Extract relevant features of input images.

Analyse some relevant image classification methods, and study image indexation and image searching techniques and applications.

5.2. Syllabus

1. Introduction
2. Filtering
 - 2.1. Introduction
 - 2.2. Morphological filtering
 - 2.3. Other techniques
3. Segmentation and extraction of features and regions of interest
 - 3.1. Introduction to image segmentation and feature extraction
 - 3.2. Morphological approaches
 - 3.3. Other methods
4. Image classification
 - 4.1. Introduction
 - 4.2. Image features for clustering and learning
 - 4.3. Indexation of images
 - 4.4. Image search applications

6. Schedule

6.1. Subject schedule*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	Topic 1,2 Duration: 03:00 Lecture	Topic 2 Duration: 01:00 Laboratory assignments		
2	Topic 2 Duration: 02:00 Lecture	Topic 2 Duration: 02:00 Laboratory assignments		
3	Topic 3 Duration: 02:00 Lecture	Topic 3 Duration: 02:00 Laboratory assignments		Computer assignment 1 Online test Continuous assessment Not Presential Duration: 02:00
4	Topic 3 Duration: 02:00 Lecture	Topic 3 Duration: 02:00 Laboratory assignments		
5	Topic 4 Duration: 02:00 Lecture	Topic 4 Duration: 02:00 Laboratory assignments		Computer assignment 2 Online test Continuous assessment Not Presential Duration: 02:00
6	Topic 4 Duration: 01:00 Lecture	Topic 4 Duration: 02:00 Laboratory assignments		Presentation and Report. Note: several days. Individual presentation Continuous assessment Presential Duration: 01:00
7	Topic 4 Duration: 01:00 Lecture	Topic 4 Duration: 02:00 Laboratory assignments		Presentation and Report. Note: several days. Individual presentation Continuous assessment Presential Duration: 01:00
8		Topic 4 Duration: 02:00 Laboratory assignments		Presentation and Report. Note: several days. Individual presentation Continuous assessment Presential Duration: 01:00 Computer assignment 3 Online test Continuous assessment Not Presential Duration: 02:00

9				<p>Computer assignment 1 Online test Final examination Not Presential Duration: 02:00</p> <p>Computer assignment 2 Online test Final examination Not Presential Duration: 02:00</p> <p>Presentation and Report Individual presentation Final examination Presential Duration: 04:00</p> <p>Computer assignment 3 Online test Final examination Not Presential Duration: 02:00</p> <p>Written or oral exam Problem-solving test Final examination Presential Duration: 03:00</p> <p>Written or oral exam Problem-solving test Continuous assessment Presential Duration: 03:00</p>
10				
11				
12				
13				
14				
15				
16				
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Computer assignment 1	Online test	No Presential	02:00	10%	/ 10	CEM8 CEM7 CG1 CG8
5	Computer assignment 2	Online test	No Presential	02:00	25%	/ 10	CEM8 CEM7 CG1 CG8
6	Presentation and Report. Note: several days.	Individual presentation	Face-to-face	01:00	5%	5 / 10	CEM8 CEM7 CG15 CGI22 CG8 CG3
7	Presentation and Report. Note: several days.	Individual presentation	Face-to-face	01:00	5%	5 / 10	CEM8 CEM7 CG15 CGI22 CG8 CG3
8	Presentation and Report. Note: several days.	Individual presentation	Face-to-face	01:00	5%	5 / 10	CG15 CGI22 CG8 CG3 CEM8 CEM7
8	Computer assignment 3	Online test	No Presential	02:00	35%	/ 10	CEM7 CG1 CG8 CEM8
9	Written or oral exam	Problem-solving test	Face-to-face	03:00	15%	5 / 10	CEM7 CG1 CG8 CEM8

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
9	Computer assignment 1	Online test	No Presential	02:00	10%	/ 10	CEM8 CEM7 CG1 CG8
9	Computer assignment 2	Online test	No Presential	02:00	25%	/ 10	CEM8 CEM7 CG1 CG8
9	Presentation and Report	Individual presentation	Face-to-face	04:00	15%	5 / 10	CEM8 CEM7 CG15 CGI22 CG8 CG3
9	Computer assignment 3	Online test	No Presential	02:00	35%	/ 10	CEM8 CEM7 CG1 CG8
9	Written or oral exam	Problem-solving test	Face-to-face	03:00	15%	5 / 10	CEM8 CEM7 CG1 CG8

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Exam	Problem-solving test	Face-to-face	00:30	15%	5 / 10	CEM8 CEM7 CG1 CG8
Presentation and Report	Individual presentation	Face-to-face	00:20	15%	5 / 10	CEM8 CEM7 CG15 CGI22 CG8 CG3
Computer assignments	Problem-solving test	Face-to-face	02:15	70%	/ 10	CEM8 CEM7 CG1 CG8

7.2. Assessment criteria

To pass the subject, at least 50 % of the total points must be achieved.

The indicated dates are tentative.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
"Digital image processing", Rafael C. Gonzalez, Richard E. Woods; Prentice Hall, 2nd. ed., 2002.	Bibliography	
"Morphological Image Analysis: Principles and Applications", Pierre Soille; Heidelberg: Springer, 2nd. ed., 2003.	Bibliography	
"Python Data Science Handbook", Jake VanderPlas, O'Reilly, 2016.	Bibliography	
"Deep Learning with Python", Francois Chollet, Manning Publications, 2017.	Bibliography	
Moodle	Web resource	
http://www.dlsiis.fi.upm.es/master_muss/asigPAI.html	Web resource	
BoofCV: http://boofcv.org/	Web resource	

OpenCV: http://opencv.org/	Web resource	
Classroom	Others	
Computers	Equipment	

9. Other information

9.1. Other information about the subject