ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

103000906 - Image Processing, Analysis And Classification

DEGREE PROGRAMME

10BA - Master Universitario en Ciencia de Datos

ACADEMIC YEAR & SEMESTER

2019/20 - Semester 2

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	103000906 - Image Processing, Analysis And Classification
No of credits	4.5 ECTS
Type	Optional
Academic year ot the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10BA - Master Universitario en Ciencia de Datos
Centre	10 - Escuela Tecnica Superior de Ingenieros Informaticos
Academic year	2019-20

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
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.)
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.)

* 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

CECD01 - Conocer los procesos de captura, extracción, manipulación y conversión de datos en diferentes entornos.

CG09 - Integración del conocimiento de distintos campos de estudio

4.2. Learning outcomes

RA22 - Poseer destrezas fundamentales de la programación que permitan la implementación de algoritmos y el uso de estructuras de datos típicos en ciencia de datos. e distintos tipos de herramientas (software o metodológicas y conceptuales) necesarias para el correcto y eficaz desarrollo de software, incluyendo entornos y librerías en el contexto de ciencia de datos.

* 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 tecniques 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 serching will be studied.

Learning Goals

Be aware 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 tecniques 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	Face-to-face classroom activities	Face-to-face laboratory activities	Other face-to-face activities	Assessment activities
1	**Topic 1,2** Duration: 03:00	**Topic 2** Duration: 01:00		
2	**Topic 2** Duration: 02:00	**Topic 2** Duration: 02:00		
3	**Topic 3** Duration: 02:00	**Topic 3** Duration: 02:00		**Computer assignment 1** Continuous assessment and final examination Duration: 02:00
4	**Topic 3** Duration: 02:00	**Topic 3** Duration: 02:00		
5	**Topic 4** Duration: 02:00	**Topic 4** Duration: 02:00		**Computer assignment 2** Continuous assessment and final examination Duration: 02:00
6	**Topic 4** Duration: 01:00	**Topic 4** Duration: 02:00		**Presentation and Report. Note: several days** Continuous assessment and final examination Duration: 01:00
7	**Topic 4** Duration: 01:00	**Topic 4** Duration: 02:00		**Presentation and Report. Note: several days** Continuous assessment and final examination Duration: 01:00
8		**Topic 4** Duration: 02:00		**Presentation and Report. Note: several days** Continuous assessment and final examination Duration: 02:00 **Computer assignment 3** Continuous assessment and final examination Duration: 02:00

9				**Written or oral exam** Continuous assessment and final examination Duration: 03:00
10				
11				
12				
13				
14				
15				
16				
17				

The independent study hours are training activities during which students should spend time on individual study or individual assignments.

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 subject schedule is based on a previous theorical planning of the subject plan and might go to through experience some unexpected changes along throughout the academic year.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Computer assignment 1		No Presential	02:00	10%	/ 10	CG09 CECD01
5	Computer assignment 2		No Presential	02:00	25%	/ 10	CG09 CECD01
6	Presentation and Report. Note: several days		Face-to-face	01:00	5%	5 / 10	CG09
7	Presentation and Report. Note: several days		Face-to-face	01:00	5%	5 / 10	CG09
8	Presentation and Report. Note: several days		Face-to-face	02:00	5%	5 / 10	CG09
8	Computer assignment 3		No Presential	02:00	35%	/ 10	CG09 CECD01
9	Written or oral exam		Face-to-face	03:00	15%	5 / 10	CG09 CECD01

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Computer assignment 1		No Presential	02:00	10%	/ 10	CG09 CECD01
5	Computer assignment 2		No Presential	02:00	25%	/ 10	CG09 CECD01
6	Presentation and Report. Note: several days		Face-to-face	01:00	5%	5 / 10	CG09
7	Presentation and Report. Note: several days		Face-to-face	01:00	5%	5 / 10	CG09
8	Presentation and Report. Note: several days		Face-to-face	02:00	5%	5 / 10	CG09
8	Computer assignment 3		No Presential	02:00	35%	/ 10	CG09 CECD01

9	Written or oral exam		Face-to-face	03:00	15%	5 / 10	CG09 CECD01

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Exam		Face-to-face	00:30	15%	5 / 10	CG09 CECD01
Presentation and Report		Face-to-face	00:20	15%	5 / 10	CG09
Computer assignments		Face-to-face	02:15	70%	/ 10	CG09 CECD01

7.2. Assessment criteria

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	