



- 1. Código:** 35677 **Nombre:** Advanced methods of artificial vision
- 2. Créditos:** 6,00 **--Teoría:** 3,00 **--Prácticas:** 3,00 **Carácter:** Optativo
- Titulación:** 2314-Máster Universitario en Ingeniería de Telecomunicación
- Módulo:** 3-Módulo de Optativas **Materia:** 5-Formación Optativa
- Centro:** E.T.S.I. DE TELECOMUNICACIÓN
- 3. Coordinador:** Del Amor del Amor, María Rocío
- Departamento:** COMUNICACIONES

4. Bibliografía

Generative deep learning : teaching machines to paint, write, compose, and play	Foster, David
Deep learning	Goodfellow, Ian
Deep learning : foundations and concepts	Bishop, Christopher M.
Deep learning with Python	Chollet, François

5. Descripción general de la asignatura

Objetivos de la asignatura

The course will be eminently practical. The general objective of the course is to study advanced deep learning techniques to solve computer vision problems such as image classification, segmentation, object detection, video analysis, scene description and image generation. The main idea is that students will be able to develop their own computer vision projects using the techniques provided in the course. The programming language Python and high-level libraries such as Tensorflow, Keras, Pytorch, etc. will be used as a basis for the development of the projects.

Contextualización de la asignatura

This course is part of the second year of the master's degree in telecommunication. The student has already taken a previous course in artificial intelligence in the first year. In this course the student will study new deep learning methods for artificial vision applications in depth.

6. Conocimientos recomendados

(35475) Inteligencia artificial para sistemas de comunicaciones y multimedia

7. Resultados

Resultados fundamentales

BA2(GE) 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;

Competencias transversales

(5) Responsabilidad y toma de decisiones

- Actividades desarrolladas relacionadas con la adquisición de la competencia

Final assignment of the courset where students must specifically address this competence by indicating the reasons for the decisions they make in the design and implementation of the work.

- Criterios de evaluación

Rubric

Resultados de Aprendizaje Específicos

RA5.1 - Identificar, formular y resolver problemas complejos, de manera autónoma, aplicando los principios de la disciplina.

8. Unidades didácticas

1. Introduction to computer vision (Hand crafted feature extraction)
 1. Statistical descriptors
 2. Local Binary Patterns
 3. Histogram of Oriented Gradients
 4. SIFT
 5. Gabor Filters





8. Unidades didácticas

6. PL1. Feature Extraction for Glaucoma characterization using OCT images
2. Fundamentals of convolutional neural networks
 1. Revisiting the MLP
 2. Concept of convolution
 3. Layers and structure of a convolutional neural network
 4. CNN architecture for classification
 5. Transfer learning and fine tuning techniques
 6. PL2. Convolutional neural network using keras: multiclass classification
3. Transformer-based feature extraction
 1. Transformer structure
 2. Visual transformers
 3. Introduction to pytorch
4. Large Vision Language Models
 1. Foundation models
 2. Examples of foundation models
5. Advanced Learning Methodologies
 1. Challenges in Supervised Machine Learning
 2. Weakly supervised learning
 3. Domain adaptation
 4. Other challenges
 5. PL3. Multiple instance learning using pytorch: histological classification
6. Autoencoder-based models
 1. Autoencoders
 2. Generative models: Variational autoencoders (VAEs)
7. Image segmentation
 1. Concept of image segmentation
 2. Training and evaluation methods for segmentation models
 3. Main algorithms: FCN (Fully Convolutional Network), U-Net, SegNet, etc.
 4. PL4. Semantic segmentation using PYTORCH: Segmentation on Satellite Images
8. Object detection
 1. Description of the object detection task
 2. Anchor boxes
 3. Most relevant architectures: R-CNN, Fast R-CNN, Mask R-CNN, Faster R-CNN, YOLO, SSD
 4. PL5. Object detection using pytorch: Cell detection and localization
9. Generative networks
 1. Introduction to generative models
 2. GAN, Conditional GAN, CycleGAN, StyleGAN
 3. PL6. Generative modelling using Pytorch: chest X-rays

9. Método de enseñanza-aprendizaje

UD	TA	SE	PA	PL	PC	PI	EVA	TP	TNP	TOTAL HORAS
1	2,00	--	2,00	--	--	2,00	--	6,00	9,00	15,00
2	6,00	--	4,00	--	--	2,00	--	12,00	20,00	32,00
3	4,00	--	4,00	--	--	--	--	8,00	12,00	20,00
4	2,00	--	2,00	--	--	0,00	--	4,00	6,00	10,00
5	2,00	--	2,00	--	--	2,00	--	6,00	9,00	15,00
6	2,00	--	2,00	--	--	--	--	4,00	6,00	10,00
7	4,00	--	0,00	--	--	2,00	--	6,00	9,00	15,00
8	4,00	--	2,00	--	--	2,00	0,00	8,00	12,00	20,00
9	4,00	--	--	--	--	2,00	--	6,00	9,00	15,00
TOTAL HORAS	30,00	--	18,00	--	--	12,00	0,00	60,00	92,00	152,00





9. Método de enseñanza-aprendizaje

UD: Unidad Didáctica. TA: Teoría de Aula. SE: Seminario. PA: Práctica de Aula. PL: Práctica de Laboratorio. PC: Práctica de Campo. PI: Práctica de Informática. EVA: Actividades de Evaluación. TP: Trabajo Presencial. TNP: Trabajo No Presencial.

10. Evaluación

Descripción

	Nº Actos	Peso (%)
(09) Proyecto	1	40
(15) Prueba práctica de laboratorio/campo/informática/aula	6	20
(14) Prueba escrita	2	40

The assessment of the content will consist of three parts:

- Participation and performance in lab sessions (20% of the mark). They will be assessed through the work done in the laboratory class.
- Theoretical-practical contents (40%). They will be evaluated through two written tests, each accounting for 20% of the mark, one in the middle of the semester and another at the end.
- A final project for the course (40% of the mark): the code presented (20%) and an oral presentation of the same (20%) will be evaluated.

The laboratory participation grade cannot be recovered. The student may repeat each of the two midterm exams separately. The final project may be made up by improving what is necessary to pass the evaluation.

If the student considers it appropriate to take the final recovery exams established in the teaching guide to improve the final grade, the final grade will be the maximum of the grade obtained in this exam and the corresponding grade of the ordinary assessment.

The conditions for this exam will be published in the exam announcement. Students who wish to sit the exam must notify the lecturer responsible for the subject by post at least 3 calendar days in advance. The final mark of the course, for all students, will be the maximum between the ordinary evaluation and the recovery.

The evaluation of students with dispensation will be the same as for the rest of the students. In the case of the 20% of the laboratory practices, will be prorated among the rest of the evaluations, 10% more for the final work, and 10% for the written exams.

11. Porcentaje máximo de ausencia

Actividad	Porcentaje	Observaciones
Teoría Aula	100	
Teoría Seminario	100	
Práctica Aula	100	
Práctica Laboratorio	100	
Práctica Informática	100	
Práctica Campo	100	

