ANX-PR/CL/001-01
GUÍA DE APRENDIZAJE

ASIGNATURA

103001062 - Generative Ai And Language Models

PLAN DE ESTUDIOS

10AZ - Master Universitario En Innovación Digital

CURSO ACADÉMICO Y SEMESTRE

2025/26 - Primer semestre

Índice

Guía de Aprendizaje

1. Datos descriptivos

1.1. Datos de la asignatura

Nombre de la asignatura	103001062 - Generative Ai And Language Models
No de créditos	4.5 ECTS
Carácter	Optativa
Curso	Primer curso
Semestre	Primer semestre
Período de impartición	Septiembre-Enero
Idioma de impartición	Castellano
Titulación	10AZ - Master Universitario en Innovación Digital
Centro responsable de la titulación	10 - E.T.S. De Ingenieros Informáticos
Curso académico	2025-26

2. Profesorado

2.1. Profesorado implicado en la docencia

Nombre	Despacho	Correo electrónico	Horario de tutorías *
Damiano Zanardini	2205	damiano.zanardini@upm.es	Sin horario. https://dia.fi.upm.es/personaldia/damiano/
Emilio Serrano Fernandez (Coordinador/a)	2201	emilio.serrano@upm.es	Sin horario. https://dia.fi.upm.es/personaldia/emilioserra/

* Las horas de tutoría son orientativas y pueden sufrir modificaciones. Se deberá confirmar los horarios de tutorías

con el profesorado.

3. Conocimientos previos recomendados

3.1. Asignaturas previas que se recomienda haber cursado

El plan de estudios Master Universitario en Innovación Digital no tiene definidas asignaturas previas recomendadas para esta asignatura.

3.2. Otros conocimientos previos recomendados para cursar la asignatura

- Basic knowledge of Python.

4. Competencias y resultados de aprendizaje

4.1. Competencias

CB07 - 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

CB10 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

CE-CD08 - Capacidad para utilizar y seleccionar las herramientas más adecuadas para deep learning

4.2. Resultados del aprendizaje

RA94 - Understand and design information extraction systems

RA63 - Identify areas of application where deep learning techniques can be used

RA64 - Apply machine learning soffware tools for practical problems related to deep learning

RA134 - Propose innovative uses of generative AI for problem-solving and creative expression across domains

RA133 - Design and evaluate effective prompts for generative AI tasks, including few-shot, zero-shot, and chain-of-thought prompting

RA95 - Understand and apply information retrieval systems

RA132 - Understand the principles, architectures, and limitations of generative models, including large language models

5. Descripción de la asignatura y temario

5.1. Descripción de la asignatura

This course provides a deep and practical introduction to one of the most transformative areas in modern artificial intelligence: Generative AI and Language Models. Students will explore how machines can generate text, images, and other forms of media by leveraging powerful deep learning architectures.

Generative AI refers to AI systems capable of producing novel content based on human input - commonly called prompts. Language models, particularly large-scale models like the GPT series lie at the heart of these systems. They not only process and generate human language but can also serve as a foundation for multimodal applications that integrate text, images, and audio.

These technologies are evolving rapidly and becoming increasingly accessible through websites, APIs, and open-source tools. As a result, their influence is spreading across many sectors. They are transforming creative industries, enhancing education, and driving innovation in fields such as scientific research, healthcare, and more.

The course explores both the theoretical foundations and practical techniques needed to build generative AI solutions.

5.2. Temario de la asignatura

1. Introduction to Generative AI and Language Models

2. Distributional Semantics and Word Embeddings

3. Sequential Models: RNNs, LSTMs, GRUs

4. Sequence-to-Sequence Models and the Transformer Architecture

5. Pretrained (Large) Language Models: GPT, BERT, T5, and beyond

6. Conversational AIs: ChatGPT, Gemini, and beyond

7. Frameworks for Building Generative AI Applications

8. Prompt Engineering: Few-shot, Chain-of-Thought, and beyond

9. Advanced Architectures: Retrieval-Augmented Generation (RAG) and Agentic Design Patterns

10. Multimodal Generative AI: text-to-image, image-to-text, and beyond

6. Cronograma

6.1. Cronograma de la asignatura *

Sem	Actividad tipo 1	Actividad tipo 2	Tele-enseñanza	Actividades de evaluación
1	**Topic 1** Duración: 02:00 LM: Actividad del tipo Lección Magistral			
2	**Topic 2** Duración: 02:00 LM: Actividad del tipo Lección Magistral			
3	**Topic 3** Duración: 02:00 LM: Actividad del tipo Lección Magistral			
4	**Topic 4** Duración: 02:00 LM: Actividad del tipo Lección Magistral			
5	**Topic 5** Duración: 02:00 LM: Actividad del tipo Lección Magistral			
6	**Topic 6** Duración: 02:00 LM: Actividad del tipo Lección Magistral			
7	**Topic 7** Duración: 02:00 LM: Actividad del tipo Lección Magistral			
8	**Topic 8** Duración: 02:00 LM: Actividad del tipo Lección Magistral			
9	**Topic 9** Duración: 02:00 LM: Actividad del tipo Lección Magistral			
10	**Topic 10** Duración: 02:00 LM: Actividad del tipo Lección Magistral			
11	**Theoretical and Practical Exam topics 1-10** Duración: 02:00 OT: Otras actividades formativas / Evaluación			**Theoretical and Practical Exam topics 1-10** EX: Técnica del tipo Examen Escrito Evaluación Progresiva Presencial Duración: 02:00
12	**Practical Project Development** Duración: 02:00 PL: Actividad del tipo Prácticas de Laboratorio			

13	**Practical Project Development** Duración: 02:00 PL: Actividad del tipo Prácticas de Laboratorio			
14	**Practical Project Development** Duración: 02:00 PL: Actividad del tipo Prácticas de Laboratorio			
15	**Presentations of Practical Projects** Duración: 02:00 OT: Otras actividades formativas / Evaluación			**Presentations of Practical Projects** TG: Técnica del tipo Trabajo en Grupo Evaluación Progresiva Presencial Duración: 02:00
16				
17				**Theoretical and Practical Exam topics 1-10** EX: Técnica del tipo Examen Escrito Evaluación Global Presencial Duración: 02:00 **Practical Project** TI: Técnica del tipo Trabajo Individual Evaluación Global Presencial Duración: 02:00

Para el cálculo de los valores totales, se estima que por cada crédito ECTS el alumno dedicará dependiendo del plan de estudios, entre 26 y 27 horas de trabajo presencial y no presencial.

7. Actividades y criterios de evaluación

7.1. Actividades de evaluación de la asignatura

7.1.1. Evaluación (progresiva)

Sem.	Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
11	Theoretical and Practical Exam topics 1-10	EX: Técnica del tipo Examen Escrito	Presencial	02:00	70%	5 / 10	CB07 CB10 CE-CD08
15	Presentations of Practical Projects	TG: Técnica del tipo Trabajo en Grupo	Presencial	02:00	30%	5 / 10	CB07 CB10 CE-CD08

7.1.2. Prueba evaluación global

Sem	Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
17	Theoretical and Practical Exam topics 1-10	EX: Técnica del tipo Examen Escrito	Presencial	02:00	70%	5 / 10	CB07 CB10 CE-CD08
17	Practical Project	TI: Técnica del tipo Trabajo Individual	Presencial	02:00	30%	5 / 10	CB07 CB10 CE-CD08

7.1.3. Evaluación convocatoria extraordinaria

Descripción	Modalidad	Tipo	Duración	Peso en la nota	Nota mínima	Competencias evaluadas
Theoretical and Practical Exam topics 1-10	EX: Técnica del tipo Examen Escrito	Presencial	02:00	70%	5 / 10	CB07 CB10 CE-CD08
Practical Project	TI: Técnica del tipo Trabajo Individual	Presencial	02:00	30%	5 / 10	CB07 CB10 CE-CD08

7.2. Criterios de evaluación

- Both classroom activities and assessment methods are designed for groups of up to 50 students per classroom. If enrollment exceeds this limit, the practical project component may be excluded, and the syllabus may be adjusted to make use of the available time.

- Qualifications of 5 or higher in partial exams and practical projects are kept for the global and extraordinary evaluation.

- You can only opt for a second or third evaluation of partial exams and practical projects if they have received grades lower than 5 or have not been submitted.

- If the minimum passing grade is not achieved in one of the evaluated parts, the grade for the entire course will be the grade of the part that was not passed.

- The instructions for practical projects, as well as the type of written exam (multiple choice, short answer, essay) may vary in different assessments (progressive, global, and extraordinary).

- In the event that a written exam is evaluated through quizzes on the Moodle platform with random questions from a question bank, the solutions to the questions will not be published since it is not allowed by this type of exam. Besides, in this exam modality and to enhance anti-cheating measures, access to the quiz will be sequential (only one question can be viewed per screen, and it will not be possible to go back once a question is answered).

- The rights and duties of university students are developed in the Statutes of the Polytechnic University of Madrid (BOCM of November 15, 2010) and in the University Student Statute (RD 1791/2010 of December 30). Article 124 (a) of the statutes of the UPM establishes as the student's duty..."to follow responsibly and profitably the process of training, knowledge acquisition, and learning corresponding to their condition as a university student"... and article 13 of the Statute of the University Student, in point (d) it also specifies as the duty of the university student "to refrain from the use or cooperation in fraudulent procedures in the evaluation tests, in the work that is carried out, or in official documents of the university". In the event that in the development of the evaluation tests the breach of the duties as a university student is appreciated, the coordinator of the subject may notify the Director if the Center, who in accordance with the provisions of article 74 (n) of the UPM Statutes has powers to "Propose the initiation of disciplinary proceedings against any member of the School or Faculty".

8. Recursos didácticos

8.1. Recursos didácticos de la asignatura

Nombre	Tipo	Observaciones
UPM Moodle	Recursos web	
[Zhao, W. X., et al., 2023]	Bibliografía	Zhao, W. X., et al. (2023). A Survey of Large Language Models. arXiv. https://arxiv.org/abs/2303.18223
[Ng 2023]	Recursos web	Online course. Generative AI for Everyone, https://www.deeplearning.ai/courses/generative-ai-for-everyone/
Bibliografía	Bibliografía	Selected bibliography (articles and textbooks).

9. Otra información

9.1. Otra información sobre la asignatura

The course uses the Moodle platform to provide students with information and documentation, as well as to announce evaluation schedules and publish grades.

This course contributes to the advancement of several Sustainable Development Goals (SDGs) defined by the United Nations 2030 Agenda, in particular:

- SDG 4 - Quality Education: Through the study and application of Deep Learning technologies in Natural Language Processing (NLP), students acquire advanced AI skills that can be applied to improve access to information, reduce language barriers, and support personalized education (e.g., intelligent tutoring systems or automated educational content generation).

- SDG 9 - Industry, Innovation and Infrastructure: The knowledge gained on advanced models such as

Transformers, LLMs, and GNNs equips students to develop innovative solutions in strategic sectors that rely on natural language processing, including public services, healthcare, transportation, and applied language technologies.

- SDG 10 - Reduced Inequalities: By exploring tools like machine translation, multilingual conversational systems, and semantic access to information, the course promotes technologies that can help reduce inequalities in access to knowledge and services, especially for populations facing linguistic or technological barriers.

- SDG 16 - Peace, Justice and Strong Institutions: The use of NLP techniques for understanding legal texts, promoting institutional transparency, or moderating content can contribute to strengthening democratic systems and ensuring equitable access to information.

The course follows an active and hands-on methodology, combining theoretical sessions with workshops and applied projects. Current tools such as Hugging Face and ChatGPT are used. Moreover, it emphasizes the ethical and responsible use of artificial intelligence, encouraging reflection on issues like bias and fairness in language processing systems.