Actividades Transversales de Doctorado
Universidad Politécnica de Cartagena
Curso 2024/25

1. Información general de la actividad / General course information					
Nombre/Name	Using Artificial Intelligence Tools for Research				
Nivel /Level	Doctorado				
Modalidad de impartición /Teaching mode	Online				
Lengua impartición/ Language	English/Spanish				
ECTS	1	**hours / ECTS**	30	**Total hours**	30

2. Datos del profesorado / Lecture data			
Profesor /Lecturer in charge	José Manuel Ferrández Vicente		
Departamento o Servicio/ Department/Service	Electrónica, Tecnología de Computadoras y Proyectos		
Area de conocimiento /Knowledge area	Arquitectura y Tecnología de Computadores		
Despacho /Office location	ETSIT (Edif. Antigones, 1rst floor)		
Teléfono /Telephone	+34 968 326456	**Fax**	
email	jm.ferrandez@upct.es		
URL / WEB	https://personas.upct.es/perfil/jm.ferrandez		
Horario de Atención /Office hours	Tuesday 11:00-14:00, Thursday 11:00-14:00		

3. Fechas por edición / Dates	
1ª edición / 1st edition-	Online
Fecha/Date	01/11/2024-31/01/2025
Horario/Hours	
2ª edición / 2nd edition-	In person-Streaming-Online
Fecha/Date	01/02/2025-30/04/2025
Horario/Hours	

3ª edición / 3rd edition-	Online
Fecha/Date	01/05/2025-10/07/2025
Horario/Hours	

4 Objetivos del curso / Course objectives

The objectives on using new AI tools for research support include developing a foundational understanding of key AI concepts, exploring applications in the research process, providing hands-on experience with popular AI tools, learning data preparation and preprocessing techniques, understanding machine learning algorithms, exploring AI's role in experimental design, discussing ethical considerations, fostering effective collaboration with AI systems, developing skills for critical evaluation of AI-generated results, using LLM, like ChatGPT for research, improving communication of findings, staying updated on AI advancements, engaging in project-based learning, facilitating interdisciplinary collaboration, receiving feedback for iterative improvement, and equipping students to adapt to future AI trends.

5. Contenidos teóricos/Theory programme

1. Foundational AI Concepts: Explore core theories and concepts that form the basis of artificial intelligence, ensuring students have a solid understanding of the field's fundamental principles.

2. Ethical Frameworks in using AI for Research: Examine theoretical frameworks for ethical considerations in AI research, emphasizing responsible and unbiased use of AI tools in the research process.

3. Theoretical Underpinnings of Machine Learning:Study the theoretical foundations of machine learning algorithms, enabling students to comprehend the principles guiding AI-driven data analysis.

4. Integration of AI in Research Design: Investigate theoretical models for seamlessly integrating AI tools into research design, emphasizing optimization of experimental methodologies.

5. Large Language Models. Using LLMs in Science. New approaches for design, analysis and Writing in Science. New regulations and Tools.

6. Theoretical Perspectives on Future Trends: Explore theoretical perspectives on emerging trends in AI research, considering potential impacts, challenges, and ethical implications, preparing students for evolving landscapes in the field.

6. Contenidos prácticos/Practical programme

1. Real-world Research Projects: Assign and guide students through practical, real-world research projects where they apply AI tools to address specific research questions, promoting practical application and problem-solving.
2. Collaborative AI Labs: Facilitate collaborative AI labs where students work in teams to explore, experiment, and troubleshoot AI tools, fostering teamwork and shared learning experiences.
3. Data Processing Clinics: Offer clinics focused on data preprocessing techniques, providing practical skills for students to effectively clean, organize, and prepare data for AI-driven analyses.
4. Tool Evaluation and Comparison: Engage students in practical sessions where they evaluate and compare the performance of different AI tools, promoting critical thinking and informed tool selection based on specific research needs.

7. Sistema de evaluación/ Sistem of evaluation

Students will be assessed through exercises and assignments. The assignments will consist in writing essays that cover the main points of the course and to discuss with the professor the more important points. The instructor deems it apropriate, students may be called for an interview to conduct the evaluation.

8. Distribución horaria de los contenidos, incluyendo las tareas de los alumnos /Hours distribution

Activity	Location	Hours
Theory programme (attend classes)	Distance learning (synchronous lectures with Microsoft Teams)	**5**
Practice (attend classes)	Distance learning (synchronous lectures with Microsoft Teams)	**5**
Homework (study of the theory contents)	At home	**4**
Homework (writing assignments)	At home	**14**
Test	On-line	**0.5**
Tutoring	On-line (sync with Teams or async by email)	**1.5**

BIBLIOGRAPHY:

1. **Books**

AI for Scientific Discovery. Janna Hastings. CRC Press, 2023

Artificial Intelligence For Science: A Deep Learning Revolution. Geofrey Fox et all. World Scientific 2023

Artificial Intelligence for Scientific Discoveries Extracting Physical Concepts from Experimental Data Using Deep Learning. Raban Iten. Springer 2023

2. **Journal Articles**

" AI and science: what 1,600 researchers think" (https://www.nature.com/articles/d41586-023-02980-0)

" The Future of Artificial Intelligence Can it be successfully regulated?" (https://cqpress.sagepub.com/cqresearcher/report/future-artificial-intelligence-cqresrre20221125)

“Scientific discovery in the age of artificial intelligence.” Hanchen Wanget al. Nature volume 620, pages47–60 (2023)

ChatGPT and Academic Research: A Review and Recommendations Based on Practical Examples Rahman , M., Terano, et al. . Journal of Education, Management and Development Studies. 3(1). 1-12. doi: 10.52631/jemds.v3i1.175

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9. Competencias cubiertas con la actividad / competences of the activity
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C1. Comprensión sistemática de un ámbito de estudio y dominio de las habilidades y métodos de investigación relacionados con dicho ámbito./ Systematic understanding of a field of study and mastery of research skills and methods related to that field. C2. Capacidad de concebir, diseñar o crear, poner en práctica y adoptar un proceso sustancial de investigación o creación./ Ability to conceive, design or create, implement and adopt a substantial research or creative process. C3. Capacidad para contribuir a la ampliación de las fronteras del conocimiento a través de una investigación original./ Ability to contribute to the expansion of the frontiers of knowledge through original research.

Competencias

C1.	Comprensión sistemática de un ámbito de estudio y dominio de las habilidades y métodos de investigación relacionados con dicho ámbito.	Systematic understanding of a field of study and mastery of research skills and methods related to that field.
C2.	Capacidad de concebir, diseñar o crear, poner en práctica y adoptar un proceso sustancial de investigación o creación.	Ability to conceive, design or create, implement and adopt a substantial research or creative process.
C3.	Capacidad para contribuir a la ampliación de las fronteras del conocimiento a través de una investigación original.	Ability to contribute to the expansion of the frontiers of knowledge through original research.
C4.	Capacidad de realizar un análisis crítico y de evaluación y síntesis de ideas nuevas y complejas.	Ability to carry out critical analysis, evaluation and synthesis of new and complex ideas.
C5.	Capacidad de comunicación con la comunidad académica y científica y con la sociedad en general acerca de sus ámbitos de conocimiento en los modos e idiomas de uso habitual en su comunidad científica internacional.	Ability to communicate with the academic and scientific community and with society in general about their fields of knowledge in the modes and languages commonly used in their international scientific community.
C6.	Capacidad de fomentar, en contextos académicos y profesionales, el avance científico, tecnológico, social, artístico o cultural dentro de una sociedad basada en el conocimiento.	Ability to promote, in academic and professional contexts, scientific, technological, social, artistic or cultural progress within a knowledge-based society.
C7.	Capacidad de fomentar la Ciencia Abierta y la Ciencia Ciudadana, conforme al artículo 12 de la Ley Orgánica 2/2023, de 22 de marzo, como modo de contribuir a la consideración del conocimiento científico como un bien común, mediante la evaluación de actividades transversales llevadas a cabo por el doctorando relacionadas con diferentes dimensiones de la Ciencia Abierta y la Ciencia Ciudadana, así como la capacitación adquirida en sendas disciplinas en formato de microcredenciales o similar.	Ability to promote Open Science and Citizen Science, in accordance with article 12 of Organic Law 2/2023 of 22 March, as a way of contributing to the consideration of scientific knowledge as a common good, through the evaluation of transversal activities carried out by the PhD student related to different dimensions of Open Science and Citizen Science, as well as the training acquired in these disciplines in the form of micro-credentials or similar.
C8.	Desenvolverse en contextos en los que hay poca información específica.	To develop in contexts where there is little specific information.
C9.	Encontrar las preguntas claves que hay que responder para resolver un problema complejo.	Find the key questions to be answered to solve a complex problem.
C10.	Diseñar, crear, desarrollar y emprender proyectos novedosos e innovadores en su ámbito de conocimiento.	Design, create, develop and undertake novel and innovative projects in their field of knowledge.
C11.	Trabajar tanto en equipo como de manera autónoma en un contexto internacional o multidisciplinar.	Work both in a team and autonomously in an international or multidisciplinary context.
C12.	Integrar conocimientos, enfrentarse a la complejidad y formular juicios con información limitada.	Integrating knowledge, dealing with complexity and formulating judgements with limited information.
C13.	La crítica y defensa intelectual de soluciones.	Critique and intellectual defence of solutions.