DEEP LEARNING: ESSENTIAL CONCEPTS AND PRACTICAL APPLICATIONS

Dates: July 1st - July 12. 2024

Teaching hours: 40 hours.

Area of knowledge: Artificial Intelligence (Computer Science)

Academic coordinator: Antonio Jesús Fernández García

INTRODUCTION [250-300 words]
The impact expected is to improve the knowledge acquired by the students by learning concepts related to the Artificial Intelligence and how this technology can be applied to increase the efficiency of companies, governments and institutions and refocuses daily tasks and efforts with an emphasis on creation and creativity. The teaching activities will focus on how to take advantage of Deep Learning to develop AI systems that meet business, organizational, and technology requirements.

MAIN GOALS
(Please briefly list the objectives of the course. Feel free to add as many rows as needed). 1. Enhance students' knowledge of Artificial Intelligence 2. Bridge AI to practical applications 3. Foster creative problem-solving 4. Develop practical skills in deep learning

CONTENT	
Course Modules	**Description**
MODULE A: Motivation and Deep Learning Fundamentals	This module is designed to provide a comprehensive introduction to the core concepts and principles underlying artificial neural networks (ANNs). This module serves as a crucial building block for students aspiring to delve into the exciting and rapidly evolving field of artificial intelligence. A simple AI Model to understand the basic concepts will be trained in this module.
MODULE B: Convolutional Neural Networks and Artificial Vision	This module offers a focused exploration convolutional neural networks (CNNs) and their pivotal role in artificial vision. This module is tailored to equip students with the skills necessary to unravel complex visual data, making it an essential component for those interested in image processing, computer vision, and pattern recognition.
MODULE C: Natural Language Processing	This module immerses students in the dynamic field of Natural Language Processing (NLP) with a specific focus on advanced techniques. This module explores the fundamental concepts of NLP while delving into the intricate worlds of Word Embeddings, Recurrent Neural Networks (RNNs), and Transformers. Students will gain an

	understanding of these technologies, equipping them to tackle complex challenges in language processing.
MODULE D: Pre-trained Models	This module provides an in-depth exploration of leveraging pre-trained models from industry-leading providers, with focus on platforms offered by Google Cloud, Microsoft Azure or Open AI among others. This module equips students with the knowledge and practical skills to harness the power of pre-trained models for various applications, accelerating development and minimizing the need for extensive training.
MODULE E: Final Project	This module serves as the culmination of the program, providing students with the opportunity to apply their acquired knowledge and skills to a real-world project. Guided by expert mentors, students embark on a journey of innovation, creating their own AI project from inception to completion. The module concludes with a presentation where a panel of judges evaluates the projects, recognizes the student achievements with a prize.

COURSE METHODOLOGY [200-250 words]	
In-lab sessions ☒	Company visits ☐
Academic visits ☒	Talks ☒
Lectures ☐	Others ☒
On the final day of the course, an esteemed judge will evaluate the projects, and prizes will be awarded to the winners during a special session.	

REQUIREMENTS [100-150 words]

A bachelor's degree in a relevant field such as Computer Science, Engineering, Mathematics, or a related discipline. Alternatively, relevant work experience in areas such as programming, data science, or technology may be considered for applicants without a formal degree.

However, the course is designed to teach from the basics and assumes no prior knowledge in the field.

Students must bring their own computers.

(Please specify if the students need to meet any criteria for their enrollment in this course, such as previous knowledge, having a personal computer, reading some bibliography, etc.).

ACADEMIC VISITS & NETWORKING

(Please specify here any information about talks with experts, visits or any other activities. At least, try to include 1 visit per week to different places of interest related to the course: companies, research centers, public institutions, non-profit organizations…).

To provide a holistic AI learning experience we will incorporate Experts and Mentors Professors that will come the second week of the course and give a talk with their valuable experiences, perspectives and insights. Additionally, mentors professors will actively guide students in their learning journey. And their projects. Additionally, experts from diverse AI domains will deliver talks, sharing their invaluable

ASSESSMENT

Throughout the course, students will be evaluated based on two key components: their Final Project Presentation and their Active Participation in the learning process.

LECTURERS

(Please list all lectures and professors taking part in the course, as well as a brief résumé –1 or 2 paragraph– of each one. Feel free to add as many boxes as needed).

Professor Antonio Jesús Fernández García, PhD

Antonio Jesús Fernández García completed his "Computer Science Engineering" and his master's degree in "Advanced Computing Techniques" in the University of Almería. As a researcher, he won a Torres Quevedo contract scholarship in 2011 by the Spanish Ministry of Industry with a duration of 2 years and, in 2014, an FPI Grant by the Spanish Ministry of Economy and Competitiveness with a duration of 4 years. As a result of the work developed under the FPI grant, he received his Ph.D. in Computer Science at the University of Almería in 2019 with "Cum Laude" qualifications and international mention due to his stay at the College of Information Sciences and Technologies of the Penn State University (United States) as a research fellowship with the professor James Z. Wang, who acted as well as External Supervisor of the Ph.D. dissertation. Mr. Fernández is a member of the research group of Informática Aplicada (TIC-211) led by Professor Dr. Iribarne at the Univ. of Almería since 2009. He has published in more than 20 JCR impact journals and internacional conference. In addition, he has participated in 3 national research networks funded by the Spanish Government and 9 research contracts funded

by private companies, which proves his research relevance in the industry and society with a total funding of more than 200.000€ in 8 years.

In the industry, he has experience as Consultant, Programmer, and Project Manager. In 2008, he funded Alborada, a company a technology-based company dedicated to Software Engineering and Artificial Intelligence. Also, he acts as Computer Science judicial expert producing expert reports and presenting them in court. in court. He was president of the Young Entrepreneurs Association of Almeria from 2017 to 2021, forming part of the board of directors of the Association of Young Entrepreneurs of Andalusia during that period and of the Spanish Confederation of Young Entrepreneurs in 2019.

In December 2019, he joins the University of Extremadura as a researcher associated with a National Project, and in September 2020, he joins the Universidad Internacional de la Rioja as Assistant Professor. As of September 2023, he is a member of the faculty at the Universidad de Almería, where he primarily teaches in the Computer Science degree program and continues his research in Artificial Intelligence (Machine Learning, Deep Learning, Recommendation Systems) and Software Engineering (Cloud Computing, Digital Transformation, and Applied Computing).

Professor Javier Criado Rodríguez, PhD

Javier Criado is an Associate Professor Doctor in the Computer Systems Languages area at the Department of Computer Science of the University of Almería (UAL). This professional category has been developed since 2019. He graduated as a Computer Engineer in 2009 at the UAL with a grade of 2.58. He obtained the award for the best End of Degree Project (Computer Engineer course 2009/2010), an award granted by the UAL. In 2009 he joined the Applied Informatics research group (TIC-211) at the same university. In 2010 he obtained a Master's degree in Advanced Computer Techniques from the UAL with a transcript of 3'00. In 2011 he got a grant for the training of university teachers (FPU) with reference AP2010-3259 (duration: 4 years). He obtained the title of International Doctor of Informatics with the defense of his doctoral thesis, in which he received an Outstanding Cum Laude. He obtained the extraordinary doctorate award (course 2014/2015). During his doctoral thesis, he spent three months at the AtlanMod research group at the ´Ecole des Mines de Nantes (France,) completing his training and research in model-based engineering techniques. For this, he obtained a grant from the FPU program with reference Est13 / 00078. He has participated in different competitive teaching innovation projects during the 2017-2018 biennium, the 2019-2020 biennium, and the 2021-2022 biennium; in this last biennium, as the main researcher. He has been the Principal Investigator of an R&D&i project of a regional project (CEIJ-C01.2, CEI·MAR, 24 months), Principal Investigator of a local R&D&i technology transfer project (24 months), and Principal Investigator of a collaboration project with the local administration (8 months). He has participated in five national research projects (TIN2007-61497, 18 months; TRA2009-0309, 24 months; TIN2010-15588, 25 months; TIN2013-41576-R, 32 months; and TIN2017-83964-R, 48 months), a regional research project (P10-TIC-6114, 50 months), and a
local research project (Statistical Observatory for the Almería City Council, 5 months). He has codirected two doctoral theses, one in 2016 and one in 2021; both obtained the best qualification "cum laude". He has authored two book chapters that collect scientific or technological research results, one in 2011 related to the application of ontologies in information systems, and another in 2013 related to a model-to-text transformation language within the model-driven engineering domain.

His research work has resulted in the publication of 20 publications with JCR impact, of which 5 are indexed in the first quartile (Q1), 9 are indexed in the second quartile (Q2), and 6 are indexed in the third quartile (Q3). He has also authored a publication in a scientific journal listed in the SJR ranking, indexed in the second quartile (Q2). Since 2011, he has participated in 23 communications in international conference proceedings and 12 communications in national conference proceedings. His main research areas are model-driven engineering, component-based software engineering, user interfaces, interoperability, service-oriented architectures, microservices and the web of things.

Professor José Antonio Piedra Fernández, PhD

José Antonio Piedra Fernández is Associate Professor in the Department of Computer Science, specializing in Computer Science and Artificial Intelligence at the University of Almería. He has been the Coordinator of the Master's in Computer Science at the University of Almería from 2014 to 2021. He is committed to active methodologies and disruptive technologies in the field of teaching. Additionally, it's worth mentioning his role as a teacher, delivering courses at other universities such as The Pennsylvania State University and the National Technological University of Mendoza.

He is a member of the European project UNIGreen (https://unigreen-alliance.eu/), granted to develop a unique campus consisting of 8 universities. He collaborates with the research group of James Wang in the United States, obtaining access to satellite data through NASA, as well as with the European Space Agency.

As an author and co-author, he has contributed to various scientific publications, including articles in JCR impact journals, book chapters, and proceedings of international conferences. Additionally, he has developed interactive applications in virtual environments such as KiNEEt in collaboration with the Princess Sofia Special Education School for individuals with special needs. He has also worked on applications related to the development of intelligent systems for sustainable buildings, such as CIESOL.

In terms of mentoring young researchers, he has supervised 4 doctoral theses, and there is currently an ongoing doctoral thesis. He is a founding member since 2018 of the EBT Virtual Dor (http://www.virtualdor.com/), focusing on the development of virtual reality applications in the fields of education and health. He is a collaborator in the mental health program Inclúyete.

Professor Francisco Orts Gómez

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