Introduction to the LLM and NLP course at the University of Salerno (UNISA)

The Natural Language Processing (NLP) and Large Language Models (LLMs) course is part of the Master's Degree in Computer Engineering at the University of Salerno, also known by its acronym UNISA. It is taught by Nicola Capuano and Antonio Greco from the DIEM department. The course provides theoretical, methodological, technological, and practical knowledge on automatic language and text understanding. It situates Large Language Models (LLMs) within the broader Natural Language Processing (NLP) framework, highlighting their innovative paradigms and modern applications. The course focuses on Natural Language Processing (NLP) and Large Language Models (LLMs), providing students with a comprehensive understanding of how machines process, understand, and generate human language. It covers foundational NLP concepts such as tokenization, word embeddings, and text classification, as well as advanced topics like neural networks (e.g., RNNs, LSTMs) and Transformer-based models. Students will explore prompt engineering, which involves crafting effective inputs to guide LLMs, and fine-tuning techniques to adapt pre-trained models for specific tasks. The course also delves into practical applications, such as text generation, translation, and building chatbots. The learning approach is hands-on, with students expected to design and implement NLP systems using modern tools and frameworks. The course aims to equip students with both theoretical knowledge and practical skills to work with cutting-edge NLP technologies.

Final Evaluation

The exam includes a project work where students apply their knowledge to a real-world problem, followed by an oral exam to discuss their work.
The project requires students to critically apply the methodologies learned during the course to a practical case study.
The oral examination will assess the theoretical knowledge acquired throughout the course, the ability to justify design choices made in the project work, and the capacity to answer questions on specific topics covered in the lectures.
The final grade will be determined as the average of the scores obtained in both assessments.

Class Schedule

The weekly schedule for Natural Language Processing and Large Language Models includes two lessons held in different locations.
On Wednesday, from 12:30 PM to 2:30 PM, a class takes place in Lab T25, located in Building E.
On Thursday, from 4:30 PM to 6:30 PM, a class is held in Room D of Building E1.

Nicola CAPUANO's Curriculum

Nicola Capuano is an Associate Professor at the Department of Information and Electrical Engineering and Applied Mathematics (DIEM) at the University of Salerno. He obtained a degree in Computer Science and a Ph.D. in Computer Science and Computer Engineering from the University of Salerno. At the same university, he also held a four-year research fellowship on the topic of "Artificial Intelligence." Before pursuing an academic career, he collaborated with private research institutions, including the Research Center in Pure and Applied Mathematics and the Center of Excellence on Software Technologies. He was also a researcher at the School of Engineering of the University of Basilicata. In 2021, he obtained the National Scientific Qualification as a Full Professor in the field of 09/H1: Information Processing Systems.

His research interests include Natural Language Processing, Machine Learning, Knowledge Representation, Fuzzy Systems, and Artificial Intelligence in Education. He is the author of more than 120 publications in scientific journals, conference proceedings, and book chapters. He is an Associate Editor for the Journal of Ambient Intelligence and Humanized Computing by Springer Nature and Frontiers in Artificial Intelligence by Frontiers Media. He has served as a Guest Editor for various journals, including the International Journal of Educational Technology in Higher Education and the International Journal of Emerging Technologies in Learning. He is a member of the editorial board and a reviewer for several journals, a track chair and program committee member of international conferences and workshops, and a member of the executive committee of The Learning Ideas international conference. He has edited the volume The Learning Grid Handbook, published by IOS Press.

He serves as an independent evaluator of projects and proposals for the European Commission under the Horizon Europe program and for the European Institute of Innovation and Technology. He was the coordinator of the Diogene (A Training Web Broker for ICT Professionals) and InTraServ (Intelligent Training Service for Management Training in SMEs) projects, both funded by the European Commission under the Fifth Framework Programme. He was a member of the European Network of Excellence Kaleidoscope (Concepts and Methods for Exploring the Future of e-Learning with Digital Technologies), where he coordinated the Special Interest Group on Learning Grids. He was responsible for the research line "Intelligent Learning Features" at the Center of Excellence in Methods and Systems for Learning and Knowledge at the University of Salerno. He has held scientific and coordination roles in various other research and innovation projects. He is a Project Management Professional (PMP), certified by the Project Management Institute.

Antonio GRECO's Curriculum

Antonio Greco graduated with honors in Computer Engineering in 2014 from the University of Salerno (Italy). In March 2018, he obtained a Ph.D. in Computer

Science and Information Engineering from the same university. In March 2020, he became a Researcher RTD/A (Scientific Sector ING-INF/05 "Information Processing Systems") at the Department of Information and Electrical Engineering and Applied Mathematics (DIEM) at the University of Salerno, where he has been a Researcher RTD/B since November 2022. Since November 2022, he has also held the position of Delegate for Student Orientation at the same department, and since May 2024, he has been a member of the Doctoral Board in Information Engineering.

He has taught or currently teaches several courses at the department, including Logic Networks (Scientific Sector ING-INF/05, Bachelor's Degree in Computer Engineering), Autonomous Vehicle Driving (Scientific Sector ING-INF/05, Master's Degree in Computer Engineering), Web Software Technologies (Scientific Sector ING-INF/05, Bachelor's Degree in Computer Engineering), Artificial Intelligence for Cybersecurity (Scientific Sector ING-INF/05, Master's Degree in Computer Engineering), Robotics for E-Health (Scientific Sector ING-INF/05, Master's Degree in Digital Health and Bioinformatics Engineering), System and Network Security (Scientific Sector ING-INF/05, Master's Degree in Computer Engineering), Artificial Vision (Scientific Sector ING-INF/05, Master's Degree in Computer Engineering), and Natural Language Processing and Large Language Models (Scientific Sector ING-INF/05, Master's Degree in Computer Engineering). Since the 2021/2022 academic year, he has also been the instructor of the Advanced Machine Learning course within the Ministerially accredited Ph.D. program in Information Engineering (D.M.226/2021).

Since 2014, he has been a member of the MIVIA Lab research group (Intelligent Machines for Video, Image, and Audio Recognition) at the Department of Information and Electrical Engineering and Applied Mathematics of the University of Salerno, which has a strong international collaboration focus. His research activities mainly focus on Computer Vision and Pattern Recognition, specifically on the design, implementation, and optimization of computer vision and deep learning algorithms. These include real-time applications for gender recognition, age estimation, ethnicity recognition, emotion analysis, fire detection, anomaly detection, people counting, object tracking, and audio event recognition, using data acquired from both static devices (smart cameras, microphones) and mobile platforms (drones, robots, autonomous vehicles). Some of these activities have been conducted in collaboration with European research groups, particularly at the University of Malta, the University of Groningen (Netherlands), and the University of Twente (Netherlands). At the latter, he spent a total of nine months (from January to April 2020 and from August 2021 to February 2022) as a Visiting Researcher, collaborating on research and teaching activities within the Data Management and Biometrics Group at the Faculty of Electrical Engineering, Mathematics, and Computer Science.

In recent years, he has organized several Special Issues for international journals, including a Special Issue in the Journal of Ambient Intelligence and Humanized Computing on the theme "Ambient Understanding for Mobile Autonomous Robots (AutoRob)", a Special Issue in Pattern Recognition on the topic "From Bench to the Wild: Recent Advances in Computer Vision Methods (WILD-VISION)",

and a Special Issue in Pattern Analysis and Applications on "Pedestrian Attribute Recognition and Person Re-Identification". Since March 2024, he has been an Associate Editor of Pattern Analysis and Applications and a reviewer for more than 25 international journals.

He has presented scientific works as a speaker at over ten international conferences and has served as a Contest Chair at various international conferences. In particular, he organized the Guess the Age (GTA) Contest 2021 at the International Conference on Computer Analysis of Images and Patterns (CAIP), co-organized the ONFIRE 2023 contest at the International Conference on Image Analysis and Processing (ICIAP), and co-organized the Pedestrian Attributes Recognition (PAR) Contest 2023 at CAIP. He was also a member of the Local Committee for the International Workshop on Graph-based Representations (GBR) held in Capri, Italy, from May 16 to 18, the International Conference on Computer Analysis of Images and Patterns (CAIP) held in Salerno, Italy, from September 2 to 6, 2019, the IEEE Conference on Cognitive and Computational Aspects of Situation Management (CogSIMA) held in Salerno, Italy, from June 6 to 10, 2022, and the International Workshop on Graph-based Representations (GBR) held in Salerno, Italy, from September 6 to 8. In 2021, he was an Invited Speaker at the Workshop on CogSIMA Challenge Problems within the IEEE Conference on Cognitive and Computational Aspects of Situation Management (CogSIMA), delivering a talk titled "Adding Awareness to AI Systems."

Within the framework of national and international research projects, he has served as the scientific coordinator of the local research unit of the Department of Information and Electrical Engineering and Applied Mathematics (DIEM) for the PON ARS01_01226 project "PerMedNet – Personalized Medicine for Innovative Strategies in Neuropsychiatric and Vascular Diseases". He was also the scientific coordinator of work packages WP4 and WP5 in the European research project "Flexible Assembly Manufacturing with Human-Robot Collaboration and Digital Twin Models" (FELICE, Grant Agreement ID: 101017151, funded by H2020-EU.2.1.1). Regarding research agreements, he was the scientific coordinator for the Department of Information and Electrical Engineering and Applied Mathematics in the research contract with the company RED&BLUE for the project "Development of a Platform for Evaluating the Safety of Artificial Intelligence Systems."

In the field of technology transfer, in December 2019, he co-founded AI-READY, a spin-off of the University of Salerno specializing in artificial intelligence applications for cognitive robotics, mobility, and autonomous vehicles.