

# DEEP FRIDAYS

Seminars and meetings with D.L. researchers from academia and industries

## Autumn Session 2023: applications in industrial and scientific research

Organizer: Prof. **Andrea Asperti**

**When:** all Fridays at 17 p.m.

**Where:** on line, via Teams: [Click here to join the meeting](#)

## Calendar

**November 10 2023** Giovanni Trovini (CTO) , Alessio Pepe ( AI Enginner)

**speaker:** **Giovanni Trovini, Alessio Pepe**

**affiliation:** **SMART-I S.r.l.**

**title:** Artificial Intelligence on the Edge

**abstract:** After a brief introduction to Smart-I, the seminar will cover topics related to hardware and software deployment of artificial intelligence models on embedded devices. The most important solutions on the market will be compared and analyzed showing the pros and cons and the reasons that led to our choices. Then will be shown the differences between already consolidated model architectures with new solutions. Finally, we will show some examples of application scenarios.

**bio:** GIOVANNI TROVINI Born in 1991, passionate and intrigued by technology since childhood, I oriented my studies in order to make my passion my work. Graduated in computer engineering with a thesis titled "A deep learning framework for micro-calcification detection in 2D mammography and C-view" presented at IWBI Conference held in Atlanta in 2018. Today, I am focused on artificial intelligence and I work as CTO at Smart-I company. My mantra is "Every dream you give up is a piece of your future that ceases to exist."

ALESSIO PEPE With a degree in Computer Engineering and a specialization in Artificial Intelligence, Alessio works as an AI Engineer. He is involved in the design and development of AI algorithms throughout their entire lifecycle, with a particular focus on computer vision tasks.

November 17 2023

**speaker:** Daniel Kallfass

**affiliation:** Airbus Defence and Space Germany

**title:** Deep Reinforcement Learning for Military Decision Support and Swarm Control for Autonomous UAS Trained in a Combat Simulation

**abstract:** Future warfare scenarios featuring fully digitised, AI-assisted command and control and the use of unmanned systems will have a dramatic impact on the tempo of combat operations. Consequently, they will put the cycles of military decision-making under even higher time pressure. Modelling and simulation in combination with advanced AI techniques will become key enablers for future decision-support systems. These systems will support military decision makers in the assessment of threats as well as in developing and evaluating the best possible courses of action for their own forces. The latest developments by AI research companies in the civilian domain, such as DeepMind's AlphaStar, have applied advanced deep reinforcement learning techniques to popular games like StarCraft II in order to train AI agents to develop superior strategies for beating their opponents.

This presentation presents the results of a study conducted by the Army Concepts and Capabilities Development Centre and Airbus. The aim of the study was to evaluate how the aforementioned machine learning techniques can be adapted and employed to train an AI agent capable of acting as a battalion commander in a combat simulation (ReLeGSim). In each time step of this simulation, the AI agent is able to send orders to the available units/companies or to request multi-domain fire support. The ReLeGSim simulates the behaviour and combat attrition of each company/unit and fire support element at the level of the individual platform. It then returns a feedback (so-called reward) to the AI agent in order to assess and improve its behaviour during the training cycle. It is also possible to select multiple trained AI agents and let them play against each other in a league system to improve them further.

Having undergone such training, the AI agent can then be applied to an actual scenario and the resulting strategies proposed to the battalion commander as possible courses of action in a decision cycle.

**bio:** Daniel Kallfass is a seasoned professional specializing in Operational Analysis within the "Simulation and Studies" department at Airbus Defence and Space in Germany. With over 18 years of extensive experience in both national and international research endeavors, his expertise lies in the domain of simulation-based operational analysis, distributed simulations, and machine learning. His primary focus centers on advancing and applying military simulations, including PAXSEM, in tandem with the Data Farming methodology, as well as the latest AI and Deep Learning techniques, such as Deep Reinforcement Learning. These simulations and autonomous agents have applications in training, providing decision support for operations planning and execution, and functioning within autonomous systems.

November 24 2023

**speaker:** Loreto Parisi

**affiliation:** Musixmatch

**title:** LLMs and RAG applied to Podcasts.

**abstract:** We explore the application of Retrieval Augmented Generation (RAG) to Podcasts transcriptions and see how it will enhance the quality of the responses by Large Language models. We will also dig into a live interaction with local and cloud LLMs in a production-like environment.

**bio:** Born in 1977 Loreto Parisi has a MSc in Computer Engineering from Unina Federico II. He was part of the Splinder team, an Italian micro-blogging platform developed in 2001 and later acquired by Dada Spa in 2006. In 2009 he co-founded Buzzreader, an online monitoring and web reputation platform. In 2010 he joined the founding team of Musixmatch, the world leading music data company with 80 millions users and 50 million active users. He is Director of Engineering and Artificial Intelligence and in 2022 Loreto and the AI Team devised the AI & metadata platform of Musixmatch Podcasts, a new platform for podcasters and listeners, driven by transcription by AI and community.

December 1 2023

**speaker:** Francesco Verni

**affiliation:** Huawei Technologies Italia S.r.l

**title:** Machine-Learning Enabled Analysis and Synthesis of Metasurfaces

**abstract:** Metasurfaces, the 2D version of metamaterials, provide unprecedented control over electromagnetic waves for applications like imaging, holography, and communications. However, designing metasurfaces to achieve desired functionalities remains challenging due to the large design space. Machine learning has emerged as a powerful tool for metasurface analysis (forward problem) and synthesis (inverse problem). In this talk, I will review recent advances in this rapidly evolving field. I will highlight case studies from recent works exemplifying the electromagnetic modeling. The talk will conclude with an outlook on future opportunities and challenges in applying machine learning to metasurface design for a new generation of daily-use devices, e.g. radio-frequency antennas or optical lenses. I will describe how data-driven techniques can work synergistically with physics-based electromagnetics to advance the field.

**bio:** Francesco Verni is currently a Senior Antenna Scientist at the Huawei Milan Research Center. He received the PhD “summa cum laude” in Electrical, Electronics and Communication Engineering from the Polytechnic of Turin, Turin, Italy, in 2020. He received the MSc degree “summa cum laude” in Electronics and Communication Engineering from the University of Siena, Italy, in 2015. In 2015, he interned for Ingegneria dei Sistemi (IDS) corporation S.p.A., Pisa, Italy, where he worked for the Computational Electromagnetics and Antenna Design Laboratory. In 2016, he joined the Istituto Superiore Mario Boella (ISMB) for a research program in reconfigurable antennas and advanced computational electromagnetics. From November 2016 to August 2020 he was a PhD student at the Politecnico

di Torino, Italy. In 2018, he was granted with the Blanceflor Scholarship for a visiting year at the University of Michigan, Ann Arbor, USA. The project was part of his PhD activities related to advanced computational electromagnetics for metasurfaces. His research interest includes advanced numerical techniques for electromagnetics, antenna modelling, periodic structures, inverse problems, metasurface and plasmonic nanostructures.