

Valerio De Caro

PH.D. STUDENT · MEMBER @PERSIVAE AI LAB

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Summary

I am a Ph.D. student in Computer Science at the University of Pisa. My research focus is wrapped around the concept of learning in pervasive environments, merging Federated Learning and Continual Learning with methodologies for learning under resource constraints, including Reservoir Computing and Randomized Neural Systems. Also, I am task leader in the TEACHING-H2020 European project, in which I lead the Human and System State monitoring task and I am one of the main designers and developers of the TEACHING platform.

Education

Ph.D. in Computer Science

UNIVERSITY OF PISA

Pisa, Italy

Nov 2020 - Present

- *Focus:* integration of Federated Learning and Continual Learning in a unifying learning paradigm, called Pervasive Learning
- *Supervisor:* Prof. Davide Bacciu
- Task Leader for the Human and System State Monitoring task in the TEACHING-H2020 European project

Visiting Ph.D. student

CENTRO SINGULAR DE INVESTIGACIÓN EN TECNOLOGÍAS INTELIXENTES (UNIVERSIDADE DE SANTIAGO DE COMPOSTELA)

Santiago de Compostela, Spain

May 2022 - Sep 2022

- *Focus:* development of a concept-drift-aware methodology for continuous adaptation of a federation of Echo State Networks
- Local Advisors: Prof. Senén Barro Ameneiro, Prof. Roberto Iglesias Rodríguez

M.Sc. in Computer Science

UNIVERSITY OF PISA

Pisa, Italy

Sep 2018 - Oct 2020

- Specialization in Artificial Intelligence
- Graduated with final mark 110/110 cum Laude and GPA 3.92/4.00 (IT: 29.31/30). Granted of the *cum laude* distinction on 6 courses.

B.Sc. in Computer Science

UNIVERSITY OF PISA

Pisa, Italy

Sep 2015 - Oct 2018

- Graduated with final mark 109/110 and GPA 3.69/4.00 (IT: 27.70/30). Granted of the *cum laude* distinction on 3 courses.

Publications

- 2022 V. De Caro, C. Gallicchio, and D. Bacciu, "Federated adaptation of reservoirs via intrinsic plasticity," in *Proceedings of the 30th European Symposium on Artificial Neural Networks ESANN 2022*, Oct. 2022
- 2022 A. Carta, G. Carfi, V. De Caro, and C. Gallicchio, "Efficient Anomaly Detection on Temporal Data via Echo State Networks and Dynamic Thresholding," in *2022 IEEE World Congress on Computational Intelligence: 1st International Workshop on Pervasive Artificial Intelligence (PAI Workshop 2022)*, July 2022
- 2022 V. De Caro, S. Bano, A. Machumilane, A. Gotta, P. Cassarà, A. Carta, R. Semola, C. Sardianos, C. Chronis, I. Varlamis, K. Tserpes, V. Lomonaco, C. Gallicchio, and D. Bacciu, "AI-as-a-Service toolkit for Human-Centered intelligence in autonomous driving," in *2022 IEEE International Conference on Pervasive Computing and Communications Workshops and Other Affiliated Events (PerCom Workshops): Demos (PerCom Demos 2022)*, Mar. 2022

Presentations

- Nov 2022 Invited talk for "Neurosymbolic AI - Thinking Fast and Slow in AI" at course in AI Fundamentals, M.Sc. in Computer Science, University of Pisa
- Oct 2022 Oral talk for "Federated adaptation of reservoirs via intrinsic plasticity" at ESANN2022
- Jul 2022 Oral talk for "Efficient Anomaly Detection on Temporal Data via Echo State Networks and Dynamic Thresholding" at 1st Pervasive AI Workshop (WCCI2022)
- Mar 2022 Oral talk for "AI-as-a-Service toolkit for Human-Centered intelligence in autonomous driving" at PerCom2022

Activities

University of Pisa

TASK LEADER @TEACHING-H2020

Pisa, Italy

Oct 2021 - Present

- Design and development of a toolkit implementing distributed intelligence in terms of an AI as a service (AlaaS) system for Cyber-Physical System of Systems (CPSoS) applications
- Research on scalable AI methodologies specialized in Human State Monitoring via recognition and characterization of physiological, cognitive and emotional state from heterogeneous sensing devices
- Research on anomaly detection methodologies on embedded systems for aircrafts' flight management platforms.

- Held the practice lectures in the course of Laboratory of Programming I, which provides the basics of programming with C and JavaScript

Projects

FedRay

PYTHON FRAMEWORK

May 2022 - now

- Design and development of a research-oriented framework based on Ray which eases the buildup, the scalability and the metrics computation in experiments in a Federated setting
- First proof of concept developed with Federated Echo State Networks (GitHub repository)

Graph Relative Density Networks

M.Sc. THESIS

Jan 2020 - Oct 2020

- Introduced and assessed two neural-probabilistic models for graph classification
- Implemented a python library based on PyTorch
- Implemented a framework based on Ray for efficient parallelization and rescheduling of the experiments on GPUs

Bundle Methods for optimization of MLPs

COMPUTATIONAL MATHEMATICS FOR LEARNING AND DATA ANALYSIS (M.Sc. COURSE)

Feb 2020 - May 2020

- Developed a MLP library based on NumPy with automatic differentiation
- Developed and assessed proximal bundle method with different degrees of aggregation of first-order information
- Developed a subproblem solver with Gurobi

RaspBrother

MOBILE AND CYBER-PHYSICAL SYSTEMS (M.Sc. COURSE)

Mar 2019 - Jun 2019

- Led the development of an IoT-based (completely independent from any cloud resource) application for the thief detection
- Built the hardware components with a central module based on Raspberry Pi and sensors with Arduino
- Exploited MQTT as communication protocol for the interaction between components
- Developed a Python server which includes a lightweight CNN for intruder detection and communicates intrusions via Telegram

Hybrid Hidden Tree Markov Networks

B.Sc. THESIS

Feb 2018 - Oct 2018

- Studied an existing neuro-probabilistic model for tree classification
- Implemented the model with TensorFlow 1.14
- Extended the model to include the Top-Down generative model for feature extraction
- Performed a comparative analysis between the three possible versions of the model

Skills

Spoken Languages Italian (Mothertongue), English (C1)

Programming Languages Python, Java, JavaScript, C++, C, SQL

Python Libraries PyTorch, Ray, TensorFlow, Pandas

Tools Docker, docker-compose, RabbitMQ, Kafka, MQTT

Operating Systems Windows, MacOS, GNU/Linux