Debora Caldarola

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Ph.D. Student in Federated Learning

Personal Information

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Research Interests

Artificial Intelligence (AI) has the potential to revolutionize numerous domains, but concerns regarding **fairness** and **responsibility** have emerged as critical considerations. Developing AI algorithms that are fair, accountable, and socially responsible is imperative for mitigating biases and ensuring equitable outcomes. In my current research, I focus on leveraging **Federated Learning** (FL) as a powerful paradigm to reach such goals. FL aims to learn a global model from disparate users' data, while respecting the privacy regulations in force. Looking at realistic scenarios, my main efforts aim to

- Learn models providing fair predictions to the entire data distribution, *e.g.*, not biased towards some less represented demographic groups.
- Broaden the horizons of applicability of FL to real-life vision tasks, such as autonomous driving, or image geo-localization, while introducing realistic constraints, *e.g.*, the absence of labeled data.

Education

September - December 2023	**Visiting Student Researcher**, *Stanford University*, Stanford, CA, USA. Project title: *Federated learning and fairness* Advisor: Prof. Sanmi Koyejo
2020 - Now	**Ph.D. in Computer Engineering**, *ELLIS VANDAL Lab*, Politecnico di Torino. Thesis: *Federated Learning across Domains* Advisor: Prof. Barbara Caputo Co-advisor: PhD Marco Ciccone
2018 - 2020	**Master's Degree in Computer Engineering**, *Data Science*, Politecnico di Torino, Grade: 110/110. Master's Thesis: *Towards Real World Federated Learning* Supervisors: Prof. B. Caputo (Politecnico di Torino), Prof. F. Galasso (Università degli Studi di Roma "La Sapienza"), Dr. M. Mancini (Eberhard Karls University of Tübingen)
2015 - 2018	**Bachelor's Degree in Computer Engineering**, Politecnico di Torino, Grade: 110/110.
2015 - 2018	**Young Talents Project**, Politecnico di Torino. Educational path aimed at 200 Bachelor students ranking in the top 5%.
2010 - 2015	**Scientific High School Diploma**, "Marco Vitruvio Pollione" Scientific High School, Grade: 100/100.

Professional Experience

2020 - Now	**Organizer**. ○ **WiCV (Women in Computer Vision) Workshop at ICCV 2023**. Committee member. ○ **I-RIM 2021** (Italian Institute of Robotics and Intelligent Machines). Volunteer.

2021 - Now	**Reviewer**.

Conferences
- Neural Information Processing Systems (NeurIPS)
- International Conference on Machine Learning (ICML)
- International Conference on Learning Representations (ICLR)
- Conference on Computer Vision and Pattern Recognition (CVPR)
- European Conference on Computer Vision (ECCV)
- IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)
- European Conference on Machine Learning (ECML)
- International Conference on Robotics and Automation (ICRA)
- International Conference on Pattern Recognition (ICPR)

Journals
- IEEE Transactions on Distributed and Parallel Systems
- IEEE Internet of Things Journal
- IEEE Robotics and Automation Letters

2018 - 2019 Intern.
- **Student Researcher in ERC project**. *Applied Electromagnetics* research group, Politecnico di Torino. Supervised by Prof. Francesco P. Andriulli.
- **SEI Explorer** (School of Entrepreneurship & Innovation). Internship aimed at discovering the bases of business and start-up creation.

Teaching

2021 - Now Invited speaker.
- *Towards Real-world Federated Learning*. Stanford University, CA.
- *Real-world Challenges in Federated Learning*. Continual Learning Reading Group with Isabelle Guyon (Director Research Scientist, Google Brain), Eleni Triantafillou (Research Scientist, Google Brain), Joaquin Vanschoren (Eindhoven University of Technology, OpenML founder)
- *Introduction to Federated Learning*, Fall School PhD Industry 4.0. Torino, IT.
- *Introduction to Federated Learning*, Machine Learning Operations Summer School. Copenhagen, DK.

2021 - Now Teaching assistant, *Politecnico di Torino*.
- Advanced Machine Learning, M.Sc course. A.ys. 2022/2023, 2021/2022.
- Machine Learning and Deep Learning, M.Sc course. A.ys. 2022/2023, 2021/2022/, 2020/2021.
- Data Analysis and Artificial Intelligence, M.Sc course. A.ys. 2022/2023, 2021/2022.
- Informatics, B.Sc course. A.y. 2021/2022.
- Computer Architectures, B.Sc course. A.y. 2018/2019. Laboratory assistant.

2021 - Now Master's Theses Supervisor, Politecnico di Torino.
- *Computation-efficient Sharpness-aware Minimizers in Federated Learning*. Pietro Cagnasso. *On-going.*
- *Federated Vision Transformers*. Luca Marcellino. *On-going.*
- *Federated Visual Geo-Localization*. Mattia Dutto. *On-going.*
- *Speeding up convergence while preserving privacy in Heterogeneous Federated Learning*. Andrea Rizzardi.
- *Sequential to Parallel Federated Learning with Semantic-Aware Client Groupings*. Andrea Silvi.
- *On the Challenges of Class Imbalance in Federated Learning for Semantic Segmentation*. Eros Fanì.
- *On the Challenges of Federated Learning in Semantic Segmentation across Domains*. Lidia Fantauzzo.

Attended Schools and Programs

September 2022	**M2L Summer School**, *Mediterranean Machine Learning Summer School*, Milan, IT. Apple and DeepMind among the main sponsors.
July 2021	**DeepLearn 2021 Summer**, *IRDTA 4th International School on Deep Learning*, Las Palmas de Gran Canaria, ES.
February - June 2021	**Innovation 4 Change (I4C)**, Politecnico di Torino. Leading impact innovation program in Italy. Promoted by Collège des Ingénieurs Italia, CERN Ideasquare and Politecnico di Torino. Collaboration with Arduino's CMO and CEO.

Awards

Extra Professional Experience

2006 - Now   **Scout**, *A.G.E.S.C.I.*.

I have been a scout since the age of ten, first as a participant and then as a leader. I strongly believe in the values of this association and in its educational offer.

2018 - 2020   **President**, *Mu Nu Chapter of IEEE Eta Kappa Nu*, Politecnico di Torino.

Eta Kappa Nu aims to recognise excellence among peers, encourage individual eminence in education and meritorious work in professional practice, placing the emphasis not only on scholastic merits but also on the character and attitude of its members. I had the honor of being part of this Association as Head of Logistics and Fundraising first and then as President.

Publications

2023

Shenaj, D., Fanì, E., Toldo, M., **Caldarola, D.**, Tavera, A., Michieli, U., Ciccone, M., Zanuttigh, P., & Caputo, B. (2022). *Learning Across Domains and Devices: Style-Driven Source-Free Domain Adaptation in Clustered Federated Learning*. Proceedings of the *IEEE Winter Conference on Applications of Computer Vision* (WACV23).

2022

Caldarola, D., Caputo, B., & Ciccone, M. (2022). *Improving Generalization in Federated Learning by Seeking Flat Minima*. Proceedings of the *European Conference on Computer Vision* (ECCV22).

Fantauzzo, L., Fani, E., **Caldarola, D.**, Tavera, A., Cermelli, F., Ciccone, M., & Caputo, B. (2022). *FedDrive: Generalizing Federated Learning to Semantic Segmentation in Autonomous Driving*. In *Proceedings of the 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems* (IROS22).

Zaccone, R., Rizzardi, A., **Caldarola, D.**, Ciccone, M., & Caputo, B. (2022). *Speeding Up Heterogeneous Federated Learning with Sequentially Trained Superclients*. In *Proceedings of the 26th International Conference on Pattern Recognition* (ICPR22).

2021

Caldarola, D., Mancini, M., Galasso, F., Ciccone, M., Rodolà, E., & Caputo, B. (2021). *Cluster-driven Graph Federated Learning over Multiple Domains*. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshop* (CVPRW21) (pp. 2749-2758).

Languages and Certificates

Italian (mother tongue), English (C1, *First Certificate in English (FCE) Grade A*), French (scholastic level), German (A1.1), Russian (A1.1).