Lorenzo Bini

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Education

University of Geneva, Ph.D. Candidate - Department of Computer Science & CUI   Nov 2022 – Ongoing
- Major: Artificial Intelligence and Machine Learning.
- Research interests: Graph neural networks, adversarial learning, representation learning, active and self-supervised learning. Generative AI for medicine and healthcare, including 3D genomics and scRNA data generation. Implementation of robust adversarial models within weak/self-supervised training strategies to reduce label acquisition costs.

Polytechnic of Turin, Master of Science in Physics of Complex Systems   Sep 2020 – Sep 2022
- GPA: 4.0/4.0

Alma Mater Studiorum - University of Bologna, Bachelor degree in Physics & Astronomy Systems   Sep 2017 – Sep 2020
- GPA: 4.0/4.0

Experience

Research Assistant, Hôpitaux Universitaires de Genève (HUG) – Geneva, Switzerland   Nov 2022 - Ongoing
- Detection of minimal residual disease (MRD) of acute lymphoblastic and myeloid leukemia (AML/ALL) from flow cytometry data.
- Development of fast training/inference deep learning models (e.g, Graph Transformers) for single-cell classification in weak/self-supervised contexts.
- Development of generative models (e.g., DDPMs) for 3D genomics, flow cytometry, scRNA-seq, spatial transcriptomic, and multiomics data.
- LLMs to streamline routine hospital processes.

Teaching Assistant, University of Geneva – Department of Computer Science & CUI   Nov 2022 – Ongoing
- Introduction to Computational Finance - 14X030;
- TALN: Traitement de la langue approches linguistiques et approches empiriques (NLP) - 34C2161;
- Information Retrieval - 14X060;
- Data Science - Analyse et Traitement de l'Information -14X026;
- Selected Chapters - Game Theory -14X060;

Research Assistant - Intern, Quantum Technology Group - University of Norway   Feb 2022 - July 2022
- Worked on quantum theory for entanglement and non-locality in optomechanics continuous variable systems. Developed quantum frameworks to analyze two-cavity optomechanics systems.

Publications

LaplaceGNN: Scalable Graph Learning through Spectral Bootstrapping and Adversarial Training   Feb 2025

Lorenzo Bini, Stéphane Marchand-Maillet

To appear in 2025, under double-blind review as a conference paper

Characterizing Massive Activations of Attention Mechanism in Graph Neural Networks   Oct 2024

Lorenzo Bini, Marco Sorbi, Stéphane Marchand-Maillet

Pre-print, under double-blind review as a conference paper

Injecting Hierarchical Biological Priors into Graph Neural Networks for Flow Cytometry Prediction   Jul 2024

Lorenzo Bini, Fatemeh Nassajian Mojarrad, Stéphane Marchand-Maillet

[ICML'2024 Workshop on Accessible and Efficient Foundation Models for Biological Discovery, Wien, Austria](#)

FlowCyt: A Comparative Study of Deep Learning Approaches for Multi-Class Classification in Flow Cytometry Benchmarking   Jun 2024

Lorenzo Bini, Fatemeh Nassajian Mojarrad, Margarita Liarou, Thomas Matthes, Stéphane Marchand-Maillet

[Conference on Health, Inference, and Learning (CHIL'24), New-York, NY.](#)

Why Attention Graphs Are All We Need: Pioneering Hierarchical Classification of Hematologic Cell Populations with LeukoGraph   Feb 2024

Lorenzo Bini, Fatemeh Nassajian Mojarrad, Thomas Matthes, Stéphane Marchand-Maillet

[arXiv:2402.18610](#)

HemaGraph: Breaking Barriers in Hematologic Single Cell Classification with Graph Attention   Dec 2023

Lorenzo Bini, Stéphane Marchand-Maillet

[arXiv:2402.18611](#)

Awards & Oral Presentations

PhD Symposium - CHIL'24 at Cornell Tech University, NY   Jun. 2024

- Winner of the PhD Symposium money-prize to attend and present PhD work "Adversarial Robust GNNs: Enhancing Learning with Knowledge Injection in Single-Cell Data" at [CHIL'24](#), conference held by Cornell Tech University, New York.

CHAIR Structured Learning Workshop - Chalmers University of Technology   Oct. 2023

- Oral presentation of the "Knowledge Distillation in Acute Myeloid Leukemia Classification: Tabular Data Meets Graph Neural Networks" poster at the [AI Structured Learning 2023 Workshop](#) in Götebor, Sweden.

Winner of Thesis on Proposal 2021/2022   Feb. 2022

- Winner of the "Thesis on Proposal 2021/2022" call for bids for Master's Thesis on "Entanglement and nonlocality in optomechanics continuous variable systems" under the supervision of Prof. Francesco Pietro Massel & Prof. Vittorio Penna.
- Received grants for research period at USN-Kongsberg.

Projects

Flow Cytometry Deep Learning Benchmark   [FlowCyt-Benchmark](#)

- Developed the first publicly available deep learning benchmark for single cell classification and clustering on flow cytometry data. Tested on a cohort of 30 patients selected by expert hematologists, from bone marrow and peripheral blood samples. Benchmarked SOTA classification/generative models including GNNs, GraphTransformers, Diffusion Models (DDPMs) and VAEs.
- Tools Used: Python, CSS, HTML.

Hackathons & Competitions   2019 - Ongoing

- Regular participation at Kaggle/LeetCode competitions and Hackathons; runner-up BR41N.IO 2021 Hackathon@PoliTO, runner-up UNIBO-IBM-Unipol Hackathon 2019, 3rd classified QuHack4IA 2023.
- Tools Used: Python - Compatative Programming.

Math/Physics Olympiad   Sep 2014 - Sep 2019

- 2x winner of the Italian Regional Math Olympiad.
- 1x winner of the Italian Regional Physics Olympiad.

Visiting Student, City Montessory School, Lucknow - Uttar Pradesh, India USN   Aug 2016 - Sep 2016

- Visited the City Montessory School together with the italian cultural association "CinemíCinemá" to provide help

and needs to elementary/mid school students.

Oxfam Volunteering   2016 - Ongoing
- I do regularly serve as volunteer for charity organization, such as Oxfam Italy.

Technologies

- **Programming Languages**: Python, Julia, R, , Matlab, Mathematica, C/C++, CUDA.
- **Frameworks**: Pytorch, Pytorch-Lightning, Tensorflow, Keras, Jupyter.
- **AI/ML**: SciPy, scikit-learn, Github, GitLab, Numpy, Pandas, Matplotlib, Seaborn, wandb, PyG.
- **Tools**: Git, Linux, ssh, SLURM, pip, Anaconda, Docker, VSCode, Bash (Shell).

Software Licenses: Kaluza Analysis Software, Zemax OpticStudio | Comprehensive Optical Design Software, TeXstudio, BioVinci Software.