
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, Flow Matching) 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

- LapDDPM: A Conditional Graph Diffusion Model for scRNA-seq Generation with Spectral Adversarial Perturbations** Jun 2025
Lorenzo Bini, Stéphane Marchand-Maillet
[ICML'2025 + GenBio Workshop: The Second Workshop on Generative AI and Biology, Vancouver.](#)
- Self-Supervised Graph Learning via Spectral Bootstrapping and Laplacian-Based Augmentations** May 2025
Lorenzo Bini, Stéphane Marchand-Maillet
[Preprint. To appear in 2025, under double-blind review as a conference paper.](#)

Massive Activations in Graph Neural Networks: Decoding Attention for Domain-Dependent Interpretability	Oct 2024
<i>Lorenzo Bini</i> , Marco Sorbi, Stéphane Marchand-Maillet	
ECAI'2025, Bologna + ICLR'2025 Workshop XAI4Science: From Understanding Model Behavior to Discovering New Scientific Knowledge, Singapore.	
Injecting Hierarchical Biological Priors into Graph Neural Networks for Flow Cytometry Prediction	Jul 2024
<i>Lorenzo Bini</i> , 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
<i>Lorenzo Bini</i> , 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
<i>Lorenzo Bini</i> , Thomas Matthes, Stéphane Marchand-Maillet	
Preprint arXiv:2402.18610, under double-blind review as a conference paper.	
HemaGraph: Breaking Barriers in Hematologic Single Cell Classification with Graph Attention	Dec 2023
<i>Lorenzo Bini</i> , Thomas Matthes, Stéphane Marchand-Maillet	
Preprint arXiv:2402.18611, under double-blind review as a conference paper.	

Awards & Oral Presentations

Oral Presentation at the Second Workshop on Explainable Artificial Intelligence for the Medical Domain - ECAI'25, Bologna	Oct. 2025
<ul style="list-style-type: none"> Invited oral presentation of the accepted paper "Massive Activations in Graph Neural Networks: Decoding Attention for Domain-Dependent Interpretability" at European Conference on Artificial Intelligence (ECAI'25), Bologna. 	
PhD Symposium - CHIL'24 at Cornell Tech University, NY	Jun. 2024
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> 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 Göteborg, Sweden. 	
Winner of Thesis on Proposal 2021/2022	Feb. 2022
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> 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 - Competitive 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 Montessori School, Lucknow - Uttar Pradesh, India USN

Aug 2016 - Sep 2016

- Visited the City Montessori School together with the Italian cultural association "CinemáCinemá" 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.