Lorenzo Bini

Geneva, Switzerland | Lorenzo.Bini@unige.ch | 022 3790124 | Webpage | linkedin.com/in/lorenzo-bini4
github.com/LorenzoBini4

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

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

Lorenzo Bini, Marco Sorbi, Stéphane Marchand-Maillet

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

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

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

Lorenzo Bini, Stéphane Marchand-Maillet

Preprint arXiv:2402.18611, under double-blind review as a conference paper.

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 - Compatitive 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.