

ALESSANDRO LICCIARDI

+39 327 042 6384 | email-alessandro.licciardi@polito.it | github.com/alelicciardi99 | linkedin.com/in/alessandro-licciardi

Ph.D. student in Mathematical Sciences at Politecnico di Torino specializing in Machine Learning theory. My research focuses on Preprocessing Operators, Federated Learning, and Generative Models, with a particular emphasis on their cross-disciplinary applications in Health-care, Physics, and Natural Sciences.

EDUCATION

Politecnico di Torino, MS in Mathematical Engineering | Turin, ITALY grade: **110/110 cum Laude** July 2023

Politecnico di Torino, BD in Mathematics for Engineering | Turin, ITALY grade: **110/ 110 cum Laude** July 2021

Courses: Probability Theory| Time-Frequency Analysis| Machine Learning| Statistics| Optimization| Numerical Analysis| PDE Modelling| Operative Research| Scientific Programming| Reinforcement Learning| Linear Algebra| Calculus

RESEARCH GROUPS

Model and Methods of Mathematical Physics, DISMA, Politecnico di Torino, Turin IT 2023-present

Istituto Nazionale di Fisica Nucleare INFN, Sezione di Torino , Turin, IT 2023-present

EXPERIENCE

Ph.D. Student in Mathematical Sciences

Department of Mathematical Sciences, Politecnico di Torino, Turin, IT Nov. 2023 - Present

- Developing interpretable **physics-inspired machine learning** algorithms for clinical imaging, in collaboration with company Eltek, headquartered in Casale Monferrato, Italy.
- Developing advanced preprocessing methods to improve the detection and classification of **gravitational waves**, in collaboration with INFN.
- Implementing decentralized client detection and domain discrimination algorithms within the **Federated Learning** framework, with the **Vandal** group in the **European Laboratory for Learning and Intelligent Systems (ELLIS)**.
- Proposed a novel feature extraction preprocessing and **classification** approach for multi-species marine mammal vocalizations and multi-scale time series analysis. This research has been accepted as a paper at ICNDA 2024.

MSc Thesis: Wavelet Scattering Transform. Mathematical Analysis and Applications to VIRGO Gravitational Waves Data

Nov 2022 - July 2023

Department of Mathematical Sciences, Politecnico di Torino, Turin, IT

- Proposed a novel preprocessing technique for gravitational waves data using the Wavelet Scattering Transform (WST), proving its superiority over Fourier-based methods (Q-transform) in capturing high-level differences in gravitational signals. In collaboration with Virgo section of INFN within the Intertwin project.

PUBLISHED PAPERS

Licciardi, A., Carbone, D., & Rondoni, L. (2024). "Wavelet Scattering Operators for Multiscale Processes: The case study of marine mammals vocalizations." In *Nonlinear Dynamics and Applications: Proceedings of the ICNDA 2024*. Springer Nature 2024

MSc PROJECTS

Neural Parameter Estimation for Brain Tumour Growth

Dec 2022 - Mar 2023

- Developed in Matlab a ML algorithm to estimate the growth and diffusion parameters of PDE model from CTscans

Protein Function Prediction

Dec 2022 - Feb 2023

- Developed in Python a ML pipeline to predict protein function from its genome, proposing the application of language analysis techniques commonly used for sentiment analysis (**TF-IDF**)

Breast Cancer Classification with LDA

Dec 2021 - Feb 2022

- Linear Discriminant Analysis (LDA) approach for predicting breast cancer from non-invasive clinical examination

SKILLS

Languages Python, Matlab, R, C/C++, SQL, LaTeX

Software Pytorch, Scikit-learn, SciPy, Kymatio, Pandas, Numpy, Statsmodels, JAX, GwPy, JAGS

Interests

Music I enjoy playing electric and acoustic guitar, especially psychedelick rock, blues, jazz and funk.

Writing and Poetry I love writing and reading poetry and, especially the lyrics for my own songs

Languages

Italian Native | English C1-fluent