Claudio **Borile**, PhD

Research Scientist

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Summary

With a foundation in Physics and a doctoral focus on computational and analytical models in ecology and biology, my career has been dedicated to applying complex systems science and machine learning to diverse scientific and technological challenges. Initially, I utilized statistical physics to analyze the emergent behaviors of multi-agent stochastic dynamical systems and artificial neural networks. My expertise then expanded to encompass a broader range of data science and machine learning methodologies for interdisciplinary applied research. A key experience includes my involvement in the precision medicine project DEFLeCT, developing cutting-edge machine learning techniques for multi-omic and multi-source analyses in non-small cell lung cancer patients, gaining familiarity with complex single-cell data. Currently, my work centers on developing AI algorithms and statistical methods to investigate complex collective behaviors, from financial networks to data-driven learning of agent-based models, with an emphasis on explainability and interpretability in generative AI models.

Experience

Research Scientist, CENTAI, Torino, Italy 2022-Present

- Explainability and Interpretability in generative neural models
- Graph Representation Learning
- Learning in Agent-Based models and Statistical inference
- Evaluation of deep generative models
- Applied Data Science and Machine Learning

Research Scientist, ISI Foundation, Torino, Italy 2021-2022

- Network Analysis, Coordinated Behavior Discovery, Time-series forecasting
- XAI and Graph Representation Learning
- Applied Data Science and Machine Learning

Senior Data Scientist, aizoOn Technology Consulting, Torino, Italy 2017–2021

- Multi-omic analysis for molecular stratification and survival prediction in non-small cell lung cancer
- Machine Learning for automated malware detection and attribution
- Multi-objective routing for traffic optimization based on real-time sensor data
- Applied data science for time-series analysis, predictive maintenance, network analysis
- production-ready code development and dashboarding for data science applications

Research Scientist, ISI Foundation & aizoOn Technology Consulting 2016–2017

- "Progetto Lagrange" scholarship winner for applied research on Big Data.
- Social networks data retrieval and analysis for quasi-real time social media monitoring in event management and public security.
- Multi-source Analysis of communication networks for people analytics.

Post-doctoral researcher, DISAT, Politecnico di Torino, Italy 2013-2015

- Statistical Physics for Neuromorphic Computing
- Supervisor Prof. Riccardo Zecchina

Visiting Researcher, Universidad de Granada, Institute "Carlos I" for Theoretical and Computational Physics, Granada, Spain 2013

- "Ing. Aldo Gini" Foundation scholarship winner.
- Statistical Physics approaches to the dynamics of spatially extended ecosystems and the role of fragmentation and disorder
- Supervisor Prof. Miguel A. Muñoz

Education

Ph.D., Statistical Physics, Università degli Studi di Padova, Italy 2013

- Effects of non-linearities and disorder in systems with multiple absorbing states. A perspective for modeling the dynamics of complex ecosystems
- Supervisor: Prof. Amos Maritan

M.Sc., Physics, Università degli Studi di Padova, Italy 2009

- Statistical Physics Methods In Genetics: Application To Mycobacterium Tuberculosis Complex Data
- Thesis work conducted at the Université Paris-Sud XI as part of the Erasmus Programme 2009
- Supervisor: Prof. Silvio Franz
- Summa cum laude

B.Sc., Physics, Università degli Studi di Padova, Italy 2007

Publications

Peer-reviewed journals and conferences

[1] How to Generalize the Detection of AI-Generated Text: Confounding Neurons
Claudio Borile, Carlo Abrate
Submitted to EMNLP 2025 (2025)

[2] Bias and Identifiability in the Bounded Confidence Model
Claudio Borile, Jacopo Lenti, Valentina Ghidini, Corrado Monti, Gianmarco De Francisci Morales
Presented at Social Simulation Conference 2024, Submitted to Proceedings of the Royal Society A (2025)

[3] Multi-Class and Multi-Task Strategies for Neural Directed Link Prediction
Claudio Moroni, **Claudio Borile**, Carolina Mattsson, Michele Starnini, André Panisson
Accepted for oral in Machine Learning and Knowledge Discovery in Databases. Research Track, 2025

[4] Explainability, Quantified: Benchmarking XAI Techniques
Alan Perotti, **Claudio Borile**, Arianna Miola, Francesco Paolo Nerini, Paolo Baracco, André Panisson
World Conference on Explainable Artificial Intelligence, 2024

[5] Non-small cell lung cancer survival estimation through multi-omic two-layer svm: A multi-omics and multi-sources integrative model
Lorenzo Manganaro, Gianmarco Sabbatini, Selene Bianco, Paolo Bironzo, **Claudio Borile**, Davide Colombi, Paolo Falco, Luca Primo, Shaji Vattakunnel, Federico Bussolino
Current Bioinformatics 18.8 (2023), pp. 658–669

[6] Evaluating link prediction explanations for graph neural networks
Claudio Borile, Alan Perotti, André Panisson
World Conference on Explainable Artificial Intelligence, 2023

[7] Towards an Automated Pipeline for Detecting and Classifying Malware through Machine Learning
Nicola Loi, **Claudio Borile**, Daniele Ucci
Presented at ITASEC 2021 (2021)

[8] moOn: A multidimensional graph approach to Human Resources Analytics
Claudio Borile,
Presented at GraphConnect 2017 Europe, London, UK

[9] Coexistence in neutral theories: interplay of criticality and mild local preferences
Claudio Borile, Daniel Molina-Garcia, Amos Maritan, Miguel A Munoz
Journal of Statistical Mechanics: Theory and Experiment 2015.1 (2015), P01030, IOP Publishing

[10] Time to absorption for a heterogeneous neutral competition model
Claudio Borile, Paolo Dai Pra, Markus Fischer, Marco Formentin, Amos Maritan

Journal of Statistical Physics 156 (2014), pp. 119–130, Springer US

[11] The effect of quenched disorder in neutral theories
Claudio Borile, Amos Maritan, Miguel A Munoz
Journal of Statistical Mechanics: Theory and Experiment 2013.04 (2013), P04032, IOP Publishing

[12] Spontaneously broken neutral symmetry in an ecological system
Claudio Borile, Miguel A Muñoz, Sandro Azaele, Jayanth R Banavar, Amos Maritan
Physical review letters 109.3 (2012), p. 038102, American Physical Society

[13] Using affinity propagation for identifying subspecies among clonal organisms: lessons from M. tuberculosis
Claudio Borile, Mathieu Labarre, Silvio Franz, Christophe Sola, Guislaine Refrégier
BMC bioinformatics 12.1 (2011), pp. 1–14, BioMed Central

Mentoring

Silvia Di Giovanni, MSc Physics of Complex Systems, Politecnico di Torino 2025
Static representation of temporal graphs

Mario Baravetto, MSc Physics of Complex Systems, Università di Torino 2025
Deep Learning Strategies for Data-Driven ABMs

Claudio Moroni, MSc Physics of Complex Systems, Università di Torino 2024
Graph Representation Learning applied to Transaction Networks

Nicola Loi, MSc Physics of Complex Systems, Università di Torino 2020
An Automated Pipeline For Detecting and Classifying Malware Through Machine Learning

Maurizio Dipierro, MSc Physics of Complex Systems, Università di Torino 2018
Feature Learning Methods for Social Organizational Networks

Teaching

Introduction to Data-Driven Digital Twin 2020
CIM4.0 Academy, CIM4.0 competence center, Torino

Statistics 2019
Big Dive Custom, TOP-IX, Torino

Network science practice 2018, 2019
Big Dive Custom, TOP-IX, Torino

General Physics, Computational Methods 2010
Tutoring for Biology and Computer Science BSc courses, Università di Padova

Technical Skills

Software Development

- Python (R, Julia)
- Pytorch, PyG, Transformers (HF)
- Python for data science (Numpy, Pandas, ...)
- SQL/ No-SQL (MongoDB, Neo4j, InfluxDB)
- Docker
- git
- Unix/Linux

Data Science

- Machine Learning
- Deep Learning
- NLP / LLMs
- Network Science / Graph Theory
- Time Series Analysis
- Mathematical Modelling
- Statistics

Soft Skills

Team-work, communication, and leadership

A versatile team player with strong communication skills, adept at conveying complex information in settings ranging from small team meetings to international conferences. Proven ability to lead and collaborate effectively with multidisciplinary teams. Successfully supervised numerous student thesis projects, providing mentorship and guidance.

Languages

Mother tongue **Italian**

Other languages[1]

	Understanding		Speaking		Writing
	Listening	Reading	Interaction	Production	
English	C2 Fluent	C2 Fluent	C2 Fluent	C2 Fluent	C2 Fluent
Portuguese (Brazil)	B2 Independent	B2 Independent	B2 Independent	B2 Independent	B2 Independent
French	B1 Independent	B1 Independent	B1 Independent	B1 Independent	B1 Independent

[1] *Common European Framework of Reference for Languages (CEFR)*

Personal interests

Capoeira Instructor, Jazz Piano and Music Theory student

In compliance with the Italian Legislative Decree no. 196 dated 30/06/2003 and GDPR (EU regulation 2016/679), I hereby authorize the recipient of this document to use and process my personal details for the purpose of recruiting and selecting staff and I confirm to be informed of my rights in accordance to art. 7 of the above mentioned decree.