Curriculum Vitae of Alessandro Lonardi

Personal data

Full name: Alessandro Lonardi (he/him)

Employment: PhD student at the Max Planck Institute for Intelligent Systems

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Short bio

I am a PhD student at the Max Planck Institute for Intelligent Systems (GER). Previously, I got my Master's degree in Mathematical Engineering at the University of Padova (IT), where I also obtained my Bachelor's degree in Physics. My PhD is supported by the International Max Planck Research School for Intelligent Systems (IMPRS-IS), which is part of the Cyber Valley initiative.
My current research mainly focuses on developing mathematical models for optimization problems on networks. More in detail, I study dynamical systems to explain how networks can optimally adapt their structure to accommodate multiple agents interacting along their edges. I am also interested in message-passing algorithms for statistical inference. The applications of my work are primarily in urban networks and machine learning but potentially span several other disciplines, such as climate science and biology. Broadly speaking, I like to address data-rich problems where mechanistic models and inferential predictions mutually benefit from each other.

Education

Sep 1, 2020 – present

PhD student at Max Planck Institute for Intelligent Systems: Physics for Inference and Optimization group, Tübingen, Germany
Thesis: Designing Networks with Adaptation Rules and Optimal Transport
Supervisor: Dr. Caterina De Bacco (MPI for Intelligent Systems)

Thesis Advisory Committee: Prof. Anna Levina (University of Tübingen), Dr. Michael Muehlebach (MPI for Intelligent Systems), Prof. Peter Ochs (Saarland University)
Program: International Max Planck Research School for Intelligent Systems (IMPRS-IS)

Oct 1, 2018 – July 23, 2020

Master's Degree in Mathematical Engineering (Mathematical Modelling for Engineering and Science) at University of Padova, Italy (cum laude)
Thesis: Developing new methods for routing and optimal transport on networks
Supervisor: Prof. Mario Putti (Uni Padova)
Co-supervisor: Dr. Caterina De Bacco (MPI for Intelligent Systems)

Oct 1, 2015 – Sep 24, 2018

Bachelor's Degree in Physics at University of Padova, Italy
Thesis: Dynamics and thermodynamics of the adiabatic piston
Supervisor: Prof. Giancarlo Benettin (Uni Padova)

Work experience

Oct, 2022 – Apr, 2023

Head, *co-founder* at Commute, a startup dedicated to providing data-driven solutions to policymakers to build transportation infrastructures for better livability.

Advancement: Our startup was admitted to the initial phase of the MAX!mize incubation program (maximize-incubator.com) for the Max Planck Society, supported by Max Planck Innovation GmbH

Additional research experience

Mar 1, 2020 – Aug 31, 2020

Research Intern at Max Planck Institute for Intelligent Systems: Physics for Inference and Optimization group, Tübingen, Germany
Supervisor: Dr. Caterina De Bacco (MPI for Intelligent Systems)

Topics: Optimal Transport Theory, Self-adaptation Equations in Networks, Belief Propagation

Contributed talks

In reverse chronological order.

[CT3] Bilevel optimization for flow control in optimal transport networks
Alessandro Lonardi
Netsci 2023 · Abstract · Slides

[CT2] Infrastructure adaptation and emergence of loops in network routing with time-dependent loads
Alessandro Lonardi
Netsci 2023 Satellite, Networks & cities · Abstract · Slides

[CT1] Optimal transport in networks for design and flux optimization
Alessandro Lonardi
NetPLACE Seminars (2023) · Slides · Video

Teaching experience

Oct 21, 2021 – Feb 11, 2022

Teaching assistant of "Advanced Probabilistic Machine Learning and Applications" at University of Tübingen, Germany
Lecturer: Dr. Caterina De Bacco (MPI for Intelligent Systems)

Topics: Mean Field Theory, TAP approximation, Bethe Approximation and Belief Propagation

Apr 19, 2021 – July 31, 2021

Teaching assistant of "Advanced Probabilistic Machine Learning and Applications" at University of Tübingen, Germany
Lecturer: Dr. Caterina De Bacco (MPI for Intelligent Systems)

Topics: Introduction to Probabilistic Machine Learning, Bethe Approximation and Belief Propagation, Variational Inference

Academic service

Peer-review: Journal of Physics Communications 3, Physica Scripta 2

Languages

English (proficient user) – IELTS score: 8/9 | Cambridge ESOL: CAE | CEFR: C1

Italian (native)

German (independent user) – CEFR: B1, formal training in progress

Spanish (basic user) – CEFR: ∼A1, personal interest

IT skills

Advanced level: Python (libraries for scientific computing, data science, ML, data visualization), Linux: Debian-based distributions, macOS, LaTeX, code parallelization on computing infrastructures, git

Basic level: C++, Mathematica, Microsoft Office Suit, Linux: Arch-based distributions, MATLAB

Extracurricular activities

July 30-31, 2022 Volunteer for "TReND in Africa Python Workshop 2022", online (trendinafrica.org)

I was a lecturer in a Python workshop organized to introduce African scientists to Python programming through experienced-based learning

2016 – 2017 Volunteer for "Pint of Science Italia", Padua, Italy (pintofscience.it)

I worked for the promotion, organization and moderation of several scientific dissemination lectures, in the context of an event held simultaneously in more than 300 cities worldwide

Publications

Each category is in reverse chronological order. Asterisks denote equal contribution.

Preprints

[PP1] Message-Passing on Hypergraphs: Detectability, Phase Transitions, and Higher-Order Information
Nicolò Ruggeri*, Alessandro Lonardi*, Caterina De Bacco
arXiv · GitHub · CO_2 compensation

Journal Papers

[JP6] Bilevel Optimization for Traffic Mitigation in Optimal Transport Networks
Alessandro Lonardi, Caterina De Bacco
Physical Review Letters 131, 267401 (2023) · arXiv · GitHub

[JP5] Immiscible Color Flows in Optimal Transport Networks for Image Classification
Alessandro Lonardi*, Diego Baptista*, Caterina De Bacco
Frontiers in Physics 11:1089114 (2023) · arXiv · GitHub · Poster · CO_2 compensation

[JP4] Infrastructure adaptation and emergence of loops in network routing with time-dependent loads
Alessandro Lonardi, Enrico Facca, Mario Putti, Caterina De Bacco
Physical Review E 107, 024302 (2023) · arXiv · GitHub

[JP3] Multicommodity routing optimization for engineering networks
Alessandro Lonardi, Mario Putti, Caterina De Bacco
Scientific Reports 12, 7474 (2022) · arXiv · GitHub

[JP2] Optimal Transport in Multilayer Networks for Traffic Flow Optimization
Abdullahi Adinoyi Ibrahim, Alessandro Lonardi, Caterina De Bacco
Algorithms, 14(7), 189 (2021) · arXiv · GitHub

[JP1] Designing optimal networks for multicommodity transport problem
Alessandro Lonardi, Enrico Facca, Mario Putti, Caterina De Bacco
Physical Review Research 3, 043010 (2021) · arXiv · GitHub