


# Curriculum Vitae of Alessandro Lonardi


## Personal data

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Full name: Alessandro Lonardi (he/him)

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

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- [alessandro.lonardi.vr \[at\] gmail.com](mailto:alessandro.lonardi.vr@gmail.com)

 Personal website: [aleable.github.io](http://aleable.github.io)

## Short bio

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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 work focuses on the development of physics-based models for routing problems on networks. In particular, I am interested in explaining how different route selection mechanisms affect agents traveling along the edges of a graph. The applications of my work span from urban and biological networks to machine learning and climate science.

## Education

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Sep 1, 2020 – present

*PhD student* at Max Planck Institute for Intelligent Systems: Physics for Inference and Optimization group, Tübingen, Germany

**Thesis:** Optimal transport in networks for design and flux optimization

**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

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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](https://maximize-incubator.com)) for the Max Planck Society, supported by Max Planck Innovation GmbH

## Additional research experience

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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

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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

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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

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

## Languages

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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

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

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

## Extracurricular activities

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July 30-31, 2022 Volunteer for “TReND in Africa Python Workshop 2022”, online ([trendinafrica.org](https://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](https://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

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

### Journal Papers

- [JP6] Bilevel Optimization for Traffic Mitigation in Optimal Transport Networks  
[Alessandro Lonardi](#), [Caterina De Bacco](#)  
Physical Review Letters · [arXiv](#) · [GitHub](#)
- [JP5] Immiscible Color Flows in Optimal Transport Networks for Image Classification  
[Alessandro Lonardi](#)<sup>\*</sup>, [Diego Baptista](#)<sup>\*</sup>, [Caterina De Bacco](#)  
[Frontiers in Physics 11:1089114 \(2023\)](#) · [arXiv](#) · [GitHub](#) · [Poster](#) · [CO<sub>2</sub> 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](#)