Sara Venturini

Curriculum Vitae et Studiorum

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born on 1st August 1996

Career Objective

Since January 2024, I have been a Postdoctoral fellow at the **MIT Senseable City Lab** at the Massachusetts Institute of Technology, mentored by Carlo Ratti and Paolo Santi. I earned a **Ph.D. in Computational Mathematics** in 2023 from the University of Padova, Italy. I started my academic career with a Bachelor's and Master's degree in Mathematics at the University of Padova, Italy. I enjoy working on the computational analysis of complex networks and their application to the real world. Therefore, I aim to leverage data to **model and analyze social systems as well as interactions**. My research interests include: **complex networks, optimization methods, machine learning, and the science of science**.

Education

Jan. 2024 – Ongoing **Senseable City Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA**
Postdoctoral Fellow in complex dataset analysis,
Mentors: Carlo Ratti, Paolo Santi.

Nov. 2022 – Dec. 2023 **University of Padova, Padova, Italy**
Research Fellow,
Analysis of bibliometric data and development of models in the field of the science of science.

Oct. 2020 – Dec. 2023 **University of Padova, Padova, Italy**
Ph.D. student in Computational Mathematics,
Title: Complex networks: community detection and graph semi-supervised learning on higher-order networks, with an application to the science of science,
Advisors: Prof. Francesco Rinaldi (University of Padova),
Prof. Francesco Tudisco (The University of Edinburgh, Gran Sasso Science Institute).
Date: 21 December 2023

Feb. 2022 – July 2022 **Indiana University Network Science Institute (IUNI), Bloomington, Indiana, USA**
Visiting Researcher - AccelNet-MultiNet fellow,
Research on networks applied to the Science of Science field, in collaboration with Prof. Santo Fortunato and Dr. Satyaki Sikdar.

Oct. 2018 – July 2020 **University of Padova, Padova, Italy**
Master Degree in Mathematics,
Application path: Operations Research and Optimization
Final score: 110/110 cum laude,

MSc thesis:
Title: Methods for community detection in multi-layer networks
Advisor: Prof. Francesco Rinaldi (University of Padova)
Co-Advisor: Prof. Francesco Tudisco (Gran Sasso Science Institute).

Oct. 2015 – Sep. 2018 **University of Padova, Padova, Italy**
Bachelor Degree in Mathematics,
Final score: 102/110,

Bachelor thesis:
Title: Mathematical programming models for Air Traffic Management in the European context
Advisor: Prof. Luigi De Giovanni (University of Padova).

Grants and Fellowships

July 2023 **ICML grant for registration and accommodation**,
which covers free conference registration and free 5 nights stay to attend the Conference on Machine Learning (ICML) 2023 in Honolulu, Hawaii, USA.

July 2021 – July 2022 **AccelNet-MultiNet fellowship travel award ($10,500)**,
which assumes a five-month visit (from February 2022 to June 2022) to Indiana University, in Bloomington, Indiana, USA, collaborating with Prof. Santo Fortunato.

List of Publications

[1] Sara Venturini, Satyaki Sikdar, Francesco Rinaldi, Francesco Tudisco, Santo Fortunato, **Collaboration and topic switches in science.**, Scientific Reports 14, 2024. doi: https://doi.org/10.1038/s41598-024-51606-6.

[2] Sara Venturini, Andrea Cristofari, Francesco Rinaldi, and Francesco Tudisco. **Learning the right layers a data-driven layer-aggregation strategy for semi-supervised learning on multilayer graphs**. Proceedings of the 40th International Conference on Machine Learning, 202, pages 35006–35023. PMLR, 23–29 Jul 2023. URL https://proceedings.mlr.press/v202/ venturini23a.html..

[3] Sara Venturini, Andrea Cristofari, Francesco Rinaldi, and Francesco Tudisco. **Laplacian-based semi-supervised learning in multilayer hypergraphs by coordinate descent**. EURO Journal on Computational Optimization, page 100079, 2023. ISSN 2192-4406. doi: https: doi.org/10.1016/j.ejco.2023.100079.

[4] Sara Venturini, Andrea Cristofari, Francesco Rinaldi, and Francesco Tudisco. **A variance-aware multiobjective louvain-like method for community detection in multiplex networks**. Journal of Complex Networks, 10(6), 11 2022. ISSN 2051-1329. doi: 10.1093/comnet/cnac048. URL https://doi.org/10.1093/comnet/cnac048.

Collaborators

Marie-Laure Charpignon, *Massachusetts Institute of Technology, Cambridge, Massachusetts, USA*.

Andrea Cristofari, *University of Rome "Tor Vergata", Rome, Italy*.

Marianna De Santis, *University of Rome "La Sapienza", Rome, Italy*.

Irene Farabella, *Istituto Italiano di Tecnologia, Genova, Italy*.

Santo Fortunato, *Indiana University, Bloomington, Indiana, USA*.

Jordan Frecon-Deloire, *Télécom Saint-Etienne, Saint-Étienne, France*.

Sagar Kumar, *Northeastern Univesity Network Science Institute, Boston, Massachusetts, USA*.

Maimuna Majumder, *Boston Children's Hospital and Harvard Medical School, Boston, Massachusetts, USA*.

Martina Mazzarello, *MIT Senseable City Lab, Cambridge, Massachusetts, USA*.

Carlo Ratti, *MIT Senseable City Lab, Cambridge, Massachusetts, USA*.

Francesco Rinaldi, *University of Padova, Padova, Italy*.

Saverio Salzo, *University of Rome "La Sapienza", Rome, Italy*.

Paolo Santi, *MIT Senseable City Lab, Cambridge, Massachusetts, USA - Instituto di Informatica e Telematica del CNR, Pisa, Italy*.

Martin Schmidt, *Trier University, Trier, Germany*.

Satyaki Sikdar, *Indiana University, Bloomington, Indiana, USA*.

Francesco Tudisco, *The University of Edinburgh, Edinburgh, United Kingdom - Gran Sasso Science Institute, L'Aquila, Italy*.

Invited Talks

November 2023 — **Workshop: Future directions in Multilayer Network Science**, Zaragoza, Spain,
Title: "Collaboration and Topic Switches in Science".

August 2023 — **EUROPT Workshop on Advances in Continuous Optimization**, Budapest, Hungary,
Title: "Learning the right layers: a zeroth-order bi-level optimization strategy for semi-supervised learning on multilayer graphs".

January 2023 — **Graduate Seminar, Department of Mathematics "Tullio Levi-Civita", University of Padova**, Padova, Italy,
Title: "Complex Networks: a highly interdisciplinary field. Tools and Applications".

October 2022 — **AccelNet-MultiNet Webinar Series**,
Title: "A Variance-aware Multiobjective Louvain-like Method for Community Detection in Multiplex Networks".

August 2022 — **International Conference on Optimization and Decision Science 2022**, Firenze, Italy,
Title: "Semi-supervised learning in multilayer hypergraphs".

July 2022 — **Workshop: Future directions in Multilayer Network Science**, Boston, Massachusetts, USA,
Title: "Social Contagion in Collaboration Networks".

October 2021 — **INFORMS 2021**, Anaheim California, USA,
Title: "Methods for Community Detection in Multilayer Networks" (flexible conference - virtual attendee).

July 2021 — **NETWORKS 2021**, IU Network Science Institute, Bloomington, USA,
Title: "Methods for Semi-Supervised Community Detection in Science of Science multilayer hypergraphs", AccelNet-MultiNet Satellite (virtual conference).

Contributed Talks

July 2023 **International Conference on Computational Social Science (IC2S2) 2023**, Copenhagen, Denmark,
Title: "Social contagion in science" (Plenary talk - accepted 16 over 918 submissions) (presenter: Satyaki Sikdar)
Title: "The COVID-19 research outbreak: how the pandemic culminated in a surge of new researchers" (presenter: Satyaki Sikdar).

July 2023 **Network Science Conference (NetSci) 2023**, Vienna, Austria,
Title: "Learning the right layers: a data-driven layer-aggregation strategy for semi-supervised learning onmultilayer graphs" (presenter: SV).
Title: "Social contagion in science" (presenter: Satyaki Sikdar).

June 2023 **International Conference on the Science of Science and Innovation (ICSSI) 2023**, Evanston, Illinois, USA,
Title: "Social contagion in science" (presenter: Satyaki Sikdar).
Title: "The COVID-19 research outbreak: how the pandemic culminated in a surge of new researchers" (presenter: Sagar Kumar).

February 2021 **5th AIRO Young Workshop 2021**, Naples, Italy,
Title: "Methods for Community Detection in Multilayer Networks" (virtual conference).

Posters

July 2023 **International Conference on Machine Learning (ICML) 2023**, Honolulu, Hawaii, USA,
Title: "Learning the right layer: a data-driven layer-aggregation strategy for semi-supervised learning on multilayer graphs".

Other Activities

November 2023 **Workshop: Future directions in Multilayer Network Science**, Zaragoza, Spain.

November 2023 **Collabathon: coarse-grained network models**, Jaca, Spain,
2-days collaboration with early reserachers, with the aim of analyze, implement and compare coarse-grained network models.

June 2023 **Mediterranean School of Complex Networks 2023**, Catania, Italy.

July 2022 **Collabathon: Rewired Networks**, Portland, Maine, USA,
3-days collaboration with early reserachers, with the aim of analyze, implement and compare techniques to rewire networks. The result will be a python library.

July 2022 **Workshop: Future directions in Multilayer Network Science**, Boston, Massachusetts, USA,
Discussion, with many of the most experts in the field of multilayer networks, on the future directions of the field.

August 2021 **EUROPT summer school 2021**, (virtual school).

February 2021 **AIRO PhD school 2021**, (virtual school).

Research Mentoring and Co-Supervision

Jan. 2023 - Dec. 2023 **Master's thesis mentor - University of Padova, Padova, Italy**,
Angelica Crepaldi, *Louvain-like methods for community detection in multilayer hypergraphs*. Master Thesis in Mathematics, with Prof. Francesco Rinaldi
Matteo Bergamaschi, *Direct Search Methods for Influence Maximization problems*. Master Thesis in Data Science, with Prof. Francesco Rinaldi
Ivan Piacere, *Community detection methods applied to chromatin tracing*. Master Thesis in Data Science, with Prof. Francesco Rinaldi and Irene Farabella (Istituto Italiano di Tecnologia)
Denis Duval (Télécom Paris), *Model pruning via bilevel optimization*. Master Thesis in Computer Science and Applied Mathematics, with Prof. Francesco Rinaldi
Balthazar Mignard (Télécom Paris), *A case study on severe malaria disease in Europe*. Master Thesis in Computer Science and Applied Mathematics, with Prof. Francesco Rinaldi and Ascoli Tommaso, D'Abramo Alessandra, Nicastri Emanuele (Istituto Nazionale per le Malattie Infettive "L.Spallanzani") .

Teaching Experiences

Oct. 2022 – June. 2023 **Teaching assistant - Agronomy Department, University of Padova, Padova, Italy**,
Didactic support for the course of Mathematics of the Department of Territory and Agro-Forestry Systems.

May 2021 – Sep. 2021 **Teaching assistant - Agronomy Department, University of Padova, Padova, Italy**,
Didactic support and preparation of exercises for all the courses of Mathematics of the Department of Agronomy, Food, Natural Resources, Animals and Environment.

March 2020 – June 2020 **Teaching assistant – Science Department, University of Padova**,
Didactic support and preparation of exercises for the course of Mathematics 2 of the Degree in Materials Sciences.

Summers 2016 – 2019 **Private lessons for Middle and High school students**,
Private lessons for debt recovery in mathematics and physics.

Other Experience

Sep. 2010 – Dec. 2019 **Bussolengo Music Band, Bussolengo (Verona), Italy**,
Participation in amateur concerts and competitions – Trumpet.

August 2015 **EXPO Milano, Milan, Italy**,
Volunteer: info-point, guide to Palazzo Italia, flow management.

Language Proficiencies

Italian Mother tongue

English Fluent

Computer Skills

Microsoft Office: Excel (intermediate), PowerPoint (advanced) and Word (advanced)

Programming languages: **Python** (advanced), **Matlab** (advanced), **Ampl** (advanced)

Markup languages: Latex (advanced)