

Sara Venturini

Curriculum Vitae et Studiorum

Network Science Institute, Northeastern University

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born on 1st August 1996

Career Objective

Since January 2025, I have been a Postdoctoral Associate at the **Network Science Institute**. Prior to this, I was a Postdoctoral Fellow at the **MIT Senseable City Lab**. I earned a **Ph.D. in Computational Mathematics** in 2023 from the University of Padova. In 2022 I won a fellowship within the AccelNet-MultiNet program, which allowed me to visit Indiana University. I like to combine my background in computational and applied mathematics with my passion for complex networks into real-world social science applications. My focus areas are **network science, computational social science, optimization methods, machine learning, and the science of science**.

Education

- Jan 2025 – Ongoing** – **Network Science Institute, Northeastern University, Boston, Massachusetts, USA**
Laboratory for the Modeling of Biological and Socio-technical Systems (MoBS Lab)
Postdoctoral Associate,
Mentor: Alessandro Vespignani.
- Jan 2024 – Jan 2025** – **Massachusetts Institute of Technology, Cambridge, Massachusetts, USA**
Senseable City Laboratory (SCL)
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 – Sept 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 – **AccelNet-MultiNet fellowship travel award (\$10,500)**,
 July 2022 which assumes a five-month visit (from February 2022 to June 2022) to Indiana University, in Bloomington, Indiana, USA, collaborating with Prof. Santo Fortunato.
- Oct 2020 – **PhD fellowship from the University of Padova**.
 Sept 2023

List of Publications

- [1] Emanuele Zangrando, Sara Venturini, Francesco Rinaldi, Francesco Tudisco, **Rank-adaptive low-rank network training via bilevel optimization**, International Conference on Learning Representations (ICLR) 2025.
- [2] Sara Venturini, Marianna De Santis, Jordan Frecon-Deloir, Martin Schmidt, Francesco Rinaldi[†], Saverio Salzo[†] **Relax and penalize: a new bi-level approach to mixed-binary hyperparameter optimization**, Transactions on Machine Learning Research (TMLR) 2025.
- [3] Satyaki Sikdar[†], Sara Venturini[†], Marie-Laure Charpignon, Sagar Kumar, Francesco Rinaldi, Francesco Tudisco, Santo Fortunato, Maiamuna S. Majumder, **What we should learn from pandemic publishing**, Nature Human Behaviour, pages 1-4, 2024. doi: <https://doi.org/10.1038/s41562-024-01969-7>.
- [4] 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>.
- [5] 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**. In International Conference on Machine Learning, pages 35006–35023. PMLR, PMLR, 2023. doi: <https://proceedings.mlr.press/v202/venturini23a.html>.
- [6] 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>.
- [7] 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>.

List of Works Under Review, Preprints, Works in Progress

- [8] Sara Venturini, Satyaki Sikdar, Martina Mazzarello, Francesco Rinaldi, Francesco Tudisco, Paolo Santi, Santo Fortunato, Carlo Ratti, **How the COVID-19 pandemic affected science: collaboration and impact**, in progress.
- [9] Sara Venturini, Daniel Carmody, Martina Mazzarello, Paolo Santi, Carlo Ratti, **The effect of remote onboarding on employee ego networks**, in progress.
- [10] Matteo Bergamaschi, Sara Venturini, Francesco Tudisco, Francesco Rinaldi, **Improving Direct Search Methods on the Influence Maximization Problem**, in progress.

* These authors contributed equally to this work.

† These authors contributed equally to this work and are listed alphabetically by last name.

Invited Talks

- July 2024 **Network Science Institute, Northeastern University**, Boston, MA, USA,
 Title: "Optimization Methods for Community Detection and Graph Semi-Supervised Learning in Multiplex Networks, and Analysis of Scholarly Collaborations".
- May 2024 **SIAM Conference on Applied Linear Algebra**, Paris, France,
 Title: "Learning the right layers of a multilayer network in semi-supervised learning",
 Mini-symposium "The linear algebra of multilayer networks" (unable to attend - substitute presenter Francesco Tudisco).
- 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

- June 2024 **Network Science Conference (NetSci) 2024**, Québec City, Canada,
Title: "The Effect of Colocation on Paper Coauthorships during COVID-19" (presenter: SV).
- 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 on multilayer 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 2024 **International Conference on the Science of Science and Innovation (ICSSI)**, Washington DC, USA,
Title: "How the COVID-19 pandemic affected science: collaboration and impact" (presenter: Satyaki Sikdar).
- 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

- March 2025 **Collabathon: coarse-grained network models**, Boston, Massachusetts, USA,
3-days collaboration with early researchers, with the aim of analyzing, implement and compare coarse-grained network models.
- November 2023 **Workshop: Future directions in Multilayer Network Science**, Zaragoza, Spain,
Discussion, with many of the experts in the field of multilayer networks, on the future directions of the field.
- November 2023 **Collabathon: coarse-grained network models**, Jaca, Spain,
2-days collaboration with early researchers, with the aim of analyzing, 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 researchers, with the aim of analyzing, implement and comparing 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 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 – **Master's thesis mentor - University of Padova, Padova, Italy,**
Dec 2023 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, Nicastrì Emanuele (Istituto Nazionale per le Malattie Infettive "L.Spallanzani") .

Teaching Experiences

- June 2024 **Teaching assistant - Network Science Society (online)** ,
Assistant in the practical sessions of the network science online course taught by Santo Fortunato.
Oct 2022 – **Teaching assistant - Agronomy Department, University of Padova, Padova, Italy,**
June 2023 Didactic support for the course of Mathematics of the Department of Territory and Agro-Forestry Systems.
May 2021 – **Teaching assistant - Agronomy Department, University of Padova, Padova, Italy,**
Sept 2021 Didactic support and preparation of exercises for all the courses of Mathematics of the Department of Agronomy, Food, Natural Resources, Animals and Environment.
Mar 2020 – **Teaching assistant – Science Department, University of Padova, Padova, Italy,**
June 2020 Didactic support and preparation of exercises for the course of Mathematics 2 of the Degree in Materials Sciences.

Services

- Oct. 2024 – **Reviewer,**
Ongoing IEEE BigData, Computers & Operations Research, EPJ Data Science.
June 2024 **NetSci2024 Best Posters Awards Committee.**

Other Experience

- Sept 2010 – **Bussolengo Music Band, Bussolengo (Verona), Italy,**
Dec 2019 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)

References

- Francesco Rinaldi** **Professor at University of Padova, Department of Mathematics, Padova, Italy**
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Francesco Tudisco **Professor at The University of Edinburgh, School of Mathematics, Edinburgh, Scotland, United Kingdom .**
Affiliated with Gran Sasso Science Institute, School of Mathematics, L'Aquila, Italy
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