

Sara Venturini

Curriculum Vitae et Studiorum

Senseable City Laboratory, Massachusetts Institute of Technology

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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**. 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 2024 – **Massachusetts Institute of Technology, Cambridge, Massachusetts, USA**

Ongoing **Senseable City Laboratory (SCL)**

Postdoctoral Fellow in complex dataset analysis,

Mentors: Carlo Ratti, Paolo Santi.

Nov 2022 – **University of Padova, Padova, Italy**

Dec 2023 **Research Fellow,**

Analysis of bibliometric data and development of models in the field of the science of science.

Oct 2020 – **University of Padova, Padova, Italy**

Dec 2023 **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 – **Indiana University Network Science Institute (IUNI), Bloomington, Indiana, USA**

July 2022 **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 – **University of Padova, Padova, Italy**

July 2020 **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 – **University of Padova, Padova, Italy**

Sept 2018 **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] 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>.
- [2] 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>.
- [3] 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>.
- [4] 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>.
- [5] 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

- [6] Emanuele Zangrando, Sara Venturini, Francesco Rinaldi, Francesco Tudisco, **Rank-adaptive low-rank network training via bilevel optimization**, submitted to the International Conference on Learning Representations (ICLR) 2025.
- [7] Matteo Bergamaschi, Sara Venturini, Francesco Tudisco, Francesco Rinaldi, **Improving Direct Search Methods on the Influence Maximization Problem**, submitted the ACM International Conference on Web Search and Data Mining (WSDM) 2025.
- [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] Marianna De Santis, Jordan Frecon-Deloir, Francesco Rinaldi, Saverio Salzo, Martin Schmidt, Sara Venturini, **Relax and penalize: a new bi-level approach to mixed-binary hyperparameter optimization**, in progress.
- [10] Sara Venturini, Daniel Carmody, Martina Mazzarello, Paolo Santi, Carlo Ratti, **The effect of remote onboarding on employee ego networks**, 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

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.

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
f.tudisco@ed.ac.uk, +39 3926535300.
- Santo Fortunato** **Professor at Indiana University**, *Luddy School of Informatics, Computing, and Engineering*, Bloomington, Indiana, USA
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