

Timothy LaRock

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Academic Appointments

Department of Civil and Environmental Engineering, Princeton University **Princeton, USA**
Postdoctoral Research Associate, Complex Infrastructure Systems *April 2025 - Present*
Supervised by Prof. Jürgen Hackl

Mathematical Institute, University of Oxford **Oxford, UK**
Postdoctoral Research Associate, Structure & Dynamics of Multi-way Interactions *April 2022 - March 2025*
Supervised by Prof. Renaud Lambiotte

Education

Northeastern University Network Science Institute **Boston, USA**
PhD in Network Science *May 2022*
Dissertation: Representing and Analyzing Pathway Data Through Networks
Committee: Prof. Tina Eliassi-Rad (Advisor), Prof. Samuel V. Scarpino (Northeastern), Prof. Hongyang Zhang (Northeastern), Prof. Ingo Scholtes (University of Würzburg)

The Honors College, University at Albany, State University of New York **Albany, USA**
Bachelor of Science in Computer Science and Applied Mathematics *May 2016*
Minor: Philosophy
Advisors: Prof. Petko Bogdanov & Prof. Mariya Zheleva
Honors Thesis: *Wireless Frequency Spectrum Characterization and Transmitter Detection Using Wavelets*

Research Experience

Mathematical Institute, University of Oxford **Oxford, UK**
Postdoctoral Research Associate *April 2022 - March 2025*
Responsible for developing and carrying out an independent research program related to the Structure and Dynamics of Multi-way Interaction data. Co-organize the Oxford Networks Seminar and serve as mentor for students in the group.

Institute of Information Science and Technologies, Italian National Research Council **Pisa, Italy**
Visiting Researcher *March-April 2024*
Won €5k visitor grant from the SoBigData++ Research Infrastructure Transnational Access grant program.

Network Science Institute, Northeastern University **Boston, USA**
Research Assistant, Rad Lab *August 2016 - December 2021*
Worked independently and collaboratively on various projects, including developing machine learning and data mining methods for (higher-order) network data. Led multiple projects that resulted in high-quality research publications.

ETH Zürich/University of Zürich **Zürich, Switzerland**
Visiting Researcher - Chair of Systems Design/Data Analytics Group *Summer 2018*
Supervised by Prof. Ingo Scholtes

Computer Science Department, University at Albany, SUNY **Albany, USA**
Research Assistant, Data Management and Mining Lab *Fall 2014 - Summer 2016*

NSF Research Experience for Undergraduates **Siena College, Loudonville, USA**
Research Assistant *Summer 2014*

Teaching Experience

Oxford Mathematical Institute **Oxford, UK**
Tutorial Instructor in Networks (2 sets) *Autumn 2023*
Taught Network Science concepts to two classes, each with more than 15 advanced undergraduate and masters students.

Oxford Summer School in Economic Networks **Oxford, UK**
Tutorial Instructor *June 2023*

Khoury College of Computer Sciences, Northeastern University **Boston, USA**
Instructor - CS 3000 - Algorithms & Data *Summer 2020*

Taught more than 80 undergraduate students in Computer Science and managed 9 Teaching Assistants. Online format with 4 live lectures per week given over Zoom. Website: <https://tlarock.github.io/teaching/cs3000/syllabus.html>

Computer Science Department, University at Albany, SUNY

Teaching Assistant for Introduction to Computer Science

Albany, USA

Fall 2014

Invited Talks

- "Encapsulation Structure and Dynamics in Hypergraphs", Keynote, HyperSci Satellite, ASONAM 2024.
- "Encapsulation Structure and Dynamics in Hypergraphs", University of Warwick Applied Mathematics Seminar, October 2024.
- "Encapsulation Structure and Dynamics in Hypergraphs", Network Science Beyond Graphs, SIAM Conference on Discrete Mathematics, July 2024.
- "Encapsulation Structure and Dynamics in Hypergraphs", Workshop on Modelling and Mining Complex Networks as Hypergraphs, Toronto Metropolitan University (virtual), May 2024.
- "Encapsulation Structure and Dynamics in Hypergraphs", NORDITA WINQ Program on Complex and Quantum Systems—Dynamics and Topology of Complex Network Systems, Stockholm, April 2024.
- "Encapsulation Structure and Dynamics in Hypergraphs", IMT Lucca School for Advanced Studies, Networks Unit, Lucca, Italy, March 2024.
- "Sequential Motifs in Observed Walks", Queen Mary University of London Complex Systems Seminar, November 2022.
- "Sequential Motifs in Observed Walks", Oxford Networks Seminar, June 2022.
- "Detecting Path Anomalies in Time Series Data on Networks", Higher Order Models in Network Science Satellite (HONS), Burlington, USA, May 2019.

Conference Presentations

- 5 talks at the International Conference on Network Science (NetSci '18, '19, '20, '23, & '24; NetSciX '24).
- 2 talks at the International Conference on Complex Networks (CompleNet '18 and '24).
- Complex Networks Winter Workshop, December 2023.
- Complex Networks and Their Applications, November 2022.
- Conference on Complex Systems, October 2022.
- IMA Conference on Mathematical challenges of Big Data, September 2022.
- American Physical Society March Meeting, March 2022.
- Networks 2021: A Joint Sunbelt and NetSci Conference, June 2021.
- 25th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD'19), August 4th, 2019. Peer-reviewed Tutorial.

Publications

Pre-prints

- S. Medina, S. Babul, R. Sahasrabuddhe, **TL**, R. Lambiotte, & N. Pedreschi. Detection of anomalous spatio-temporal patterns of app traffic in response to catastrophic events. arXiv:2409.01355, September 2024.

Peer-Reviewed Journal Papers

- B. Klein, **TL**, S. McCabe, L. Torres, L. Friedland, M. Kos, F. Privitera, B. Lake, M.U.G. Kraemer, J.S. Brownstein, R. Gonzalez, D. Lazer, T. Eliassi-Rad, S.V. Scarpino, A. Vespignani, & M. Chinazzi. Characterizing the collective physical distancing of the United States during the first nine months of the COVID-19 pandemic. *PLOS Digital Health*, February 2024. <https://doi.org/10.1371/journal.pdig.0000430>.
- **TL** & Renaud Lambiotte, "Encapsulation Structure and Dynamics in Hypergraphs", *Journal of Physics: Complexity*, November 2023 <https://doi.org/10.1088/2632-072X/ad0b39>.
- **TL**, I. Scholtes, T. Eliassi-Rad, "Sequential Motifs in Observed Walks", *Journal of Complex Networks*, 10:5, October 2022 <https://doi.org/10.1093/comnet/cnac036>.
- **TL**, M. Xu, T. Eliassi-Rad, "A Path-based Approach to Analyzing the Global Liner Shipping Network", *EPJ Data Science*, 11:1, March 2022. <https://doi.org/10.1140/epjds/s13688-022-00331-z>.
- S. McCabe, L. Torres, **TL**, S.A. Haque, C-H Yang, H. Hartle, & B. Klein (2021). "netrd: A library for network reconstruction and graph distances.", *Journal of Open Source Software*. 6 (62), 2990. [10.21105/joss.02990](https://doi.org/10.21105/joss.02990). Open review: joss-reviews/issues/2990.
- **TL**, T. Sakharov, S. Bhadra, T. Eliassi-Rad, "Understanding the Limitations of Network Online Learning", *Applied Network Science*, 5:60, September 2020. <https://doi.org/10.1007/s41109-020-00296-w>.

Peer-Reviewed Conference Papers

- **TL**, V. Nanumyan, I. Scholtes, G. Casiraghi, T. Eliassi-Rad, F. Schweitzer, "HYPA: Efficient Detection of Path Anomalies in Time Series Data on Networks", Proceedings of the 2020 SIAM International Conference on Data Mining (SDM), May 2020. <https://epubs.siam.org/doi/abs/10.1137/1.9781611976236.52>.
- M. Zheleva, **TL**, P. Schmitt, P. Bogdanov, "Efficient spectrum summarization using compressed spectrum scans", 2018 IEEE Conference on Computer Communications Poster and Demo (INFOCOM), April 2018.
- M. Zheleva, P. Bogdanov, **TL**, P. Schmitt, "AirVIEW: Unsupervised transmitter detection for next generation spectrum sensing", IEEE International Conference on Computer Communications (INFOCOM2018), April 2018.
- **TL**, P. Schmitt, P. Bogdanov, E. Belding, M. Zheleva, "AirPress: Towards Scalable Spectrum Inventory", 13th USENIX Symposium on Networked Systems Design and Implementation, March 2016.
- **TL**, L. Mathews, M. Roberts, D. Lim, S. Small, "Siena's Twitter Information Retrieval System: The 2014 Microblog Track", In Proceedings of the Twenty-Third Text REtrieval Conference (TREC), November 2014.

Peer-Reviewed Workshop Papers

- **TL**, T. Sakharov, S. Bhadra, T. Eliassi-Rad, "Reducing Network Incompleteness Through Online Learning: A Feasibility Study", 14th International Workshop on Mining and Learning with Graphs (MLG, co-located with The 24th ACM SIGKDD Conference on Knowledge Discovery and Data Mining), August 2018.

Professional Activities & Service

Satellite Meeting Co-organizer

- NetSci 2024 Satellite TopoNets: Between higher-order mechanisms and phenomena, June 2024.
- Networks 2021 Satellite on Dynamics and Motifs in Networks (DynaMo), June 2021.

Journal Referee

- Science Advances
- Communication Physics
- EPJ Data Science
- Transactions on Knowledge and Data Engineering
- Nature Humanities and Social Sciences Communications
- Heliyon

Journal Editing

- Topic Coordinator, Frontiers in Physics Research Topic on Motifs of Complex Networks

Program Committee

- Complex Networks and Their Applications 2022

Departmental Service

- Oxford Networks Seminar Co-organizer
- Oxford Mathematical Sciences for Refugees and Asylum and Sanctuary Seekers 2024 Co-organizer
- Poster Judge for Conference of the Oxford SIAM Student Chapter
- Oxford Mathematical Institute Early Career Researchers (ECR) Committee
- Oxford Maths Inst. Representative to the University of Oxford Research Staff Forum
- Oxford Maths Inst. Happy Hour Committee

Open-source Software

- *Core Developer*, XGI: CompleX Group Interactions Python package, [GitHub](#).
- *Core Developer*, Encapsulation Dynamics Python code, [GitHub](#).
- *Core Developer*, netrd: A library for network {reconstruction, distances, dynamics}, [GitHub](#).
- *Core Developer*, DeBruijnNets.jl Julia code, [GitHub](#).
- *Core Developer*, Hypergeometric Path Anomaly Detection Python code, [GitHub](#).
- *Core Developer*, Shipping Networks Python code, [GitHub](#).
- *Contributor*, Pathpy2 python package, [GitHub](#).

Awards & Honors

Student-led Research on New Opportunities for Dynamic Spectrum Access Award

With Prof. Mariya Zheleva, Awarded by Dynamic Spectrum Alliance

Spring 2019

Excellence in Undergraduate Research in Computer Science Award

Awarded to graduating University at Albany CS students for research contributions.

Spring 2016

University at Albany Presidential Undergraduate Award For Research

Project: Adaptive Power Load Balancing in Cellular Networks

Spring 2015

Computer Sciences Corporation Scholarship Award

Chosen by University at Albany Computer Science Faculty - 2 students per year

Fall 2015