Timothy LaRock

Mathematical Institute, University of Oxford – Oxford, UK

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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   **Albany, USA**
Teaching Assistant for Introduction to Computer Science   *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 Quantam 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

Peer-Reviewed Journal Papers

- 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. *EPJ Data Science*, 2025 (in press).
- 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. 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*