YU TIAN

MPI PKS | CBG   E-mail: yu.tian.research@gmail.com

RESEARCH INTEREST

Network Science, Network Dynamics and Optimisation, Mathematical Statistics and Data Science.

ACADEMIC POSITIONS

Max Planck Institute for Physics of Complex Systems | Cell Biology and Genetics
(MPI PKS | CBG)   **Dresden, Germany**
Research Fellow   Oct. 2024 -
- ELBE Postdoctoral Fellow, Center for Systems Biology Dresden (CSBD)
- Leave for ill close relatives: Jan. - May 2025

Nordita, Stockholm University and KTH Royal Institute of Technology   **Stockholm, Sweden**
Research Fellow   Oct. 2022 - Oct. 2024
- Funding: Wallenberg Initiative on Networks and Quantum information (WINQ).
- PIs: Prof. Frank Wilczek (MIT) and Prof. John Wettlaufer (Yale University).

EDUCATION

University of Oxford   **Oxford, UK**
Ph.D. Mathematics   Sep. 2018 - Oct. 2022
EPSRC Centre for Doctoral Training for Industrially Focused Mathematical Modelling (InFoMM CDT)
- Thesis: Role Extraction, Dynamics, and Optimisation on Networks; supervised by Prof. Renaud Lambiotte (Oxford), and industrial collaborators Dr. Alisdair Wallis, Dr. Sebastian Lautz (Tesco).

HONOURS AND AWARDS

- Travel Scholarship from Wenner-Gren Foundation (10/2024)
- Simons Foundation Fellowship from Isaac Newton Institute (07 - 08/2024)
- EPSRC InFoMM CDT Studentship (fully-funded PhD studentship, 2018 – 2022)
- First Prize in China Undergraduate Mathematical Contest in Modelling (Beijing, 09/2016 & 09/2015)
- First-Class People's Scholarship (5% in academia, 2014-2016)
- National Scholarship (5% in academic, research and other activities, 2014-2015)

PUBLICATIONS AND PREPRINTS
*co-first author | †surname order

Preprints
16. A. Gallo, **Y. Tian**, R. Lambiotte, and T. Carletti. Global Synchronization in Matrix-Weighted Networks. Preprint, arXiv:2507.12322, 2025.
15. M. Strindberg, **Y. Tian**, and P. Fransson. *Whole-brain entrainment and anticipation in fMRI motor task data*. Preprint, bioRxiv 2025.01.31.635910, 2025.
14. X. Meng† and **Y. Tian**†. *Finding hypergraph immersion is fixed-parameter tractable*. Preprint, arXiv:2411.16017, 2024.
13. **Y. Tian**, Y. Liu, and X. Meng. *Multipartite entanglement routing as a hypergraph immersion problem*. Preprint, arXiv:2406.13452, 2024.

Peer-reviewed Publication in Mathematics and Physics
12. **Y. Tian**, S. Kojaku, H. Sayama, and R. Lambiotte. *Matrix-weighted networks for modeling multidimensional dynamics*. Phys. Rev. Lett., 134, 237401, 2025.

11. **Y. Tian**, and E. Estrada. *Balance with memory in signed networks via Mittag-Leffler matrix functions*. SIAM J. Matrix Anal. Appl., 46, 2, 1460–1483, 2025.

10. R. Wang, **Y. Tian**, P. Liò, and G. Bianconi. *Dirac-equation signal processing: physics boosts topological machine learning*. PNAS Nexus, 4, 5, pgaf139, 2025.

9. S. Babul, **Y. Tian**, and R. Lambiotte. *Strong and weak random walks on signed networks*. npj Complexity, 2, 4, 2025

8. L. Gyllingberg*, **Y. Tian***, and D. Sumpter. *A minimal model of cognition based on oscillatory and reinforcement processes*. J. R. Soc. Interface, 22, rsif.2024.0402, 2025.

7. **Y. Tian***, Z. Lubberts* and M. Weber. *Curvature-based clustering on graphs*. JMLR, 26 (52), 1 - 67, 2025.

6. **Y. Tian** and R. Lambiotte. *Structural balance and random walks on complex networks with complex weights*. SIAM J. Math. Data Sci., 6(2), 372 - 399, 2024.

5. **Y. Tian** and R. Lambiotte. *Spreading and structural balance on signed networks*. SIAM J. Appl. Dyn. Syst., 23(1), 50 - 80, 2024.

4. X. Meng, X. Hu, **Y. Tian**, G. Dong, R. Lambiotte, J. Gao, and S. Havlin. *Percolation theories for quantum networks*, Entropy, 25(11), 1564, 2023.

3. **Y. Tian**, Z. Lubberts and M. Weber. *Mixed-membership community detection via line graph curvature*. NeurIPS Symmetry and Geometry in Neural Representations, 2023.

2. **Y. Tian** and R. Lambiotte. *Unifying information propagation models on networks and influence maximization*. Phys. Rev. E, 106, 034316, 2022.

Peer-reviewed Publication in Interdisciplinary Research

1. **Y. Tian**, S. Lautz, A. Wallis and R. Lambiotte. *Extracting complements and substitutes from sales data: a network perspective*. EPJ Data Sci., 10:45, 2021.

SELECTED COMMUNICATIONS

Invited talks

- **Seminar at Statistical Physics Youth Communications** (Virtual). (Oct. 2025)
- **Seminar at Technical University of Dresden**, Dresden, Germany (Oct. 2025)
- **Math and AI Meeting jointly at MPI for Mathematics in Sciences, ScaDS.AI, and MPI for Human Cognitive and Brain Sciences**, Leipzig, Germany (Oct. 2025)
- **Computational Science Seminar at Frankfurt School**, Frankfurt, Germany (Aug. 2025)
- **SIAM Conference on Mathematics of Data Science**, Atlanta, US. (Oct. 2024)
- **Isaac Newton Institute Satellite Programme on Hypergraphs: theory and applications**, London, UK. (July 2024)
- **NERDS (NEtwoRks, Data, and Society) Seminar, IT University of Denmark**, Copenhagen, Denmark. (Apr. 2024)
- **Seminar at Technical University of Denmark**, Copenhagen, Denmark. (Apr. 2024)
- **Seminar at Niels Bohr Institute**, Copenhagen, Denmark. (Apr. 2024)
- **Nordic Workshop on Statistical Physics: Biological, Complex and Non-equilibrium Systems**, Stockholm, Sweden. (Mar. 2024)
- **Seminar at Vermont Complex Systems Center** (Virtual), Vermont, US. (Mar. 2024)
- **Seminar at Binghamton Center of Complex Systems** (Virtual), New York, US. (Feb. 2024)
- **Applied and Interdisciplinary Seminar at University of Bath**, Bath, UK. (Feb. 2024)
- **NetPLACE Seminar** (Virtual). (Feb. 2024)
- **Seminar at Imperial College London**, London, UK. (Feb. 2024)
- **CASA Seminar at University College London**, London, UK. (Feb. 2024)
- **Seminar at Queen Mary, University of London**, London, UK. (Jan. 2024)
- **Seminar at Linköping University**, Linköping, Sweden. (Sep. 2023)
- **Seminar at Indiana University** (Virtual), Bloomington, US. (Sep. 2023)
- **Seminar at Northwestern University** (Virtual), Chicago, US. (Aug. 2023)
- **BrainNet workshop at KTH**, Stockholm, Sweden. (May, 2023)
- **SIAM Conference on Applications of Dynamical System**, Portland, US. (May 2023)
- **Seminar at Uppsala University**, Uppsala, Sweden. (May 2023)
- **Soft Matter Seminar at Nordita**, Stockholm, Sweden. (Oct. 2022)
- **Seminar at Technical University of Munich** (Virtual), Munich, Germany. (May 2022)

- **Seminar at Dartmouth College** (Virtual), Hanover, US. (Jan. 2022)
- **Oxford Networks Seminar** (Virtual), University of Oxford, UK. (May 2021)

Contributed talks
- **HOOC (Higher Order Opportunities and Challenges) Workshop**, Aachen, Germany (Aug. 2025)
- **Conference on Network Sciences**, Maastricht, Netherlands. (June 2025)
- **Conference on Network Sciences**, Quebéc city, Canada. (June 2024)
- **British NetSci Symposium**, London, UK. (May 2024)
- **WINQ Mini-Workshop at Nordita**, Stockholm, Sweden. (Feb. 2023)
- **The 4th IMA Conference on The Mathematical Challenges of Big Data**, University of Oxford, UK. (Sep. 2022)
- **SIAM Workshop on Network Science** (Virtual). (Sep. 2022)
- **Conference on Network Sciences (NetSci)** (Virtual), Shanghai, China. (July 2022)
- **Industrial Mathematics in the 21st Century: A cornucopia of unsolved problems**, University of Oxford, UK. (June 2022)
- **InFoMM Annual Meeting**, University of Oxford, UK. (June 2022)
- **SIAM UKIE National Student Chapter Conference**, Edinburgh, UK. (June 2022)
- **The 13th International Conference on Complex Networks (CompleNet)** (Virtual), Exeter, UK. (May - June 2022)
- **The 10th International Conference on Complex Networks and their Applications (CNA)**, Madrid, Spain. (Nov. 2021)
- **Conference on Complex Systems (CCS)**, Lyon, France. (Oct. 2021)
- **InFoMM Annual Meeting** (Virtual), University of Oxford, UK. (July 2021)

TEACHING EXPERIENCE

University of Oxford   **Oxford, UK**
Tutor   Oct. 2021 - Dec. 2021
- Introduction to Statistics, Michaelmas Term 2021

Teaching Assistant   Oct. 2019 - Apr. 2020
- Networks, Hilary Term 2020
- Graph Theory, Michaelmas Term 2019

PROFESSIONAL EXPERIENCE

Reviewers
- **Journals**: Science Advances, Scientific Reports, PNAS Nexus, PLOS Complex Systems, Physica A: Statistical Mechanics and its Applications, Advances in Complex Systems.
- **Conferences**: International AAAI Conference on Web and Social Media, NeurIPS New Perspectives in Graph Machine Learning.

Organisers
- **WINQ Workshop on Complex Dynamical Networks**, Nordita   Apr. 2024 - May 2024
- **Session at INFORMS 2023 Annual Meeting**, Phoenix   Oct. 2023
  Session Title: Networks in Machine Learning and Data Science
- **WINQ Mini-Workshop**, Nordita   Feb. 2023
- **WINQ Seminar**, Nordita   Oct. 2022 - Oct. 2024
- **Oxford Networks Seminar**, University of Oxford   Oct. 2021 - June 2022

Service and Outreach
- **Equity, Diversity and Inclusion (EDI) Committee** Member, Nordita   Oct. 2023 - Oct. 2024

INDUSTRIAL EXPERIENCE

University of Oxford   **Oxford, UK**

InFoMM CDT Mini-Project: Inter-District Packaged Gas Optimisation.   Jul. - Sep. 2019

Supervisors: Prof. Raphael Hauser (Oxford), Dr. Peter Connard, Dr. Harsida Jenkins (Air Products)

- Formulated the problem of both inventory management and transshipment of products as a mixed integer programming, and reviewed state-of-the-art techniques.
- Proposed several relaxation methods based on Lagrangian relaxation to improve solving efficiency.

InFoMM CDT Mini-Project: Halo Effect and Demand Transfer on Products.   Apr. - Jun. 2019

Supervisors: Prof. Renaud Lambiotte (Oxford), Dr. Alisdair Wallis (Tesco).

- Devised a method combining Poisson processes with time series analysis to identify the product relationships from aggregated sales data quantitatively.
- Applied regression techniques, and proposed several validation methods with real data.

TECHNOLOGY SKILLS

- **Programming:** Proficiency in Python (pandas, numpy, scipy, networkx, statsmodels, scikit-learn etc), MATLAB; Familiarity with R Language, C Language.
- **Optimisation:** MOSEK, Lingo.

MEMBERSHIPS

- The Institute for Operations Research and the Management Sciences (INFORMS), Member
- Society for Industrial and Applied Mathematics (SIAM), Early Career Member
- Institute of Mathematics and its Applications (IMA), Associate Member