

Tao Wen

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(Last updated: October 28, 2024)

EDUCATION

- Integrated PhD and MSc in *Data Analytics and Society* (funded by **ESRC Centre for Doctoral Training in Data Analytics and Society**) 2025
Advisor: Prof. Yu-wang Chen and Associate Prof. Tahir Abbas Syed
University of Manchester (UoM), Manchester, UK
- MEng. (Research) in *Science, Mathematics & Technology* (funded by **SUTD Fellowship**) 9/2021
Advisor: Associate Prof. Kang Hao Cheong
Singapore University of Technology and Design (SUTD), Singapore
- B. S. in *System Engineering* 6/2019
Advisor: Prof. Yong Deng and Prof. Wen Jiang
Northwestern Polytechnical University (NWPU), Xi'an, China

RESEARCH INTERESTS

- AI & Machine Learning
- Game Theory
- Data Analytics on Misinformation
- Network Science
- Complex System
- Decision Science and Decision Analysis

TEACHING & SUPERVISION

- Teaching Assistant
 - AI and Machine Learning: Business Application (5K7V0024, MSc Level) Spring 2024
Led by Dr. Ting Wu, Manchester Metropolitan University.
 - Programming in Python for Business Analytics (BMAN73701, MSc Level) Fall 2022
Led by Prof. Richard Allmendinger & Prof. Manuel Lopez-Ibanez, UoM.
 - Modelling Space and Systems (10.018, BSc Level) Spring 2021
Led by Associate Prof. Kang Hao Cheong, SUTD.
- MSc Dissertation Co-supervision
 - Vania Faustanta, Dhruv Nilesh Kapadia, Frederick Ching Fung Ling 2024
 - Tony Mathew Abraham (MS student @ UoM → JLR, Dean's Award) 2023
 - Elena Narang (MS student @ UoM → IOM, UN Migration) 2023

SELECTED PUBLICATIONS (*: equal contributions)

See the full list in [Google Scholar](#) (*citation: 1000+*, *h-index: 19*)

- [1] Kang Hao Cheong*, **Tao Wen***, Sean Benler, Jin Ming Koh, Eugene V. Koonin (2022). Alternating Lysis and Lysogeny is a Winning Strategy in Bacteriophages due to Parrondo's Paradox. In *Proceedings of the National Academy of Sciences*. [[Link](#), [Code](#)]
- [2] **Tao Wen**, Kang Hao Cheong, Joel Weijia Lai, Jin Ming Koh, Eugene V. Koonin (2022). Extending the Lifespan of Multicellular Organisms via Periodic and Stochastic Intercellular Competition. In *Physical Review Letters*. [[Link](#), [Code](#)]
- [3] **Tao Wen**, Yu-wang Chen, Renaud Lambiotte (2024). Collective Effect of Self-learning and Social Learning on Language Dynamics: A Naming Game Approach in Social Networks. In *Journal of the Royal Society Interface*. [[Link](#), [Code](#)]
- [4] **Tao Wen**, Kang Hao Cheong (2024). Parrondo's Paradox Reveals Counterintuitive Wins in Biology and Decision Making in Society. In *Physics of Life Reviews*. [[Link](#)]
- [5] **Tao Wen**, Jinde Cao, Kang Hao Cheong (2023). Gravity-based Community Vulnerability Evaluation Model in Social Networks: GBCVE. In *IEEE Transactions on Cybernetics*. [[Link](#)]
- [6] **Tao Wen**, Kang Hao Cheong (2021). The Fractal Dimension of Complex Networks: A Review. In *Information Fusion (ESI 1% Highly Cited Paper)*. [[Link](#), 150+ citations]

Paper in the pipeline

- [1] **Tao Wen**, Yu-wang Chen, Jie Zhao, Yong-Yeol Ahn, Kang Hao Cheong. Early-stage Localization

of Information Propagation Sources via Generalized Bayesian Inference in Large-scale Social Networks. Submitted to *Nature Computational Science* under consideration.

- [2] **Tao Wen**, Rui Zheng, Yu-wang Chen, Zeyi Liu, Ting Wu, Mi Zhou, Tahir Abbas Syed, Darminder Ghataoura. Formulating Opinion Dynamics from Belief Formation, Diffusion and Updating in Social Network Group Decision Making: A Holistic Framework. Submitted with invitation from Editor-in-chief to *European Journal of Operational Research* under consideration.

SELECTED FELLOWSHIP & AWARDS

- The Chinese Government Award for Outstanding Self-financed Students Abroad (Highest government award for overseas Chinese PhD students) 2024
- Support Fund from the Department of Social Statistics 2024
- The Turing Scheme 2024
- **Enrichment Scheme Placement Award** at The Alan Turing Institute (Up to 55 awardees who are engaging in AI/ML across the UK) 2023
- Excellent Paper Award of 5th China and UK Forum of International Young Scholars in Manchester 2023
- **Turing Exchange Fellowship** 2022
- Excellent Paper Award of International Postgraduate Interdisciplinary Forum on Smart Shipping and Green Future 2022
- Support Fund from Decision and Cognitive Sciences Research Centre 2022
- ESRC Funded Integrated PhD and MSc in Data Analytics and Society Scholarship 2021
- SUTD MEng (Research) Fellowship 2020
- The “Challenge Cup” National Undergraduate Extracurricular Academic Science and Technology Contest: **Special First Prize (Top 4%)** 2019
- **Outstanding Student Pacemaker** in NWPU (TOP 0.1%, only 10 awardees among more than 12,000 undergraduates) 2018
- **China National Scholarship** 2018

RESEACH EXPERIENCE

Data Analytics for Addressing Fake News and Deepfakes in Social Networks 9/2021 - Present
UoM (PhD project), Advisor: Prof. Yu-wang Chen and Associate Prof. Tahir Abbas Syed

Temporal Dynamics of Belief Networks 7/2024 - 8/2024
Indiana University Bloomington (Funded by The Turing Scheme), Advisor: Prof. Yong-Yeol Ahn

Data-driven Modelling and Analysis of Opinion and Decision Dynamics 1/2024 - 7/2024
The Alan Turing Institute (2023 Enrichment Scheme)

Quantifying Impact of Social Influence on Language Dynamics 2/2023 - 1/2024
University of Oxford (Funded by Turing Exchange Fellowship), Advisor: Prof. Renaud Lambiotte

Studying Economic Growth and Environmental Sustainability through Cooperation 5/2022 - 9/2022
University of Manchester, Advisor: Prof. Yu-wang Chen and Dr. Ting Wu

Analyzing Parrondo’s Paradox Phenomenon and its Applications 1/2020 - 9/2021
Singapore University of Technology and Design, Advisor: Associate Prof. Kang Hao Cheong

Finding Important Properties of Nodes and Communities in Complex Networks 6/2019 - 9/2019
University of Electronic Science and Technology of China, Advisor: Prof. Yong Deng

Exploring the Properties of Networks by Different Dimensions 5/2016 - 6/2019
Northwestern Polytechnical University, Advisor: Prof. Wen Jiang and Prof. Yong Deng

PRESENTATIONS

Early-stage Inference of Misinformation Propagation Sources.
▪ Conference on Complex Systems 2024, Exeter, UK. 9/2024

Forecasting Time Series through Motif Structure Analysis within Visibility Graph
▪ 29th International Conference on Automation and Computing, Sunderland, UK. 8/2024

Collective Effect of Social Behaviors on Language Dynamics in Social Networks.
▪ NetSci 2024, Québec City, Canada. 6/2024

- Networks and Time II, Northeastern University London, London, UK. 4/2024
- Data Natives, City, University of London, London, UK. 4/2024
- PhD Student Presentations and Networking, The Alan Turing Institute, London, UK. 3/2024
- Examining Communication Network Behaviors, Structure and Dynamics.
 - Postgraduate Summer Research Showcase, UoM, Manchester, UK. 6/2023
 - Advances in Data Science and AI Conference, Manchester, UK. 6/2023
 - Brown Bag Seminar on Fintech & Digital Transformation, UoM, Manchester, UK. 5/2023
- Exploring the Vulnerability of Logistics Networks by Entropy.
 - 5th China and UK Forum of International Young Scholars in Manchester, Manchester, UK. 6/2023
 - International Postgraduate Interdisciplinary Forum on Smart Shipping and Green Future. 9/2022
- Analysis of Fractal Characteristics of Complex Networks and Its Application.
 - 4th China and UK Forum of International Young Scholars in Manchester, Manchester, UK. 6/2022
- Evidential Reasoning-based Influential Users Evaluation in Social Networks.
 - 26th International Conference on Multiple Criteria Decision Making, Portsmouth, UK. 6/2022
- Analysis of Fractal Properties of Complex Networks and Its Application.
 - Oberseminar Dynamics Seminar, Technical University of Munich, Online. 5/2021
 - Ao Xiang Students Lecture, Northwestern Polytechnical University, Xi'an, China. 12/2019
- Forecasting Time Series based on Visibility Graph and Relative Entropy.
 - 9th China Information Fusion Conference, Taiyuan, China. 7/2019

SERVICES

- Assist in organizing Decision and Cognitive Sciences Research Centre seminars.
- **Special Issue Editor** on Mathematics (Data-driven Decision Making: Models, Methods and Applications).
- **Session Chair**
 - 2024: ICAC
- **Journal Reviewer**
 - *Communications Physics*
 - *Chaos: An Interdisciplinary Journal of Nonlinear Science*
 - *European Physical Journal B*
 - *Humanities & Social Sciences Communications*
 - *IEEE Transactions on Neural Networks and Learning Systems*
 - *IEEE Transactions on Network Science and Engineering*
 - *IEEE Transactions on Signal and Information Processing over Networks*
 - *Journal of Computational Science*
 - *Physica A: Statistical Mechanics and Its Applications*
 - *Reliability Engineering & System Safety*
 - *Scientific Reports*
 - ...
- **Program Committee Member**
 - 2024: NeurIPS, ICLR, NetSci, AISTATS, DASA

REFERENCES

Prof. Dr. Yu-Wang Chen

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 University of Manchester
 Manchester, UK
Yu-wang.Chen@manchester.ac.uk

Prof. Dr. Richard Allmendinger

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Associate Prof. Dr. Kang Hao Cheong

College of Computing and Data Science
 School of Physical and Mathematical Sciences
 Nanyang Technological University
 Singapore
kanghao.cheong@ntu.edu.sg

FULL PUBLICATIONS LIST (*: equal contributions)

2025

- [1] Collective Effect of Self-learning and Social Learning on Language Dynamics: A Naming Game Approach in Social Networks.
Tao Wen, Yu-wang Chen, Renaud Lambiotte. In *Journal of the Royal Society Interface*. [Code]
- [2] Examining Communication Network Behaviors, Structure and Dynamics in an Organizational Hierarchy: A Social Network Analysis Approach.
Tao Wen, Yu-wang Chen, Tahir Abbas Syed, Darminder Ghataoura. In *Information Processing & Management*.
- [3] Strategic Variability in Routing: Enhancing Network Performance in Two-layer Traffic Systems.
Kang Hao Cheong, Ankit Mishra, **Tao Wen**. In *Physical Review E*.

2024

- [4] Parrondo's Paradox Reveals Counterintuitive Wins in Biology and Decision Making in Society.
Tao Wen, Kang Hao Cheong. In *Physics of Life Reviews*.
- [5] ERIUE: Evidential Reasoning-based Influential Users Evaluation in Social Networks.
Tao Wen, Yu-wang Chen, Tahir Abbas Syed, Ting Wu. In *Omega*. (Grade 3 journal)
- [6] How Flexible Parasites Can Outsmart Their Hosts for Evolutionary Dominance.
Tao Wen, Eugene V. Koonin, Kang Hao Cheong. In *Physical Review Research*.
- [7] Cooperation-guided Experts Importance Identification Model with Fuzzy Framework: A Network Design.
Zeyi Liu*, **Tao Wen***, Yong Deng, Hamido Fujita. In *IEEE Transactions on Emerging Topics in Computational Intelligence*.
- [8] Parrondo's Paradox in Network Communication: A Routing Strategy.
Ankit Mishra, **Tao Wen**, Kang Hao Cheong. In *Physical Review Research*.
- [9] Efficient Traffic Management in Networks with Limited Resources: The Switching Routing Strategy.
Ankit Mishra, **Tao Wen**, Kang Hao Cheong. In *Chaos, Solitons and Fractals*.

2023

- [10] Gravity-based Community Vulnerability Evaluation Model in Social Networks: GBCVE.
Tao Wen, Jinde Cao, Kang Hao Cheong. In *IEEE Transactions on Cybernetics*. (Grade 3 journal)
- [11] Switching between Two Losing Stocks may Enable Paradoxical Win: An Empirical Analysis.
Tao Wen, Joel Weijia Lai, Kang Hao Cheong. In *Fractals*.
- [12] Multi-Objective Squirrel Search Algorithm for EEG Feature Selection.
Chao Wang, Songjie Li, Miao Shi, Jie Zhao, **Tao Wen**, U. Rajendra Acharya, Neng-gang Xie, Kang Hao Cheong. In *Journal of Computational Science*.

2022

- [13] Extending the Lifespan of Multicellular Organisms via Periodic or Stochastic Intercellular Competition.
Tao Wen, Kang Hao Cheong, Joel Weijia Lai, Jin Ming Koh, Eugene V. Koonin. In *Physical Review Letters*. (The Highest Impact Letter in Physics) [Code]
- [14] Alternating Lysis and Lysogeny is a Winning Strategy in Bacteriophages due to Parrondo's Paradox.
Kang Hao Cheong*, **Tao Wen***, Sean Benler, Jin Ming Koh, Eugene V. Koonin. In *Proceedings of the National Academy of Sciences*. [Code]
- [15] Exploring the Vulnerability of Logistics Networks by Entropy: An Asia-Europe Maritime Transportation Network Case Study.
Tao Wen, Qiuya Gao, Yu-wang Chen, Kang Hao Cheong. In *Reliability Engineering & System Safety*. (Grade 3 journal)
- [16] A Review of Predator-Prey Systems with Dormancy of Predators.
Tao Wen, Qiuya Gao, Tamás Kalmár-Nagy, Yong Deng, Kang Hao Cheong. In *Nonlinear Dynamics*.
- [17] Visibility Graph for Time Series Prediction and Image Classification: A Review.
Tao Wen, Huiling Chen, Kang Hao Cheong. In *Nonlinear Dynamics*.
- [18] The Random Walk-based Gravity Model to Identify Influential Nodes in Complex Networks.

- Jie Zhao, **Tao Wen**, Hadi Jahanshahi, Kang Hao Cheong. In *Information Sciences*.
- [19] [A Novel Network-based and Divergence-based Time Series Forecasting Method](#). Qiuya Gao, **Tao Wen**, Yong Deng. In *Information Sciences*.
- 2021**
- [20] [The Fractal Dimension of Complex Networks: A Review](#). **Tao Wen**, Kang Hao Cheong In *Information Fusion*. (150+ citation, ESI 1% Highly Cited Paper)
- [21] [An Alternating Active-dormitive Strategy Enables Disadvantaged Prey to Outcompete the Perennially Active Prey through Parrondo's Paradox](#). **Tao Wen**, Eugene V. Koonin, Kang Hao Cheong. In *BMC Biology*.
- [22] [Information Volume Fractal Dimension](#). Qiuya Gao, **Tao Wen**, Yong Deng. In *Fractals*. (ESI 0.1% Hot Paper & ESI 1% Highly Cited Paper)
- [23] [Game Dynamics of Emotion Evolution based on the Moran Process](#). Yayun Dai, Guangjie Zhan, Ye Ye, Wei Bao, **Tao Wen**, Kang Hao Cheong, Nenggang Xie. In *Chaos: An Interdisciplinary Journal of Nonlinear Science*.
- [24] [Automatic COVID-19 Detection using Exemplar Hybrid Deep Features with X-ray Images](#). Prabal Datta Barua, Nadia Fareeda Muhammad Gowdh, Kartini Rahmat, Norlisah Ramli, Wei Lin Ng, Wai Yee Chan, Mutlu Kuluozturk, Sengul Dogan, Mehmet Baygin, Orhan Yaman, Turker Tuncer, **Tao Wen**, Kang Hao Cheong, U. Rajendra Acharya. In *International Journal of Environmental Research and Public Health*.
- 2020**
- [25] [Relieving Cost of Epidemic by Parrondo's Paradox: A COVID-19 Case Study](#). Kang Hao Cheong, **Tao Wen**, Joel Weijia Lai. In *Advanced Science*. (Press)
- [26] [Vital Spreaders Identification in Complex Networks with Multi-Local Dimension](#). **Tao Wen**, Danilo Pelus, Yong Deng. In *Knowledge-Based Systems*.
- [27] [The Vulnerability of Community Structure in Complex Networks: An Entropy Approach](#). **Tao Wen**, Yong Deng. In *Reliability Engineering & System Safety*. (ESI 1% Highly Cited Paper, Grade 3 journal)
- [28] [Identification of Influencers in Complex Network by Local Information Dimensionality](#). **Tao Wen**, Yong Deng. In *Information Sciences*. (100+ citations, ESI 1% Highly Cited Paper)
- 2019**
- [29] [Node Similarity Measuring in Complex Networks with Relative Entropy](#). **Tao Wen**, Shuyu Duan, Wen Jiang. In *Communications in Nonlinear Science and Numerical Simulation*.
- [30] [Identifying Influential Nodes based on Fuzzy Local Dimension in Complex Networks](#). **Tao Wen**, Wen Jiang. In *Chaos, Solitons & Fractals*.
- [31] [Measuring the Complexity of Complex Network by Tsallis Entropy](#). **Tao Wen**, Wen Jiang. In *Physica A: Statistical Mechanics and Its Applications*.
- [32] [A New Information Dimension of Complex Network based on Rényi Entropy](#). Shuyu Duan, **Tao Wen**, Wen Jiang. In *Physica A: Statistical Mechanics and Its Applications*.
- 2018**
- [33] [Evaluating Topological Vulnerability based on Fuzzy Fractal Dimension](#). **Tao Wen**, Moxian Song, Wen Jiang. In *International Journal of Fuzzy Systems*.
- [34] [An Information Dimension of Weighted Complex Networks](#). **Tao Wen**, Wen Jiang. In *Physica A: Statistical Mechanics and Its Applications*.
- Conference paper**
- [1] Evidential Reasoning-based Early-stage Inference of Information Propagation Source in Large-scale Social Networks. (Abstract)
Tao Wen, Yu-wang Chen. In *Conference on Complex Systems*, Exeter, UK, September 2024.
- [2] Forecasting Time Series through Motif Structure Analysis within Visibility Graph.
Tao Wen, Yu-wang Chen. In *29th International Conference on Automation and Computing*, Sunderland, UK, August 2024.
- [3] Evidential Reasoning-based Inference of Early-stage Information Propagation Source in Large-scale Social Networks. (Abstract)
Yu-wang Chen, **Tao Wen**. In *33rd European Conference on Operational Research*, Copenhagen,

- Denmark, July 2024.
- [4] Data Analytics for the Impact of Renewable Energy on Decoupling Economic Growth from Carbon Emissions. (Abstract)
Ting Wu, **Tao Wen**, Yu-wang Chen. In *33rd European Conference on Operational Research*, Copenhagen, Denmark, July 2024.
 - [5] Exploring the Effect of Social Behaviors on Language Dynamics in Social Networks. (Abstract)
Tao Wen, Yu-wang Chen, Renaud Lambiotte. In *NetSci 2024*, Québec City, Canada, June 2024.
 - [6] Characterising Decision Making in Social Networks with Belief Diffusion and Updating. (Abstract)
Yu-wang Chen, **Tao Wen**, Ting Wu. In *27th International Conference on Multiple Criteria Decision Making*, Hammamet, Tunisia, June 2024.
 - [7] Analysing Communication Network Structure and Dynamics in an Organizational Hierarchy. (Abstract)
Yu-wang Chen, **Tao Wen**. In *23rd Conference of the International Federation of Operational Research Societies*. Santiago, Chile, July 2023.
 - [8] Analyzing Communication Patterns and Dynamics in an Organizational Hierarchy through Social Network Analysis. (Abstract)
Tao Wen, Yu-wang Chen, Tahir Abbas Syed. In *Advances in Data Science and AI Conference 2023*. Manchester, UK, June 2023.
 - [9] Ranking Influential Users in Social Networks by the Evidential Reasoning Algorithm. (Abstract)
Tao Wen, Yu-wang Chen, Tahir Abbas Syed. In *26th International Conference on Multiple Criteria Decision Making*. Portsmouth, UK, June 2022.
 - [10] Forecasting Time Series based on Visibility Graph and Relative Entropy. (In Chinese)
Tao Wen, Shuyu Duan, Wen Jiang. In *The Ninth Chinese Information Fusion Conference*, Taiyuan, China, Oct. 2019.
 - [11] Identifying Influential Nodes based on Tsallis Entropy and Information Dimension. (In Chinese)
Shuyu Duan, **Tao Wen**, Xinyang Deng, Wen Jiang. In *The Ninth Chinese Information Fusion Conference*, Taiyuan, China, Oct. 2019.
 - [12] A Physarum-inspired Model for the Path Planning of Uninhabited Combat Air Vehicle. (In Chinese)
Shuai Xu, Zichang He, **Tao Wen**, Wen Jiang. In *The Eighth Chinese Information Fusion Conference*, Xi'an, China, July 2018.

Paper in the pipeline

- [1] Early-stage Localization of Information Propagation Sources via Generalized Bayesian Inference in Large-scale Social Networks.
Tao Wen, Yu-wang Chen, Jie Zhao, Yong-Yeol Ahn, Kang Hao Cheong. Submitted to *Nature Computational Science* under consideration.
- [2] Formulating Opinion Dynamics from Belief Formation, Diffusion and Updating in Social Network Group Decision Making: A Holistic Framework.
Tao Wen, Rui Zheng, Yu-wang Chen, Zeyi Liu, Ting Wu, Mi Zhou, Tahir Abbas Syed, Darminder Ghataoura. Submitted with invitation from Editor-in-chief to *European Journal of Operational Research* under consideration.
- [3] ChatEVO: Large Language Model as All-Encompassing Evolutionary Optimizers.
Jie Zhao, **Tao Wen**, Kang Hao Cheong. Submitted to *AAAI 2024* under consideration.
- [4] Leveraging Data Analytics to Tackle Fake News and Deepfakes in Social Networks.
Tony Mathew Abraham, **Tao Wen**, Ting Wu, Yu-wang Chen. Submitted to *Humanities and Social Sciences Communications* under consideration.
- [5] Advanced Strategy Formulation in Parrondo's Games through Large Language Models.
Kang Hao Cheong, Jie Zhao, **Tao Wen**. Submitted to *Physical Review E* under consideration.
- [6] Human Umbilical Cord Lining Epithelial Cells as a Hypoimmunogenic Source for Retinal Regenerative Therapy.
Bhav Harshad Parikh, Zengping Liu, Chou Chai, Fritz Lai, Asfa Alli-Shaik, Nancy Zhao, Kakkad Regha, Binxia Yang, **Tao Wen**, Vinod Selvan, Hang Liu, Mayuri Bhargava, Shaun Loong, Oleg V. Grinchuk, Mei Sheng Lau, Yee Jie Yeap, Ernest Poon, Rajvinder Singh Khare, Queenie Shu Woon Tan, Daniel Soo Lin Wong, Haofei Wang, Claudine Wong, Abdurrahmaan Al-Mubaarak, Paul Blakeley, Jeyakumar Masilamani, Chee Tian Ong, Toan Thang Phan, Chui Ming Gemmy Cheung, Veluchamy Amutha Barathi, Wee-Wei Tee, Walter Hunziker, Tim Xiaoming Hu, Kang Hao Cheong, Gopal Lingam, Qi-Jing Li, Qingfeng Chen, Kah Leong Lim, Xinyi Su. Submitted to

Nature Medicine under consideration.