

# Tao Wen

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RESEARCH INTERESTS	Complexity Science, Network Science, Game Theory, Fractal Property Decision-making, Belief & Decision Dynamics	
EDUCATION	<b>University of Manchester (UoM)</b> <i>Integrated PhD and MSc in Data Analytics and Society (ESRC funded)</i> Advisor: Prof. Yu-wang Chen and Associate Prof. Tahir Abbas Syed	Manchester, UK 2021 - Present
	<b>Singapore University of Technology and Design (SUTD)</b> <i>MEng. (Research) in Science, Mathematics &amp; Technology</i> Advisor: Associate Prof. Kang Hao Cheong	Singapore 2020 - 2021
	<b>Northwestern Polytechnical University (NWPU)</b> <i>B. S. in Detection, Guidance, and Control Technology (System Engineering)</i> Advisor: Prof. Wen Jiang and Prof. Yong Deng	Xi'an, China 2015 - 2019
SELECT PUBLICATIONS	* Corresponding Author; † Contribute equally.	
[ <a href="#">Google Scholar</a> ]	[1] <b>Tao Wen</b> , Kang Hao Cheong*, Joel Weijia Lai, Jin Ming Koh, Eugene V. Koonin. “Extending the lifespan of multicellular organisms via periodic or stochastic intercellular competition,” <i>Physical Review Letters</i> . vol. 128, p. 218101, 2022. ( <b>The Highest Impact Letter in Physics</b> )	
Citation: 750+	[2] Kang Hao Cheong*†, <b>Tao Wen</b> †, Sean Benler, Jin Ming Koh, Eugene V. Koonin*. “Alternating lysis and lysogeny is a winning strategy in bacteriophages due to Parrondo's Paradox,” <i>Proceedings of the National Academy of Sciences</i> . vol. 119, p. e2115145119, 2022.	
H-Index: 16	[3] <b>Tao Wen</b> , Jinde Cao, Kang Hao Cheong*. “Gravity-based Community Vulnerability Evaluation Model in Social Networks: GBCVE,” <i>IEEE Transactions on Cybernetics</i> . vol. 53, no. 4, pp. 2467-2479, 2023. (Grade 3 journal in ABS list)	
I10-Index: 20	[4] <b>Tao Wen</b> , Kang Hao Cheong*. “The Fractal Dimension of Complex Networks: A Review,” <i>Information Fusion</i> . vol. 73, pp. 87-102, 2021. (ESI Highly Cited Paper 🏆)	
	[5] <b>Tao Wen</b> , Yong Deng*. “The vulnerability of community structure in complex networks: An entropy approach,” <i>Reliability Engineering &amp; System Safety</i> . vol. 196, p. 106782, 2020. (ESI Highly Cited Paper 🏆, Grade 3 journal in ABS list)	
	[6] <b>Tao Wen</b> , Yong Deng*. “Identification of influencers in complex network by local information dimensionality,” <i>Information Sciences</i> . vol. 512, pp. 549-562, 2020. (ESI Highly Cited Paper 🏆)	
	[7] Qiuya Gao, <b>Tao Wen</b> , Yong Deng*. “Information Volume Fractal Dimension”. <i>Fractals</i> . vol. 29, p. 2150263, 2021. (ESI Hot Paper 🔥 & ESI Highly Cited Paper 🏆)	
SELECT FELLOWSHIPS AND AWARDS	<ul style="list-style-type: none"><li>▪ <b>Enrichment Scheme Placement Award</b> at The Alan Turing Institute (<b>up to 55 awards</b>)</li><li>▪ Excellent paper award of 5th China and UK Forum of International Young Scholars in Manchester</li><li>▪ <b>Turing Exchange Fellowship</b></li><li>▪ Excellent paper award of International Postgraduate Interdisciplinary Forum on Smart Shipping and Green Future</li><li>▪ Decision and Cognitive Sciences Research Centre Support Fund</li></ul>	2023 2023 2022 2022 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
- The “Challenge Cup” National Undergraduate Extracurricular Academic Science and Technology Contest in Shaanxi Area: **Outstanding Winner** 2019
- **Outstanding Student Pacemaker** in NWPU (**TOP 0.1%, only 10 awardees** among more than 12,000 undergraduates in NWPU) 2018
- **China National Scholarship** 2018
- Global Mathematical Contest in Modeling (awarded by COMAP): Meritorious Winner 2018

RESEARCH  
EXPERIENCE

**Data Analytics for Addressing Fake News and Deepfakes in Social Networks** Sep 2021 - Present  
University of Manchester, Advisor: Professor [Yu-wang Chen](#) and Associate Prof. [Tahir Abbas Syed](#)

- Analyzed communication behavior, pattern, and dynamics within an organizational hierarchy through the perspective of social network analysis.
- Taken into account multiple sources of structural information to assess the influential ability of users in social networks, thereby promoting or curbing the dissemination of specific information.

**Quantifying Impact of Social Influence on Language Dynamics** Feb - Mar 2023

University of Oxford (**Funded by Turing Exchange Fellowship**), Advisor: Professor [Renaud Lambiotte](#)

- Characterized the dynamics of linguistic rules in the presence of group behaviors within the network structure and individual decision-making process with uncertainty and ignorance.
- Highlighted the substantial influence of network structure on the transition of group opinions, from consensus to polarization, offering valuable insights into how individual learners adopt language rules through the lenses of complexity science and decision science.

**Studying Economic Growth and Environmental Sustainability through Cooperation** May - Sep 2022

University of Manchester, Advisor: Professor [Yu-wang Chen](#) and Dr. [Ting Wu](#)

▪

**Data-driven Modelling and Analysis of Opinion and Decision Dynamics** Jan - Aug 2024

The Alan Turing Institute (2023 **Enrichment Scheme**),

▪

**Analyzing Parrondo’s Paradox Phenomenon** Jan 2020 - Sep 2021

Singapore University of Technology and Design, Advisor: Assistant Professor [Kang Hao Cheong](#)

- Explored the counterintuitive phenomena in (a) the evolution of bacteriophages, (b) the intercellular competition in multicellular organisms, (c) the prey dormancy of predator-prey systems, and (d) the implementation of different strategies under the epidemic of COVID-19 – attributed to Parrondo’s paradox.
- Reviewed the development and progress of fractal characteristics in the network systematically, including network covering, various concepts of dimensions, and their real-world applications.

**Finding Important Properties of Nodes and Communities in Complex Networks** June - Sep 2019

University of Electronic Science and Technology of China, Advisor: Professor [Yong Deng](#)

- Combined the internal and external factors of communities to measure each community's vulnerability and improved the recognition accuracy in real-world network applications via the entropy-based method.
- Collected the personal opinion of each expert by 2-order additive fuzzy measure and identified the most important expert after constructing the expert network based on their relationships, thereby solving group decision-making problems without sufficient information.

	<b>Exploring the Properties of Networks by Different Dimensions</b>	May 2016 - June 2019
	Northwestern Polytechnical University, Advisor: Professor <u>Wen Jiang</u> & <u>Yong Deng</u>	
	<ul style="list-style-type: none"> <li>▪ Promoted information dimension and Rényi dimension into weighted complex networks and explored complex networks' fractal and self-similarity properties.</li> <li>▪ Developed several recognition models based on the dimension of the network to solve practical problems, such as measuring the complexity and vulnerability of airline networks and identifying the similarity and importance of individuals.</li> </ul>	
	<b>Evaluating Vulnerability of Networks Based on Fuzzy Fractal Dimension</b>	May 2017 - May 2018
	Team Leader, National Undergraduate Training Programs for Innovation and Entrepreneurship ( ¥20, 000)	
	<b>An Autonomous Landing Scheme for Cargo Drone Based on Computer Vision</b>	May 2017 - May 2018
	Researcher, National Undergraduate Training Programs for Innovation and Entrepreneurship ( ¥20, 000)	
	<b>Exploring the Composition and Future Scalability of Smart House</b>	Jan - Feb 2019
	Australian National University, Summer Session Course Project	
TALKS AND POSTERS	<ul style="list-style-type: none"> <li>▪ Talk at 5<sup>th</sup> China and UK Forum of International Young Scholars in Manchester, Manchester, UK. 2023</li> <li>▪ Poster at Postgraduate Summer Research Showcase, UoM, Manchester, UK. 2023</li> <li>▪ Talk and Poster at Advances in Data Science and AI Conference, Manchester, UK. 2023</li> <li>▪ Talk at Brown Bag Seminar on Fintech &amp; Digital Transformation, UoM, Manchester, UK. 2023</li> <li>▪ Talk at International Postgraduate Interdisciplinary Forum on Smart Shipping and Green Future, Shanghai Jiao Tong University (Online), Shanghai, China. 2022</li> <li>▪ Talk at 4<sup>th</sup> China and UK Forum of International Young Scholars in Manchester, Manchester, UK. 2022</li> <li>▪ Talk at 26<sup>th</sup> International Conference on Multiple Criteria Decision Making, Portsmouth, UK. 2022</li> <li>▪ Talk at Oberseminar Dynamics Seminar, Technical University of Munich (Online), Munich, Germany. 2021</li> <li>▪ Talk at 9<sup>th</sup> China Information Fusion Conference, Taiyuan, China. 2019</li> <li>▪ Talk at Ao Xiang Students Lecture, NWPU, Xi'an, China. 2019</li> </ul>	
ACADEMIC SERVICE	<ul style="list-style-type: none"> <li>▪ Special Issue Editor on <i>Mathematics</i> (Data-driven Decision Making: Models, Methods and Applications).</li> <li>▪ Independent reviewer: <i>Communications Physics</i>, <i>Chaos: An Interdisciplinary Journal of Nonlinear Science, Humanities &amp; Social Sciences Communications</i>, <i>IEEE Transactions on Signal and Information Processing over Networks</i>, <i>International Journal of Intelligent Systems</i>, <i>Journal of Computational Science</i>, <i>Mathematics</i>, <i>Physica A: Statistical Mechanics and Its Applications</i>, <i>Reliability Engineering &amp; System Safety</i>, <i>Scientific Reports</i>, <i>Sensors</i>, ...</li> </ul>	
TEACHING EXPERIENCE	<ul style="list-style-type: none"> <li>▪ <b>Teaching Assistant</b>   SOST71032, Statistical Models for Social Networks, UoM. 2023</li> <li>▪ <b>Teaching Assistant</b>   BMAN73701, Programming in Python for Business Analytics, UoM. 2022</li> <li>▪ <b>Teaching Assistant</b>   10.018, Modelling Space and Systems, SUTD. 2020</li> </ul>	
SOCIAL ACTIVITIES	<ul style="list-style-type: none"> <li>▪ <b>Volunteer</b>   International Conference on Intelligent Unmanned Systems 2018</li> <li>▪ <b>Volunteer</b>   Northwestern Polytechnical University 80th Anniversary 2018</li> </ul>	
SKILLS	<p>Technology: Python, MATLAB, R language, C language, LaTeX, Gephi, Origin, UCINET, MPNet.</p> <p>Languages: Mandarin, English.</p>	

## REFERENCES

### **Prof. Dr. Yu-Wang Chen**

Alliance Manchester Business School  
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### **Associate Prof. Dr. Kang Hao Cheong**

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### **Prof. Dr. Yong Deng**

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### **Prof. Dr. Wen Jiang**

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Northwestern Polytechnical University  
Xi'an, Shaanxi, P. R. China

✉ [jiangwen@nwpu.edu.cn](mailto:jiangwen@nwpu.edu.cn)

2024

- [1] **Tao Wen**, Yu-wang Chen\*, Tahir Abbas Syed, Ting Wu. “ERIUE: Evidential Reasoning-based Influential Users Evaluation in Social Networks,” *Omega*. vol. 122, p. 102945, 2024. (Grade 3 journal in ABS list)

2023

- [2] **Tao Wen**, Jinde Cao, Kang Hao Cheong\*. “Gravity-based Community Vulnerability Evaluation Model in Social Networks: GBCVE,” *IEEE Transactions on Cybernetics*. vol. 53, no. 4, pp. 2467-2479, 2023. (Grade 3 journal in ABS list)
- [3] **Tao Wen**, Joel Weijia Lai, Kang Hao Cheong\*. “Switching between two losing stocks may enable paradoxical win: an empirical analysis,” *Fractals*. vol. 31, no. 10, p. 234001, 2023.
- [4] Chao Wang, Songjie Li, Miao Shi, Jie Zhao, **Tao Wen**, U. Rajendra Acharya, Neng-gang Xie\*, Kang Hao Cheong\*. “Multi-objective squirrel search algorithm for EEG feature selection,” *Journal of Computational Science*. vol. 73, p. 102140, 2023.

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- [5] **Tao Wen**, Kang Hao Cheong\*, Joel Weijia Lai, Jin Ming Koh, Eugene V. Koonin. “Extending the lifespan of multicellular organisms via periodic or stochastic intercellular competition,” *Physical Review Letters*. vol. 128, p. 218101, 2022. (**The Highest Impact Letter in Physics**)
- [6] Kang Hao Cheong\*†, **Tao Wen**†, Sean Benler, Jin Ming Koh, Eugene V. Koonin\*. “Alternating lysis and lysogeny is a winning strategy in bacteriophages due to Parrondo's Paradox,” *Proceedings of the National Academy of Sciences*. vol. 119, p. e2115145119, 2022.
- [7] **Tao Wen**, Qiuya Gao, Yu-wang Chen, Kang Hao Cheong\*. “Exploring the Vulnerability of Logistics Networks by Entropy: An Asia-Europe Maritime Transportation Network Case Study,” *Reliability Engineering & System Safety*. vol. 226, p. 108578, 2022. (Grade 3 journal in ABS list)
- [8] **Tao Wen**, Qiuya Gao, Tamás Kalmár-Nagy, Yong Deng\*, Kang Hao Cheong\*. “A Review of Predator-Prey Systems with Dormancy of Predators,” *Nonlinear Dynamics*. vol. 107, pp. 3271-3289, 2022.
- [9] **Tao Wen**, Huiling Chen, Kang Hao Cheong\*. “Visibility Graph for Time Series Prediction and Image Classification: A Review,” *Nonlinear Dynamics*. vol. 110, pp. 2979-2999, 2022.
- [10] Jie Zhao, **Tao Wen**, Hadi Jahanshahi, Kang Hao Cheong\*. “The random walk-based gravity model to identify influential nodes in complex networks,” *Information Sciences*. vol. 609, pp. 1706-1720, 2022.
- [11] Qiuya Gao, **Tao Wen**, Yong Deng\*. “A Novel Network-based and Divergence-based Time Series Forecasting Method,” *Information Sciences*. vol. 612, pp. 553-562, 2022.

2021

- [12] **Tao Wen**, Kang Hao Cheong\*. “The Fractal Dimension of Complex Networks: A Review,” *Information Fusion*. vol. 73, pp. 87-102, 2021. (**ESI Highly Cited Paper**)
- [13] **Tao Wen**, Eugene V. Koonin, Kang Hao Cheong\*. “An alternating active-dormitive strategy enables disadvantaged prey to outcompete the perennially active prey through Parrondo's paradox,” *BMC Biology*. vol. 19, p. 168, 2021.
- [14] Qiuya Gao, **Tao Wen**, Yong Deng\*. “Information Volume Fractal Dimension”. *Fractals*. vol. 29, p. 2150263, 2021. (**ESI Hot Paper & ESI Highly Cited Paper**)
- [15] Yayun Dai, Guangjie Zhan, Ye Ye, Wei Bao, **Tao Wen**, Kang Hao Cheong\*, Nenggang Xie\*. “Game dynamics of emotion evolution based on the Moran process,” *Chaos: An Interdisciplinary Journal of Nonlinear Science*. vol. 31, p. 033153, 2021.
- [16] 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. “Automatic COVID-19 detection using exemplar hybrid deep features with X-ray images,” *International Journal of Environmental Research and Public Health*. vol. 18, p. 8052, 2021.

2020

- [17] Kang Hao Cheong\*, **Tao Wen**, Joel Weijia Lai. “Relieving cost of epidemic by Parrondo's paradox: A COVID-19 case study,” *Advanced Science*. vol. 7, p. 2002324, 2020. [[Press](#)]
- [18] **Tao Wen**, Danilo Pelus, Yong Deng\*. “Vital Spreaders Identification in Complex Networks with Multi-Local Dimension,” *Knowledge-Based Systems*. vol. 195, p. 105717, 2020.
- [19] **Tao Wen**, Yong Deng\*. “The vulnerability of community structure in complex networks: An entropy approach,” *Reliability Engineering & System Safety*. vol. 196, p. 106782, 2020. (**ESI Highly Cited Paper**, Grade 3 journal in ABS list)
- [20] **Tao Wen**, Yong Deng\*. “Identification of influencers in complex network by local information dimensionality,” *Information Sciences*. vol. 512, pp. 549-562, 2020. (**ESI Highly Cited Paper**)

#### 2019

- [21] **Tao Wen**, Shuyu Duan, Wen Jiang\*. “Node similarity measuring in complex networks with relative entropy,” *Communications in Nonlinear Science and Numerical Simulation*. vol. 78, p. 104867, 2019.
- [22] **Tao Wen**, Wen Jiang\*. “Identifying influential nodes based on fuzzy local dimension in complex networks,” *Chaos, Solitons & Fractals*, vol. 119, pp. 332-342, 2019.
- [23] **Tao Wen**, Wen Jiang\*. “Measuring the complexity of complex network by Tsallis entropy,” *Physica A: Statistical Mechanics and Its Applications*. vol. 526, p. 121054, 2019.
- [24] Shuyu Duan, **Tao Wen**, Wen Jiang\*. “A new information dimension of complex network based on Rényi entropy,” *Physica A: Statistical Mechanics and Its Applications*, vol. 516, pp. 529–542, 2019.

#### 2018

- [25] **Tao Wen**, Moxian Song, Wen Jiang\*. “Evaluating topological vulnerability based on fuzzy fractal dimension,” *International Journal of Fuzzy Systems*, vol. 20, pp. 1956–1967, 2018.
- [26] **Tao Wen**, Wen Jiang\*. “An information dimension of weighted complex networks,” *Physica A: Statistical Mechanics and Its Applications*, vol. 501, pp. 388 – 399, 2018.

#### Conference paper

- [27] Yu-wang Chen\*, **Tao Wen**. “Analysing communication network structure and dynamics in an organizational hierarchy,” *23rd Conference of the International Federation of Operational Research Societies*. Santiago, Chile, July 2023. (Abstract)
- [28] **Tao Wen**, Yu-wang Chen\*, Tahir Abbas Syed. “Analyzing Communication Patterns and Dynamics in an Organizational Hierarchy through Social Network Analysis,” *Advances in Data Science and AI Conference 2023*. Manchester, UK, June 2023. (Abstract)
- [29] **Tao Wen**, Yu-wang Chen\*, Tahir Abbas Syed. “Ranking Influential Users in Social Networks by the Evidential Reasoning Algorithm,” *26th International Conference on Multiple Criteria Decision Making (MCDM2022)*. Portsmouth, UK, June 2022. (Abstract)
- [30] **Tao Wen**, Shuyu Duan, Wen Jiang\*. “Forecasting time series based on visibility graph and relative entropy,” *The Ninth Chinese Information Fusion Conference*, Taiyuan, China, Oct. 2019. (In Chinese)
- [31] Shuyu Duan, **Tao Wen**, Xinyang Deng, Wen Jiang\*. “Identifying influential nodes based on Tsallis entropy and information dimension,” *The Ninth Chinese Information Fusion Conference*, Taiyuan, China, Oct. 2019. (In Chinese)
- [32] Shuai Xu, Zichang He, **Tao Wen**, Wen Jiang\*. “A Physarum-inspired Model for the Path Planning of Uninhabited Combat Air Vehicle,” *The Eighth Chinese Information Fusion Conference*, Xi'an, China, July 2018. (In Chinese)

#### Paper submitted to Journal

- [33] **Tao Wen**, Eugene V. Koonin, Kang Hao Cheong\*. “Bending the Rules of Coevolution: How Flexible Parasites Can Outsmart Their Hosts for Evolutionary Dominance,” *TBD*.
- [34] **Tao Wen**, Yu-wang Chen\*, Tahir Abbas Syed, Darminder Ghataoura. “Examining communication network structure and dynamics in an organizational hierarchy: A social network analysis approach,” *TBD*.

- [35] **Tao Wen**<sup>†</sup>, Rui Zheng<sup>†</sup>, Yu-wang Chen<sup>\*</sup>, Tahir Abbas Syed, Darminder Ghataoura. “From belief to decision dynamics in social networks: A review,” *TBD*.
- [36] Zeyi Liu<sup>†</sup>, **Tao Wen**<sup>†</sup>, Yong Deng<sup>\*</sup>, Hamido Fujita. “Cooperation-guided Experts Importance Identification Model with Fuzzy Framework: A Network Design,” *TBD*.
- [37] Tony Mathew Abraham, **Tao Wen**, Yu-wang Chen<sup>\*</sup>. “Leveraging Data Analytics to Tackle Fake News and Deepfakes in Social Networks,” *TBD*.
- [38] Ankit Mishra, **Tao Wen**, Kang Hao Cheong<sup>\*</sup>. “Enhancing Network Communication with Brownian-Inspired Game Theory,” *TBD*.
- [39] Ankit Mishra, **Tao Wen**, Kang Hao Cheong<sup>\*</sup>. “Efficient Traffic Management in Networks with Limited Resources: The Switching Routing Strategy,” *TBD*.
- [40] Qiuya Gao, **Tao Wen**, Xiangfeng Dai, Mengge Chai, Kang Hao Cheong<sup>\*</sup>, Zhen Wang<sup>\*</sup>. “Measuring Similar Nodes in Complex Networks based on Gravity Model,” *TBD*.
- [41] Kang Hao Cheong<sup>\*</sup>, Michael C. Jones, **Tao Wen**. “‘Governing’ the ungovernable: When will we learn?” *TBD*.

Last updated: July 1, 2023