Yiming Huang

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EDUCATION

University of Electronic Science and Technology of China   Chengdu, China
Master of Computer Science and Technology   *Sep. 2021 – Jun. 2024*

- GPA: **3.8** / 4.0
- Research with **Prof. Linyuan Lü**
- Core Courses: Graph Theory and its Application (98), Algorithmic Game Theory (93), Matrix Theory et al.

Nanjing University of Information Science & Technology   Nanjing, China
Bachelor of Computer Science and Technology   *Sep. 2017 – Jun. 2021*

- GPA: **4.1** / 5.0
- Research with **Prof. Zhiguo Qu**
- Core Courses: Data Structure (100), Object-oriented Programming (98), Linear Algebra (97), Discrete Mathematics (97), Analytic Geometry (96), University Physics (95), Probability and Statistics (93) et al.

RESEARCH PRESENTATIONS

[1] Higher-order Graph Convolutional Network with Flower-Petals Laplacians on Simplicial Complexes
Yiming Huang, Yujie Zeng, Qiang Wu and Linyuan Lü   *Submitted to NeurIPS2023*

[2] Identifying key players in complex networks via network entanglement
Yiming Huang, Hao Wang, Xiao-Long Ren, and Linyuan Lü   *Under Review*

[3] A Novel Coherence-based Quantum Steganalysis Protocol
Zhiguo Qu, Yiming Huang, Min Zheng (Student first author)   *Quantum Inf. Process.*

[4] Cooperative Network Learning for a Large-Scale and Decentralized Graph
Qiang Wu, Yiming Huang, Yujie Zeng, Yijie Teng, Fang Zhou, and Linyuan Lü (Student first author)   *Under Review*

[5] Influential Simplices Mining via Simplicial Convolutional Network
Yujie Zeng, Yiming Huang, Qiang Wu and Linyuan Lü (Joint first author)   *preprint arXiv:2307.05841*

[6] Identifying vital nodes through augmented random walks on higher-order networks
Yujie Zeng, Yiming Huang, Xiao-Long Ren and Linyuan Lü   *preprint arXiv:2305.06898*

[7] Graph Machine Learning (Chinese Book)
Linyuan Lü, Qiang Wu, Yiming Huang, Yujie Zeng (Subeditor)   *Collaborate with Prof. Jure Leskovec*

RESEARCH EXPERIENCE

Higher-order GCN with Flower-Petals Laplacian   Jul. 2022 – Present
Aim: integrate higher-order networks into geometric and topological deep learning   *USTC, Hefei*

- It has been presented at the **NetSci2023** conference in oral and is under review in *NeurIPS2023*.
- Proposed a higher-order graph convolutional network (HiGCN), which achieves SOTA in various graph learning tasks.
- Quantified the influence of higher-order structures in the network by the filter weight of HiGCN.
- Explored the impact of higher-order GNNs on sociological tasks, such as identifying influential research communities (simplices).
- Extended HiGCN to cell complexes, a more general scenario, and distinguish the impact of different higher-order structures, such as simplex and cell, on graph learning.

Cooperative Network Learning for a Large-Scale and Decentralized Graph   Aug. 2022 – Jun. 2023
Aim: establish a multi-party trusted, decentralized, and privacy-preserving graph learning framework.   *UESTC, Chengdu*

- Published a monograph - Graph Machine Learning (Chinese), and the latest research is under review in *Nat. Commun.*

- Introduced a Cooperative Network Learning (CNL) framework, which unifies the formulation of graph models with distributed data for various agencies.
- Utilized homomorphic encryption and relevant technologies to ensure data security of inter-organizational computing.
- Demonstrated the effectiveness, reliability, and security of CNL on multi-party graph learning tasks through various graph learning tasks, including contagion dynamics prediction, node classification, and link prediction.

Identifying Key Players in Complex Networks via Network Entanglement   Sep. 2021 – Jul. 2022
Aim: incorporate quantum information theory and design a metric to capture global topological properties.   *UESTC-YDRI, Huzhou*
- It has been presented at the **NetSci2022** conference in oral and is under review in *Commum. Phys.*
- Proposed a novel method - vertex entanglement (VE) - to identify key players in networks, which quantifies the effect of local perturbations on entropy and is found to be strongly related to network robustness and functional diversity.
- Demonstrated the effectiveness of VE in network dismantling tasks with numerical experiments.
- Detected topological discrepancies in functional brain networks between ASD patients and typical controls with VE.

HoRW: Augmented Random Walks on Higher-order Networks   Sep. 2021 – Jul. 2022
Aim: propose a higher-order structure-based model to address the shortcomings of the traditional models.   *UESTC-YDRI, Huzhou*
- This work has been oral presented at the **NetSci2022** conference.
- Proposed a novel high-order representation and higher-order random walk (HoRW) model.
- Presented a novel HoRW-based influencer identification strategy that allows multiscale analysis according to the strength of higher-order effects.
- Demonstrated HoRW's effectiveness in epidemic spreading and network dismantling experiments.

Quantum Computation and Quantum Steganalysis   Sep. 2019 – Sep. 2020
Aim: introduce an effective quantum steganalysis protocol.   *NUIST, Nanjing*
- This work has been published in **Quantum Inf. Process.**
- Proposed a novel coherence-based quantum steganalysis protocol, which adheres to the fundamental fact that classical steganography tends to change the probability distribution of the carrier, and the physical properties that the unknown quantum state discrimination process is sensitive to the distribution in quantum state discrimination.
- Conducted the quantum steganalysis and performance evaluation targeting a famous quantum steganography protocol - BB84 - in detail.

AWARDS & HONORS

Awards: **1** international awards, more than **10** provincial and above awards; **6** patents; **1** national research projects.

Honor Graduate (Top 10%)	*2021*
Mathematical Contest In Modeling (MCM) - Finalist (Top 1%)	*2020*
National Training Program of Innovation and Entrepreneurship for Undergraduates - PI	*2020*
China Software and Information Technology "Blue Bridge Cup" Design Competition - Second Prize	*2020*
China Undergraduate Mathematical Contest in Modeling - Second Prize	*2019*
Academic Scholarship of Master Degree student, Bachelor Degree students - First-Class (Top 10%)	*2017-2022*

SKILLS & INTERESTS

Programming Languages: proficient with Python, MatLab, C, C++, Java; using Illustrator, Gephi, SPASS.
Languages: Mandarin (native), English (native).
Strong Learning Ability: used to learn a new programming language and develop software in a week; used to spend three days in a mathematical modeling competition doing algorithm writing and paper writing in a new knowledge field.
Interests: running, badminton, drawing, board games.

SLECTED COURSES

Probability Theory (xx)	Probability Theory (xx)	Probability Theory (xx)
Probability Theory (xx)	Probability Theory (xx)	Probability Theory (xx)

RESEARCH EXPERIENCE OLD

Higher-order GCN with Flower-Petals Laplacian
Jul. 2022 – Present

Aim: analyze the influence of high-order structure on network structure and function by using machine learning.   *Co-researcher*

- This work will be posted at the **NetSci2023** conference.
- Propose a higher-order graph convolutional network (HiGCN) which achieves SOTA in traditional machine learning tasks.
- Quantify the influence of higher-order structures in the network by the weight of HiGCN.
- Explore the impact of HiGCN on sociological tasks, such as finding important research communities (simplices).

HoRW: Augmented Random Walks on Higher-order Networks
Sep. 2021 – Jul. 2022

Aim: propose a model using higher-order structure to solve the shortcomings of the traditional models.   *Independent-researcher*

- This work has been posted at the **NetSci2022** conference.
- Propose a novel representation and model HoRW based on Higher-order Random Walk for high-order networks.
- Present a novel node ranking method based on HoRW that allows multiscale analysis according to the strength of higher-order effects.
- Demonstrate HoRW's effectiveness in vital node identification, along with significant performance gains in epidemic spreading and network dismantling experiments.

Hyper-null Models through Hyperedge Swapping and Their Applications
Sep. 2021 – Jun. 2023

Aim: explore the relationship between network dynamics and randomness by constructing null models.   *Independent-researcher*

- Define the construction of hyper-null models through hyperedge swapping.
- Verify the relationship between network structure and function and null models of different orders by epidemic spreading and network dismantling.
- Statistic the indicators of high-order networks (simplicial complexes and hypergraphs) and write a review.

Cooperative Network Learning for a Large-Scale and Decentralized Graph
Oct. 2022 – Jun. 2023

Aim: build a multi-party trusted, decentralized graph neural network platform.   *Co-researcher*

- Write a multi-party trusted graph neural network platform by Python.
- Verify the reliability and effectiveness of the model on the generative network by some traditional graph tasks.