Kaichen Ouyang

Email: oykc@mail.ustc.edu.cn | Homepage: https://oykc1234.github.io/

Education Background

2020.09 – 2024.06   **University of Science and Technology of China**   **China**
- Degree: Bachelor
- Major: Mathematics and Applied Mathematics, GPA 82.04/100, Talents Class

2024.09 – 2027.06(Expected)   **University of Science and Technology of China**   **China**
- Degree: Master
- Major: Physics

Research Interests: AI & Dynamical Systems

• **Dynamical Systems of AI:** Understanding AI through the lens of dynamical systems, including analyzing training dynamics of optimizers such as SGD and Adam, as well as interpreting training dynamics from the perspectives of statistical physics and neural evolution.

• **Dynamical Systems for AI:** Designing AI algorithms inspired by real-world dynamical systems, such as evolutionary computation, swarm intelligence, diffusion models, and flow matching.

• **AI for Dynamical Systems:** Solving complex dynamical system problems with AI, including simulation, prediction, and optimization (e.g., graph neural networks, physics-informed neural networks, physics-informed evolution, and more).

Publications

- Ouyang, K., et al *Learn from Global Correlations: Enhancing Evolutionary Algorithm via Spectral GNN* AAAI 2026,Poster--**First Author**
- Ouyang, K., et al *Wasserstein Evolution: Evolutionary Optimization as Phase Transition*, IJCAI 2026,Under review--**First Author**
- Ouyang, K., et al *Physics-Informed Evolution: An Evolutionary Framework for Solving Quantum Control Problems Involving the Schrödinger Equation*, PPSN 2026,Under review--**First Author**
- Ouyang, K., et al *Consciousness as a Jamming Phase* (Arxiv)-- ICLR 2027,In Progress--**First Author**
- Ouyang, K., et al *Rethinking Over-Smoothing in Graph Neural Networks: A Perspective from Anderson Localization* (Arxiv)--ICLR 2027,In Progress--**First Author**
- Ouyang, K., et al *Graph Learning Metallic Glass Discovery from Wikipedia* AI for Science--**First Author**
- Ouyang, K., et al. *Dynamic Graph Neural Evolution:An Evolutionary Framework Integrating Graph Neural Networks with Adaptive Filtering.* 2025 IEEE Congress on Evolutionary Computation (CEC 2025),Oral--**First Author**
- Ouyang, K.,et al. *Escape: an optimization method based on crowd evacuation behaviors.* Artificial Intelligence Review. (JCR Q1, IF:13.9)--**First Author**
- Ouyang, K., et al *Beaver Behavior Optimizer: A Novel Metaheuristic Algorithm for Solar PV Parameter Identification and Engineering Problems* Journal of Advanced Research (JCR Q1, IF:13.0)--**First Author**
- Ouyang, K., et al *Multi-objective Red-billed Blue Magpie Optimizer: A Novel Algorithm for Multi-objective*

- *UAV Path Planning* Results in Engineering (JCR Q1, IF:7.9), **--First Author**
- Ouyang, K., et al *Newton Downhill Optimizer for Global Optimization with Application to Breast Cancer Feature Selection* Biomedical Signal Processing and Control (JCR Q2, IF:4.9)**--Corresponding Author**
- Ouyang, K.,et al. *Multiple Objectives Escaping Bird Search Optimization and Its application in Stock Market Prediction Based on Transformer Model*. Scientific Reports. (JCR Q1, IF:3.9)**--Corresponding Author**
- Ouyang, K.,et al. *A Comprehensive Analysis of Digital Inclusive Finance's Influence on High Quality Enterprise Development through Fixed Effects and Deep Learning Frameworks*. Scientific Reports. (JCR Q1, IF:3.9)--**Corresponding Author**
- Ouyang, K., et al *A Generative Adversarial Network Based Investor Sentiment Indicator: Superior Predictability for the Stock Market* Mathematics (JCR Q1, IF:2.2)--**Corresponding Author**
- Ouyang, K.,et al *Multi-strategy improved dung beetle algorithm and its applications in engineering optimization and bankruptcy prediction* Neural Networks (JCR Q1,IF:6.3), *Under review*--**Corresponding Author**
- Ouyang, K., et al *Stochastic Gradient-guided Adaptive Differential Evolution: Algorithm and Its Application in the Diagnosis of COVID-19, Influenza, and Bacterial Pneumonia* Artificial Intelligence In Medicine (JCR Q1, IF:6.1), *Under review*--**First Author**
- Ouyang, K., et al *Trend-Aware Mechanism for metaheuristic algorithms* Applied Soft Computing (JCR Q1, IF:6.6)--**Second Author**
- Ouyang, K., et al *MLLMs-MR: Multi-modal Recognition based on Multi-modal Large Language Models* Knowledge-Based Systems.(JCR Q1, IF: 7.2)-**Second Author**
- Ouyang, K *A novel plug-and-play meta-black-box optimization module based on video streams for non-contact physiological signal extraction* **S**warm and Evolutionary Computation(JCR Q1,IF:8.0)-**Co Author**
- Ouyang, K *FLNM-Net: A Frequency-Adaptive and Luminance-Noise Aware Mask Network for rPPG Signal Extraction from Video* Pattern Recognition(JCR Q1,IF:7.6)-**Co Author**
- Ouyang, K., et al. *Study of nonequilibrium phase transitions mechanisms in exclusive network and node model of heterogeneous assignment based on real experimental data of KIF3AC and KIF3CC motors.* European Physical Journal Plus. (JCR Q2, IF:2.8)-**Co Author**
- Ouyang, K., et al. *Physical mechanisms of exit dynamics in microchannels of nonequilibrium transport systems*. International Journal of Modern Physics B. (JCR Q2, IF:2.6)-**Co Author**
- Ouyang, K.,et al *Twisted Convolutional Networks (TCNs): Enhancing Feature Interactions for Non-Spatial Data Classification* Neural Networks (JCR Q1,IF:6.3)-**Co Author**
- Ouyang, K *Wave Optics Optimizer: A novel meta-heuristic algorithm for engineering optimization* Communications In Nonlinear Science And Numerical Simulation(JCR Q1,IF:3.8)-**Co Author**

Research Experience

Non-equilibrium Statistical Physics & Complex Networks
Research Assistant at USTC   2021.3 – 2022.9
Advisor: Prof. Binhong Wang

Evolutionary Algorithms & Machine Learning
Research Assistant at Wenzhou University   2021.9 – Present
Advisor: Prof. Huiling Chen

Statistical Physics & Artificial Intelligence
Master Student at USTC   2023.5 – Present

Advisor: Prof. Hua Tong

Deep Neural Network-Based Control of Quantum Uncertain Systems
University Innovation Project at USTC   2023.3 – 2024.6
Advisor: Prof. Sen Kuang

Discovery of Metallic Glasses Driven by Large Language Models and Graph Neural Networks
University Innovation Project at Songshan Lake Materials Laboratory   2024.2 – 2024.9
Advisor: Prof. Yuanchao Hu

Surrogate-Driven Multi-Objective Evolutionary Design of Battery Phase Change Materials
Cooperation Project at USTC   2025.5 – Present
Advisor: Prof. Qiangling Duan

Conference Experience

- 5th Amorphous Physics and Materials Symposium 2024, Attendee
- IEEE Congress on Evolutionary Computation (CEC) 2025, Oral Presentation

Teaching Assistant Experience

- 2022, Mathematical Analysis B1, Teaching Assistant
- 2024, Mathematical Modeling, Teaching Assistant

Reviewer Experience

- 2024,Swarm and Evolutionary Computation (JCR Q1, IF: 8.2), Reviewer
- 2025,Knowledge-Based Systems,(JCR Q1, IF: 7.2), Reviewer
- 2025,International Joint Conference on Neural Networks (IJCNN),Reviewer
- 2025,International Conference on Intelligent Computing (ICIC),Reviewer
- 2025,AAAI 2026,Reviewer
- 2025,Computers and Electrical Engineering (JCR Q1, IF: 4.9), Reviewer
- 2025,International Journal of Computational Intelligence Systems (JCR Q2, IF: 3.116), Reviewer
- 2025,Information Sciences (JCR Q1, IF: 6.8), Reviewer
- 2025,Neurocomputing (JCR Q1, IF: 6.5), Reviewer
- 2025,Scientific Reports (JCR Q1, IF: 3.9), Reviewer
- 2025,Engineering Reports (JCR Q2, IF: 2.0), Reviewer
- 2025,Biomedical Signal Processing and Control (JCR Q2, IF: 4.9), Reviewer
- 2025,Engineering Computations (JCR Q2, IF: 1.9), Reviewer
- 2025,Cluster Computing (JCR Q1, IF: 4.1), Reviewer
- 2025,Control and Decision (Chinese Core Journals, IF:3.012), Reviewer
- 2025,ISPRS Journal of Photogrammetry and Remote Sensing(JCR Q1, IF: 12.2), Reviewer
- 2025,Results in Engineering(JCR Q1, IF: 7.9), Reviewer
- 2025,Smart Agricultural Technology(JCR Q1, IF: 5.7), Reviewer
- 2025,Optik, Reviewer
- 2025,Advanced Engineering Informatics(JCR Q1, IF: 9.9), Reviewer
- 2026, IEEE WCCI 2026, Reviewer

Honours

- 2024, Second Prize(Honorable Mention), MCM/ICM
- 2023, First Prize (Meritorious), Huashu Cup International Mathematical Contest in Modeling
- 2023, First Prize,National College Students' Mathematics Competition
- 2022, International Second Prize, Asia-Pacific Mathematical Modeling Competition
- 2020-2021, Outstanding Student Gold Award, University of Science and Technology of China

Skills

- **Language skills**: Chinese (Native), English (IELTS:7.0/9.0)
- **Computer Skills**: Microsoft Office 365, Python, MATLAB, MySQL, Java,C/C++,Lammps