

Kaichen Ouyang

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Education Background

2020.09 – 2024.06	University of Science and Technology of China	China
<ul style="list-style-type: none">Degree: BachelorMajor: Mathematics and Applied MathematicsGPA 82.04/100 IELTS:7.0/9.0		
2024.09 – 2027.06(Expected)	University of Science and Technology of China	China
<ul style="list-style-type: none">Degree: MasterMajor: PhysicsHomepage: https://oykc1234.github.io/		

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* The Fortieth AAAI Conference on Artificial Intelligence (AAAI 2026),Poster--**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 *Graph Learning Metallic Glass Discovery from Wikipedia* AI for Science--**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 *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* Swarm and Evolutionary Computation(JCR Q1,IF:8.0)-**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**

Preprints and Works under review

- 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 *Wasserstein Evolution: Evolutionary Optimization as Phase Transition*, IJCAI 2026,*Under review*--**First Author**
- Ouyang, K., et al *Rethinking Over-Smoothing in Graph Neural Networks: A Perspective from Anderson Localization* (Arxiv)--**Sole First Author**
- Ouyang, K., et al *Consciousness as a Jamming Phase* (Arxiv)--**Sole First Author**
- Ouyang, K., et al *Why Flow Matching is Particle Swarm Optimization?* (Arxiv)--**Sole First Author**
- Ouyang, K., et al *Multi-Objective Mobile Damped Wave Algorithm (MOMDWA): A Novel Approach For Quantum System Control* (Arxiv)--**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 *IKUN: A mean-field game theoretic KD-tree density guided mechanism for swarm optimization* Swarm and Evolutionary Computation (JCR Q1,IF:8.5), *Under review*-**Co Author**

Research Experience

- 2025.5 - Present, Data-Driven Multi-Objective Evolutionary Design of Battery Liquid Cooling Materials, USTC, RA
- 2024.2 - Present, Graph Neural Networks & Material Science, Songshan Lake Materials Laboratory, RA
- 2023.9 - 2024.4, Deep Neural Network-Based Control of Quantum Uncertain Systems, USTC, University Innovation Project
- 2023.5 - 2024.6, Intersection of Non-equilibrium Statistical Physics & Machine Learning, USTC, RA
- 2021.9 - Present, Evolutionary Algorithms & Machine Learning, Wenzhou University, RA
- 2021.3 - 2022.9, Non-equilibrium Statistical Physics & Complex Networks, USTC, RA

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 (Fluent)
- **Computer Skills:** Microsoft Office 365, Python, MATLAB, MySQL, Java, C/C++, Lammmps