# Ruijie **Yao**

## Summary

Machine Learning Researcher / Engineer working on LLM-driven multimodal AI systems for sensing and healthcare. Experienced in deploying vision and time-series models in real-world environments. Published at European Conference on Computer Vision and Medical Image Analysis, with industry experience at SenseTime Research building production vision systems. Focused on applying AI to improve human health and building reliable systems that teams can deploy and scale.

## Contact details

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## Skills

**Languages:** Python, C++
**ML Frameworks:** PyTorch, MMCV
**ML Areas:** LLMs, Agent Systems, Computer Vision, Multimodal Learning, Time-Series Modeling
**Systems:** CUDA-enabled training, distributed training, edge inference
**Data:** large-scale dataset construction, annotation pipelines

## Service

Reviewer for CVPR, ECCV, AISTATS, WiCV, GRAIL.

## Publications

- Yao **R***, Jin S*, et al. UniFS: Universal Few-shot Instance Perception (Co-first author). *ECCV 2024*
- Yao **R** et al. GKGNet: Graph-based Multi-label Recognition (First author). *ECCV 2024*
- Zhang W, Yao **R**, et al. Predicting Diabetic Macular Edema Treatment Responses Using OCT. *Med. Image Anal. 2025*
- Liu S, Yao **R**, et al. Automated Diagnosis of Lumbar Spondylolisthesis from Spinal X-rays. *Heliyon 2024*
- Chen B, Yao **R**, et al. AI-Assisted High-Throughput Screening for Hydrogel Architectures. *Adv. Funct. Mater. 2022*

## Awards & Honors

- Duke Summit on AI for Health Innovation Scholarship **2025**
- Comprehensive Excellent Scholarship **2023**
- Tsinghua-Xuancheng Scholarship **2022**
- Champion of APTOS Big Data Competition (among 10,000+ teams) **2021**
- Runner-up, 4th Singapore Medical AI Data Marathon **2021**
- National Encouragement Scholarship **2020**
- Tsinghua - Mr. and Mrs. Huang Yicong Scholarship **2019**
- National Encouragement Scholarship **2018**

## Education

**Duke University**. PH.D., Mechanical engineering. NC, USA. *Jan 2025 – Present*

**Tsinghua University**. M.S., Electronic engineering. Beijing, China. *Sep 2021 – Jun 2024*

**Tsinghua University**. B.S., Electronic engineering. Beijing, China. *Sep 2017 – Jun 2021*

## Research & Industry Experience

- **APTOS Big Data Competition** *2021*
  Team Lead. Global
  - **Global Champion** among **10,000+ teams**. Led ML system for diabetic macular edema treatment prediction from OCT imaging.
  - Built deep learning models (CNN + transformer) for retinal biomarker detection and treatment continuation prediction.
  - Resulting work published in *Medical Image Analysis*; continues to attract industry interest in clinical AI.
- **Duke University** *2025 – Present*
  Research Assistant. Advisor: Prof. Xiaoyue Ni. Durham, NC
  - **LLM-ready IMU feature learning for behavioral sensing:** Developed TCNet, a lightweight neural model that corrects statistical IMU features under rotation and noise distortions. The system produces stable, interpretable motion representations designed for downstream reasoning by large language models (LLMs). Achieved SOTA on five public HAR benchmarks while preserving interpretable statistical features for clinical sensing.
  - **LLM-agent assistive system for ALS voice reconstruction:** Building a personalized voice reconstruction system that restores a patient's natural voice from limited pre-disease recordings. The system integrates neural speech synthesis with an LLM-based personal assistant agent, enabling ALS patients to communicate through an adaptive voice interface designed for assistive healthcare.
  - **Privacy-preserving wearable sensing for social interaction analysis:** Designed a body-conducted vibration sensing pipeline replacing microphones for privacy-preserving speech detection. Built IMU-based temporal models (MA-Net) to classify interaction patterns (solo/dyadic/group). Collected and processed 117.6 hours of real-world wearable data and achieved 0.86 weighted F1 in naturalistic environments. Deployed for Duke Hospital clinicians assessing communication willingness in cognitively impaired elders.
- **SenseTime Research** *Jun 2022 – Sep 2024*
  Computer Vision Research Intern. Advisor: Prof. Ping Luo; Manager: Sheng Jin. Beijing, China
  Global AI company specializing in computer vision.
  - **Multi-label image recognition (ECCV 2024, first author):** Developed GKGNet, a graph-based vision model for multi-label recognition linking semantic labels with image patches. Deployed as a core classifier within SenseTime production pipelines. Supports large-scale image understanding tasks in real-world vision systems.
  - **Unified few-shot instance perception (ECCV 2024, co-first author):** Designed UniFS, a universal few-shot framework that represents detection, segmentation, pose estimation, and counting through a unified point-based representation. The system simplified annotation workflows for SenseTime's internal labeling teams, enabling consistent annotation formats and large-scale training across tasks.
  - **Large-scale human attribute recognition (production system):** Built and trained human attribute recognition models for deployment in SenseTime products. Developed components within the MMCV-based production pipeline, providing reusable tooling adopted across multiple internal teams.
- **TowardPi Medical Technology** *Feb 2021 – Dec 2024*
  AI Algorithm Engineer Intern. Beijing, China
  Ophthalmic imaging company developing AI-enabled OCT diagnostic systems.
  - **AI development for clinical OCT systems:** Collaborated with the company's early AI team during the development of AI-enabled ophthalmic imaging products. Contributed algorithm design and technical guidance for OCT-based analysis, including retinal layer segmentation, anatomical structure detection, and disease classification.
  - **Long-term technical collaboration (2021–2024):** Maintained a multi-year partnership bridging academic research and industrial development, advising engineering teams on integrating recent research advances into product pipelines.
- **Tsinghua University** *2020 – 2024*
  Graduate Researcher. Advisor: Prof. Ji Wu. Beijing, China
  - **Clinical AI system for spinal X-ray diagnosis:** Led development of an end-to-end AI-assisted diagnosis platform for spinal radiography, covering standardized data collection, collaborative annotation workflows, cloud-based dataset management, and automated diagnosis tools. The system was deployed at **Peking University Third Hospital Orthopedics**, supporting large-scale dataset creation with **8,000+ annotated patient cases**.
  - **Automated vertebral analysis and diagnosis:** Built models for vertebral detection, segmentation, and disease classification, reducing average clinical diagnosis time from $\sim$20 minutes to $<$2 seconds. The system architecture supports extensible algorithms and resulted in 6 patents (first student inventor).