Zhengrui (David) Guo

zguobc@connect.ust.hk | +852 5761 0159 | Google Scholar | LinkedIn | Homepage

PhD in Computer Science and Engineering, Hong Kong University of Science and Technology

Research Profile

My research lies at the intersection of computational pathology and computational biology, with a focus on advancing cancer diagnosis and prognostic assessment to support clinical decision-making in precision oncology. I develop generalizable foundation models and multimodal AI systems that connect tissue morphology with molecular and clinical information at scale. I evaluate these systems in real-world settings through multi-institutional studies, prospective clinical validation, and human–AI studies in close collaboration with pathologists.

Education

Hong Kong University of Science and Technology (HKUST) — **Hong Kong SAR**
PhD in Computer Science and Engineering — *Aug 2022 – Aug 2026 (expected)*
Supervisor: **Prof. Hao Chen**.
Research focus: computational pathology, foundation models, and multimodal learning for precision oncology.

Harbin Institute of Technology (Weihai) — **Weihai, China**
BSc in Mathematics and Applied Mathematics — *Sep 2018 – Jun 2022*
GPA: **3.84/4.00**; ranked **1/120**.

Selected Research Contributions

1. **Generalizable and clinically validated pathology foundation models.** Co-developed **GPFM**, establishing a generalizable pathology foundation model that achieved state-of-the-art performance across a broad range of tasks. Developed **PulmoFoundation**, extending this direction to a subspecialty-specific foundation model for comprehensive lung pathology validated across multiple institutions, prospective cohorts, and real-world clinical settings.

   GPFM was published in *Nature Biomedical Engineering*; PulmoFoundation is currently under review.

2. **Overcoming computational and annotation bottlenecks in gigapixel pathology.** Developed **Querent**, enabling context-sensitive modeling of gigapixel images by adapting computation to diagnostic queries. Developed **FOCUS**, enabling effective whole-slide image classification when expert-labeled data are scarce.

   These works were published at ICML 2025 and CVPR 2025, respectively.

3. **Multimodal learning for pathology and biomedical science.** Developed **HistGen**, which generates diagnostic reports from gigapixel pathology images, and **BLEND**, which models neural population dynamics with guidance from behavioral information. Together, these works connect heterogeneous biomedical signals with complementary knowledge.

   These works were published at MICCAI 2024 and ICLR 2025, respectively.

Academic Leadership and Service

- **Program Chair**, MICCAI 2026 COMPAYL Workshop (COMputational PAthologY and multimodal data), Strasbourg, France.

  Coordinated reviewer recruitment and the OpenReview peer-review process, including review synthesis and decision support for the scientific program.
- **Program Chair**, MICCAI 2023 Myopic Maculopathy Analysis Challenge (MMAC), Vancouver, Canada.

  Contributed to proposal revision and evaluated shortlisted projects through interviews and scoring.

  Associated publication: B. Qian, ... **Zhengrui Guo**, et al. "A Competition for the Diagnosis of Myopic Maculopathy by Artificial Intelligence Algorithms." *JAMA Ophthalmology*, 142(11):1006–1015, 2024.
- **Research Mentorship**: Supervised junior PhD student and undergraduate students in research projects related to pathology foundation-model development and evaluation.
- **Reviewer**: NeurIPS 2025; ICLR 2026.

Publications

*Equal contribution.

First- and Co-first-author Peer-reviewed Publications

1. Jiabo Ma*, **Zhengrui Guo***, Fengtao Zhou, et al. "A Generalizable Pathology Foundation Model Using a Unified Knowledge Distillation Pretraining Framework." *Nature Biomedical Engineering*, 10:545–564, 2026.
2. **Zhengrui Guo**, Qichen Sun, Jiabo Ma, et al. "Context Matters: Query-aware Dynamic Long Sequence Modeling of Gigapixel Images." *International Conference on Machine Learning (ICML)*, PMLR 267:20941–20963, 2025.
3. **Zhengrui Guo**, Conghao Xiong, Jiabo Ma, et al. "FOCUS: Knowledge-enhanced Adaptive Visual Compression for Few-shot Whole Slide Image Classification." *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 15590–15600, 2025.
4. **Zhengrui Guo**, Fangxu Zhou, Wei Wu, et al. "BLEND: Behavior-guided Neural Population Dynamics Modeling via Privileged Knowledge Distillation." *International Conference on Learning Representations (ICLR)*, 2025.
5. **Zhengrui Guo**, Jiabo Ma, Yingxue Xu, et al. "HistGen: Histopathology Report Generation via Local-global Feature Encoding and Cross-modal Context Interaction." *International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI)*, LNCS 15004:189–199, 2024.
6. Cheng Jin*, **Zhengrui Guo***, Yi Lin, Luyang Luo, and Hao Chen. "Learning with Less Supervision: A Survey of Label-Efficient Learning for Medical Image Analysis." *Medical Image Analysis*, 111:104062, 2026.
7. Haoxuan Che*, Haibo Jin*, **Zhengrui Guo***, et al. "LLM-driven Medical Report Generation via Communication-efficient Heterogeneous Federated Learning." *IEEE Transactions on Medical Imaging*, 45(1):28–39, 2026.

First- and Co-first-author Manuscripts Under Review

8. **Zhengrui Guo***, Zhengyu Zhang*, Jiabo Ma, et al. "A Clinically Validated Foundation Model for Comprehensive Lung Pathology Interpretation." *Preprint*, 2026; manuscript under review at *Nature*.
9. Qichen Sun*, **Zhengrui Guo***, Rui Peng, Hao Chen, and Jinzhuo Wang. "Any-to-Any Learning in Computational Pathology via Triplet Multimodal Pretraining." *Preprint*, 2025; manuscript under review at AAAI 2027.

Other Peer-Reviewed Publications

10. Conghao Xiong, **Zhengrui Guo**, Zhe Xu, et al. "Exploiting Low-Dimensional Manifold of Features for Few-Shot Whole Slide Image Classification." *International Conference on Learning Representations (ICLR)*, 2026.
11. Wei Wu, Yuxing Lu, **Zhengrui Guo**, et al. "Generalized and Invariant Single-Neuron In-Vivo Activity Representation Learning." *Advances in Neural Information Processing Systems (NeurIPS)*, 2025.
12. Wei Wu, Can Liao, Zizhen Deng, **Zhengrui Guo**, and Jinzhuo Wang. "Neuron Platonic Intrinsic Representation from Dynamics Using Contrastive Learning." *International Conference on Learning Representations (ICLR)*, 2025.

Other Preprints

13. Jiabo Ma, Yingxue Xu, Fengtao Zhou, ... **Zhengrui Guo**, et al. "PathBench: A Comprehensive Comparison Benchmark for Pathology Foundation Models towards Precision Oncology." *Preprint*, 2025.
14. Zhe Xu, Ziyi Liu, Junlin Hou, ... **Zhengrui Guo**, et al. "A Versatile Pathology Co-pilot via Reasoning Enhanced Multimodal Large Language Model." *Preprint*, 2025.

Patents

- **A Clinically Validated Foundation Model for Comprehensive Lung Pathology Interpretation.** U.S. Provisional Patent Application No. 64/043891; filed 20 April 2026.
- **Towards a Generalizable Pathology Foundation Model via Unified Knowledge Distillation.** U.S. Provisional Patent Application No. 63/771782; filed 14 March 2025.

Awards and Honors

- **Young Scientists Program Scholarship** (HK$30,000), Hong Kong University of Science and Technology, 2025/26; supported by Antalpha Technologies (HK) Limited.
- **ASDP 2026 Travel Grant**, Asian Society of Digital Pathology, 2026.
- **National Scholarship**, Harbin Institute of Technology, 2021 (ranked 1/120).

Selected Presentation

- **Oral Presentation (Forthcoming)**, 3rd Annual Congress of the Asian Society of Digital Pathology, Singapore, 2026.
  Topic: A Clinically Validated Foundation Model for Comprehensive Lung Pathology Interpretation.

Teaching Experience

Hong Kong University of Science and Technology **Hong Kong SAR**
Teaching Assistant *2023*

- **COMP4331: Data Mining**
- **COMP4451: Game Programming**

Earlier Research Experience

Hong Kong University of Science and Technology **Hong Kong SAR**
Research Intern, Computational Pathology *Aug 2021 – Jan 2022*
Worked under the supervision of Prof. Hao Chen on computational pathology and multi-instance learning, including reproducing leading whole-slide image classification methods.

Harbin Institute of Technology (Weihai) **Weihai, China**
Research Intern, Applied Mathematics and Control Theory *Apr 2020 – Oct 2020*
Worked under the supervision of Prof. Wenxue Li and Dr. Yongbao Wu.
Associated publication: Yongbao Wu, **Zhengrui Guo**, Lei Xue, Choon Ki Ahn, and Jian Liu. "Stabilization of Complex Networks under Asynchronously Intermittent Event-triggered Control." *Automatica*, 161:111493, 2024.

Harbin Institute of Technology (Weihai) **Weihai, China**
Research Intern, Applied Mathematics and Control Theory *Apr 2019 – Oct 2019*
Worked under the supervision of Prof. Wenxue Li and Dr. Yongbao Wu.
Associated publication: Yongbao Wu, **Zhengrui Guo**, Wenxue Li, and Jiqiang Feng. "Synchronisation of Second-order Stochastic Complex Dynamical Networks via Intermittent Pinning Discrete Observations Control and Their Applications." *IET Control Theory & Applications*, 14(20):3440–3450, 2020.

Technical Skills and Languages

Programming and Machine Learning: Python, PyTorch, scikit-learn, MATLAB
Research Tools: NumPy, pandas, SciPy, Git, Linux, LaTeX
Languages: Chinese (native), English (fluent)