Heqin Zhu

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RESEARCH INTERESTS

My research centers on AI for Science (AI4S), with a specific focus on fundamental challenges in **computational biology**, from sequence understanding, structure and function prediction to drug discovery and other applications, including:

- **RNA secondary structure [I6] and tertiary structure prediction**.

- **Structure-guided RNA foundation model (LLM)** for sequence understanding, structure and function prediction [I8].

- Functional applications such as **identification of IRES [I7]**, exploration of functional RNA motifs within non-coding genomic regions, and **AI-driven drug discovery**.

Previously, I worked on medical imaging computing, where I developed universal models [I1, I2] and few-shot learning methods [I5] for localizing anatomical landmarks.

EDUCATION

- **University of Science and Technology of China (USTC)** — *Sept. 2023 - 2026 (expected)*, Suzhou, China
  Ph.D. student, Biomedical Engineering
  ◦ Advisor: S. Kevin Zhou(Fellow of IEEE, AIMBE, NAI)

- **Institute of Computing Technology (ICT), Chinese Academy of Sciences (CAS) & University of Chinese Academy of Sciences (UCAS)** — *Sept. 2020 - Jun. 2023*, Beijing, China
  M.S., Computer Applications
  ◦ Advisor: S. Kevin Zhou(Fellow of IEEE, AIMBE, NAI)
  ◦ *Thesis*: Landmark Detection from X-ray Images with Anatomical Universality

- **University of Science and Technology of China (USTC)** — *Sept. 2016 - Jun. 2020*, Hefei, China
  B.S., Computer Science and Technology
  ◦ Hua Xia Talent Program in Computer Science and Technology
  ◦ *Thesis*: Enhancement and Analysis of CBCT images

HONORS AND AWARDS

- **Suzhou Industrial Park Scholarship**, USTC — *2025*
- First Class Scholarship, USTC — *2024-2025*
- First Class Scholarship, UCAS & ICT — *2020-2023*
- **Merit Student Award**, UCAS & ICT — *2023*
- Outstanding Student Award, USTC — *2018-2019*
- **Institute of Chemistry Excellence Scholarship**, USTC — *2017*

PROFESSIONAL EXPERIENCE

- **Tencent, JAVIS Lab** — *Jul. 2021 - Nov. 2021*, Shenzhen, China
  Research Intern
  ◦ Depth-supervised salient object detection.

PROFESSIONAL SERVICES

- **Conference reviewer**: MICCAI

- **Journal reviewer**: TCSVT

TEACHING & VOLUNTEER EXPERIENCES

- Volunteer: Medical Augmented Reality Summer School, Suzhou — *2024*
- TA: Electronic information openness practices, USTC — *Fall 2023*
- Volunteer: Dushu Lake Forum Dushu Lake Symposium on Medical lmage Computing, Suzhou — *2023*

Selected publications, # denotes co-first author and * denotes co-corresponding author. For full list, please refer to Google Scholar.

Representative Papers

[I8] **Heqin Zhu**, Ruifeng Li, Zaixi Zhang, Feng Zhang, Fenghe Tang, Tong Ye, Yunjie Gu, Peng Xiong*, and S. Kevin Zhou*. "Structure-guided pretraining of RNA foundation model for RNA sequence understanding and structural prediction." (In preparation, 2025).

[I7] Feng Zhang#, **Heqin Zhu#**, Jie Hu, Jiayin Gao, Ke Chen, S. Kevin Zhou*, and Peng Xiong*. "IRESeek: Structure-informed deep learning method for accurate identification of internal ribosome entry sites in circular RNAs." (Submitted, 2025).

[I6] **Heqin Zhu**, Fenghe Tang, Quan Quan, Ke Chen, Peng Xiong*, and S. Kevin Zhou*. "Deep generalizable prediction of RNA secondary structure via base pair motif energy." Nature Communications 16, (2025): 5856. (Nat. Commun., 2025). [Paper; Code]

[I5] **Heqin Zhu**, Quan Quan, Qingsong Yao, Zaiyi Liu, and S. Kevin Zhou. "Uod: Universal one-shot detection of anatomical landmarks." In International Conference on Medical Image Computing and Computer-Assisted Intervention, pp. 24-34. Cham: Springer Nature Switzerland, 2023. (MICCAI 2023). [Paper; Code]

[I4] **Heqin Zhu**, Qingsong Yao, and S. Kevin Zhou. "Datr: Domain-adaptive transformer for multi-domain landmark detection." arxiv preprint arxiv:2203.06433 (2022). [Paper; Code]

[I3] **Heqin Zhu**, Xu Sun, Yuexiang Li, Kai Ma, S. Kevin Zhou*, and Yefeng Zheng*. "DFTR: Depth-supervised fusion transformer for salient object detection." arxiv preprint arxiv:2203.06429 (2022). [Paper; Code]

[I2] **Heqin Zhu**, Qingsong Yao, Li Xiao, and S. Kevin Zhou. "Learning to Localize Cross-Anatomy Landmarks in X-Ray Images with a Universal Model." BME Frontiers 2022 (2022): 9765095. (BMEF 2022). [Paper; Code]

[I1] **Heqin Zhu**, Qingsong Yao, Li xiao, and S. Kevin Zhou. "You only learn once: Universal anatomical landmark detection." In Medical Image Computing and Computer Assisted Intervention, pp. 85-95. Springer International Publishing, 2021. (MICCAI 2021). [Paper; Code]

Journal Papers

[J4] Quan Quan#, Qingsong Yao#, **Heqin Zhu**, and S. Kevin Zhou. "IGU-Aug: Information-guided unsupervised augmentation and pixel-wise contrastive learning for medical image analysis." IEEE Transactions on Medical Imaging (2024). (TMI 2024).

[J3] Quan Quan#, Qingsong Yao#, **Heqin Zhu**, Qiyuan Wang, and S. Kevin Zhou. "Which images to label for few-shot medical image analysis?." Medical Image Analysis 96 (2024): 103200. (MIA 2024).

[J2] Huang Zhen#, Han Li#, Shitong Shao, **Heqin Zhu**, Huijie Hu, Zhiwei Cheng, Jianji Wang, and S. Kevin Zhou. "PELE scores: pelvic X-ray landmark detection with pelvis extraction and enhancement." International Journal of Computer Assisted Radiology and Surgery 19, no. 5 (2024): 939-950. (IJCARS 2024).

[J1] Pengbo Liu, Hu Han, Yuanqi Du, **Heqin Zhu**, Yinhao Li, Feng Gu et al. "Deep learning to segment pelvic bones: large-scale CT datasets and baseline models." International Journal of Computer Assisted Radiology and Surgery 16 (2021): 749-756. (IJCARS 2021).

Conference Papers

[C4] Xinyi Wang, Zikang Xu, **Heqin Zhu**, Qingsong Yao, Yiyong Sun, and S. Kevin Zhou. "SIX-Net: Spatial-Context Information miX-up for Electrode Landmark Detection." In International Conference on Medical Image Computing and Computer-Assisted Intervention, pp. 338-348. Cham: Springer Nature Switzerland, 2024. (MICCAI 2024).

[C3] Fenghe Tang, Ronghao Xu, Qingsong Yao, Xueming Fu, Quan Quan, **Heqin Zhu**, Zaiyi Liu, and S. Kevin Zhou. "Hyspark: Hybrid sparse masking for large scale medical image pre-training." In International Conference on Medical Image Computing and Computer-Assisted Intervention, pp. 330-340. Cham: Springer Nature Switzerland, 2024. (MICCAI 2024).

[C2] Quan Quan, Fenghe Tang, Zikang Xu, **Heqin Zhu**, and S. Kevin Zhou. "Slide-SAM: Medical SAM Meets Sliding Window." In Medical Imaging with Deep Learning, pp. 1179-1195. PMLR, 2024. (MIDL 2024).

[C1] Yuanyuan Lyu, Haofu Liao, **Heqin Zhu**, and S. Kevin Zhou. "A 3 DSegNet: anatomy-aware artifact disentanglement and segmentation network for unpaired segmentation, artifact reduction, and modality translation." In International Conference on Information Processing in Medical Imaging, pp. 360-372. Cham: Springer International Publishing, 2021. (IPMI 2021).