朱河勤

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研究兴趣

我的研究聚焦于用人工智能解决科学问题(AI4S)，特别关注计算生物学领域从结构预测到序列-结构-功能应用的基础性挑战，具体包括：

- RNA 二级结构 [I.6]与三级结构预测；
- 结构引导的**RNA** 基础模型（**LLM**）开发 [I.8]，用于序列理解与结构相关预测；
- 功能应用研究：如IRES 识别 [I.7]、非编码基因组区域功能性RNA 基序探索，以及AI 驱动的药物发现。

在这之前，我研究过医学影像计算，开发了具有跨域适应能力的通用模型 [I.1, I.2] 及小样本学习算法[I.5]，用于医学影像关键点的精准定位。

教育经历

- 中国科学技术大学 *2023.09 - 现在*
  博士研究生，生物医学工程 苏州
  - 导师: 周少华教授 (Fellow of IEEE, AIMBE, NAI)
- 中国科学院，计算技术研究所 *2020.09 - 2023.06*
  硕士，计算机应用技术 北京
  - 导师: 周少华教授 (Fellow of IEEE, AIMBE, NAI)
- 中国科学院大学 *2020.09 - 2023.06*
  硕士，计算机应用技术 北京
  - 导师: 周少华教授 (Fellow of IEEE, AIMBE, NAI)
- 中国科学技术大学 *2016.09 - 2020.06*
  本科, 计算机科学与技术 合肥
  - 华夏计算机科学与技术英才班

荣誉获奖

- 苏州工业园区奖学金，中国科学技术大学 *2025*
- 一等学业奖学金，中国科学技术大学 *2024-2025*
- 一等学业奖学金，计算所&国科大 *2020-2023*
- 三好学生，计算所&国科大 *2023*
- 优秀学生奖，中国科学技术大学 *2018-2019*
- 化研所英才奖, 中国科学技术大学 *2017*

实习经历

- 腾讯天衍实验室 *2021.07 - 2021.11*
  研究实习生 深圳
  - 使用深度图监督学习进行图像显著性检测

学术服务

- 会议审稿: MICCAI
- 期刊审稿: TCSVT

志愿活动

- 志愿者：医学增强现实夏季学期，苏州 *2024*
- 志愿者：医学影像计算独墅湖会议，苏州 *2023*
- 助教：电子信息开放实践，中国科学技术大学 *2023*

PATENTS AND PUBLICATIONS

C=CONFERENCE, J=JOURNAL, P=PATENT, S=IN SUBMISSION, T=THESIS

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

Representative Papers

[I.8] **Heqin Zhu**, Ruifeng Li, Peng Xiong*, and S. Kevin Zhou*. "Structure-guided pretraining of RNA foundation model for RNA sequence understanding and structural prediction." (In preparation. 2025).

[I.7] Feng Zhang#, **Heqin Zhu#**, S. Kevin Zhou*, and Peng Xiong*. "IRESeek: Structure-informed deep learning method for accurate identification of internal ribosome entry sites in circular RNAs." (In preparation. 2025).

[I.6] **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 2025. (Nat. Commun. 2025). [Paper; Code]

[I.5] **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]

[I.4] **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]

[I.3] **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]

[I.2] **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]

[I.1] **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

[J.4] 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).

[J.3] 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).

[J.2] 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).

[J.1] 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

[C.4] 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).

[C.3] 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).

[C.2] 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).

[C.1] 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).