朱河勤

博士研究生◇ 中国科学技术大学◇ 最新简历

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核心研究：AI FOR SCIENCE

- 计算生物学：结构引导的 RNA 语言模型: structRFM [I8](Nature, Under Revision); IRES 检测: IRESeek [I7](Under Revision); 利用碱基对基序能量进行 RNA 二级结构预测: BPfold [I6](Nature Communications (IF=15.7)), NCfold [I9](Under Review).
- 医学影像计算：域适应通用模型: GU2Net [I1, I2](医学影像顶会MICCAI 2021, BMEF), DATR [I4]; 小样本学习: UOD [I5](MICCAI 2023), SCP [J3](医学影像顶刊MIA); 对比学习: IGU-Aug [J4](医学影像顶刊TMI).

教育经历

- 中国科学技术大学 *2023.09 - 2026.06（预计）*
  博士研究生，生物医学工程 苏州
  - 导师：周少华教授（Fellow of AIMBE, IAMBE, IEEE, MICCAI, and NAI）
- 中国科学院，计算技术研究所&中国科学院大学 *2020.09 - 2023.06*
  硕士，计算机应用技术 北京
  - 导师：同上
- 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

- 国家奖学金，教育部 *2025*
- 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，计算所&中国科学技术大学 *2020-2025*
- 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*

研究实习

- 结构引导的 **RNA** 基础模型 **structRFM [Paper; Code] 28 stars** *2025.08*
  独立一作 Nature, Under Revision
  - 融合序列与结构信息的 RNA 基础模型。通过配对匹配掩码机制，将碱基配对结构信息直接融入语言建模，并动态平衡碱基级与结构级的掩码比例。
  - 在零样本同源分类任务上，15个生物语言模型中排名领先。
  - 二级结构预测：刷新现有方法最佳成绩。
  - 三级结构预测：在 RNA Puzzles 数据集上相比 AlphaFold3 提升19%。
  - 功能预测等任务：IRES 识别任务 F1分数提升49%。
- **RNA** 二级结构预测 **BPfold [Paper; Code] 22 stars** *2025.07*
  独立一作 Nature Communications
  - 从碱基对层面引入碱基对模体能量来提高数据的覆盖率和质量，从而克服 RNA 结构预测实验解析结构数据严重不足的难题。设计序列与能量矩阵多模态融合网络 BPfold, 提高了二级结构的预测准确性和模型泛化性。
- 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，开发了DFTR 多模态融合模型 [I3]
  - 计算机学习资源整理 GitHub 开源项目[link] 15K stars：主导整理了计算机相关的学习资源。

学术活动

- 学术审稿：MICCAI (CCF B), TCSVT (IF=11.1): 负责 AI 在医学影像，生物信息领域的论文评审。
- 志愿活动：医学影像计算会议 (2023), 增强现实夏季学期 (2024): 协助会议组织论坛，促进产学研合作。
- 助教：电子信息开放实践：中国科学技术大学 2023 年秋季学期。

技术技能

- 深度学习： PyTorch, 语言模型，扩散模型，多模态融合，Git，Vim，C++

PUBLICATIONS

I=REPRESENTATIVE, J=JOURNAL, C=CONFERENCE

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

Representative Papers

[I9] **Heqin Zhu#**, Ruifeng Li#, Ao Chang, Mingqian Li, Hongyang Chen*, Peng Xiong*, and S. Kevin Zhou*. "RNA non-canonical base pair prediction." (Under Review).

[I8] **Heqin Zhu**, Ruifeng Li, Feng Zhang, Fenghe Tang, Tong Ye, Xin Li, Yunjie Gu, Peng Xiong*, and S. Kevin Zhou*. "A fully open structure-guided RNA foundation model for robust structural and functional inference." (Nature, Under Revision). [bioRxiv; Code]

[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." (Under Revision).

[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).