

朱河勤

博士研究生◇中国科学技术大学◇最新简历

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研究兴趣: RNA结构/功能预测, 生物大模型, RNA/蛋白质设计

- 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]; 利用碱基对基序能量进行 RNA 二级结构预测: BPfold [I6](Nature Communications), NCfold [I9](ICLR 2026).
- 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 [I3](医学影像顶刊MIA); 对比学习: IGU-Aug [I4](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), 熊鹏研究员
- 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, 计算机科学与技术 北京
◦ 导师: 周少华教授
- 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

- 安徽省普通高等学校优秀毕业生 (省双优生), 安徽省 2026
- 中国科学技术大学优秀毕业生 (2026届博士), 中国科学技术大学 2026
- 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
- 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] 33 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] 31 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, TCSVT: 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。
- 中国科学技术大学助教: 电子信息开放实践 (2023年秋季学期); 生物大分子结构预测与建模 (2024年春季学期)
- 邀请报告: 2025-03, 基于碱基对模体能量的核酸结构预测, 第三届全国生物分子预测和建模大会

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++

SELECTED PUBLICATIONS

I=Representative, J=Journal, C=Conference

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*. "Toward Accurate RNA Non-Canonical Structure Prediction: The NC-Bench Benchmark and the NCfold Framework." (ICLR 2026). [bioRxiv; Code]
- [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**#, Jiayin Gao, Jie Hu, Ke Chen, Shaohua Kevin Zhou*, and Peng Xiong*. "IRESeek: structure-informed deep learning method for accurate identification of internal ribosome entry sites in circular RNAs." NAR Genomics and Bioinformatics 7, no. 4 (2025): lqaf210. (NAR Genomics and Bioinformatics). [Paper; Code]
- [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). (Preprint). [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). (Preprint). [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] Fenghe Tang, Chengqi Dong, Wenxin Ma, Zikang Xu, **Heqin Zhu**, Zihang Jiang, Rongsheng Wang, Yuhao Wang, Chenxu Wu, and Shaohua Kevin Zhou. "U-Bench: A Comprehensive Understanding of U-Net through 100-Variant Benchmarking." arXiv preprint arXiv:2510.07041 (2025). (Under review).
- [C3] 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).
- [C2] 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).
- [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).