KUN ZHAO

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Research Interests

Medical Multimodal Foundation Models · Reinforcement Learning & Post-Training · Evidence-Grounded Clinical Reasoning · Reliable Medical AI

Ph.D. candidate at the University of Pittsburgh developing reliable multimodal foundation models for medical imaging and clinical generation. My research focuses on reinforcement-learning-based post-training, evidence-grounded reasoning, and robust evaluation, spanning radiology report generation and multimodal neuroimaging–genomics analysis. First/co-first author of work at ACL, EMNLP, and *Frontiers in Radiology*, with experience in multimodal SFT, RL optimization, and evaluation.

Selected Publications

- **HERO: Hierarchical Evidential Reasoning Optimization for Radiology Report Generation via Reason-then-Summarize**
  Kun Zhao, Guodong Liu, Hui Ji, Siyuan Dai, Pan Wang, Jifeng Song, Chenghua Lin, Liang Zhan, Haoteng Tang
  arXiv:2601.03321 · ***Under review***, *AAAI 2027* · ***First author***
  Contribution: Developed factorized GRPO credit assignment for free-text findings and a 14-label diagnostic JSON, improving clinical efficacy, think–answer consistency, and evidence grounding on MIMIC-CXR, with transfer evaluation on IU-Xray.
- **X-ray Made Simple: Lay Radiology Report Generation and Robust Evaluation**
  Kun Zhao, Chenghao Xiao, Sixing Yan, Haoteng Tang, William K. Cheung, Noura Al Moubayed, Liang Zhan, Chenghua Lin
  ACL 2026 Findings · ***First author***
  Contribution: Created sentence- and report-level lay radiology datasets, a semantics-based metric that exposes template-driven BLEU inflation, and a lay-guided training strategy.
- **Interpretable Multimodal Learning for Integrating Neuroimaging and Genetic Data in Alzheimer's Disease**
  Kun Zhao, Siyuan Dai, Yingying Zhang, Guodong Liu, Pengfei Gu, Chenghua Lin, Paul M. Thompson, Alex Leow, Heng Huang, Lifang He, Liang Zhan, Haoteng Tang
  Frontiers in Radiology, 2026 · ***First author***
  Contribution: Developed R-GenIMA, pairing ROI-wise 3D MRI tokens with prompted SNP representations for four-stage Alzheimer's disease classification and interpretable ROI–gene attribution.

Education

University of Pittsburgh — *Pittsburgh, PA, USA*
Ph.D. in ECE · GPA 3.925/4.00 · Advisor: Prof. Liang Zhan — *Sep. 2023 – Expected 2027*

Wuhan University — *Wuhan, China*
M.Eng. in Cyberspace Security, School of Cyber Science and Engineering — *Sep. 2019 – Jun. 2022*

Zhengzhou University of Light Industry — *Zhengzhou, China*
B.Eng. in Internet of Things Engineering — *Sep. 2014 – Jun. 2018*

Research Experience

University of Pittsburgh — Dept. of Electrical & Computer Engineering *Pittsburgh, PA, USA*
Graduate Research Assistant · Advisor: Prof. Liang Zhan *Sep. 2023 – present*

- Research on medical multimodal LLMs, reinforcement-learning post-training, and reliable evaluation of open-ended generation; lead author and project lead on three research lines.

Reinforcement Learning for Clinically Faithful Multimodal Generation *2024 – present*
Project lead · with Prof. Liang Zhan, Prof. Chenghua Lin, Prof. Haoteng Tang

- Developed **HERO** on Qwen-2.5-VL-7B with a two-part output: free-text radiological findings followed by a 14-label CheXpert diagnostic JSON.
- Replaced vanilla GRPO's broadcast advantage with **segment-specific advantages**, TF–IDF and pathology-aware token weighting, and an **evidence-grounded completion gate**; designed a nine-component reward bank spanning reasoning, consistency, grounding, validity, and diagnostic correctness.
- On MIMIC-CXR, achieved RadGraph 0.354 and report-level Micro-F1(14) 0.574; reached think–answer SCS 0.980 and evidence grounding 0.773, with transfer evaluation on IU-Xray.
- Implemented two-stage SFT followed by GRPO with vLLM rollouts, per-token importance-sampling correction, KL regularization, and conditional ground-truth injection on NVIDIA A100 GPUs.

Interpretable and Multimodal Medical AI *2024 – present*
Project lead · with Prof. Liang Zhan, Prof. Haoteng Tang

- Developed **R-GenIMA**, which represents parcellated 3D MRI regions as visual tokens and SNP profiles as prompted genetic tokens for four-stage Alzheimer's disease classification; ROI and gene attribution analyses recover stable, biologically plausible patterns (*Frontiers in Radiology*, 2026, first author).
- Created refined sentence- and report-level lay radiology datasets and a semantics-based metric that exposes template-driven BLEU inflation; showed that lay-guided training improves semantic learning as data scale increases (ACL 2026 Findings, first author). The data were used in the BioLaySumm 2025 radiology-report track.
- Systematically benchmarked vision-encoder and language-backbone combinations for radiology report generation through controlled component swaps (ICDM Workshops 2025, first author).
- Contributed to STE-ODE, which models structural–effective brain-network dynamics with directed graph embeddings and ordinary differential equations (MICCAI 2024), and to FigEx2, which detects panels and generates panel-level captions from compound scientific figures (EMNLP 2026 Main Conference).

Reliable Evaluation of Open-Ended Generation *2021 – present*
Project lead · with Prof. Chenghua Lin, Prof. Liang Zhan

- Developed a line of **reference-free evaluation methods**, progressing from latent-space response modeling (**CMN**) to SLM–LLM collaboration (**SLIDE/DRE**) and structured semantic augmentation with **AMR**.
- Introduced CMN by augmenting a conditional VAE with next-sentence prediction and mutual information, improving evaluation of valid dialogue responses that are semantically distant from a single reference (ACL 2023 Main, **Oral; first author**).
- Developed SLIDE: a contrastively trained SLM separates robust response features and supplies a semantic-sensitivity score that is adaptively combined with an LLM evaluator (ACL 2024 Findings). DRE adds SLM-guided interior prompt refinement and exterior score refinement, improving alignment with human judgments across dialogue benchmarks (*Neural Networks*, 2026, **in press**).
- Co-developed an AMR-enhanced evaluator that gates AMR graph information into an SLM and injects both AMR knowledge and SLM predictions into LLM prompts, improving discrimination of lexically similar adversarial responses (EMNLP 2025 Findings, **co-first author**).

Wuhan University — Big Data and Artificial Intelligence Laboratory *Wuhan, China*
Research Assistant · hierarchical latent-variable models for long-form text *Sep. 2022 – Apr. 2023*

Publications

Grouped by publication type; dated papers in reverse chronological order. **Bold** indicates my name; * indicates equal contribution.

Peer-Reviewed Conference Papers

[1] FigEx2: Visual-Conditioned Panel Detection and Captioning for Scientific Compound Figures
Jifeng Song, Arun Das, Pan Wang, Hui Ji, **Kun Zhao**, Yufei Huang
EMNLP 2026 Main Conference · ***Accepted***

[2] X-ray Made Simple: Lay Radiology Report Generation and Robust Evaluation
Kun Zhao, Chenghao Xiao, Sixing Yan, Haoteng Tang, William K. Cheung, Noura Al Moubayed, Liang Zhan, Chenghua Lin
ACL 2026 Findings | **First author**

[3] Emphasising Structured Information: Integrating Abstract Meaning Representation into LLMs for Enhanced Open-Domain Dialogue Evaluation
Bohao Yang*, **Kun Zhao***, et al.
EMNLP 2025 Findings | **Co-first author**

[4] Crafting Customisable Characters with LLMs: A Persona-Driven Role-Playing Agent Framework
Bohao Yang, Dong Liu, Chenghao Xiao, **Kun Zhao**, Chen Tang, Chao Li, Lin Yuan, Yang Guang, Chenghua Lin
EMNLP 2025 Findings

[5] Who Matters More in Radiology Report Generation: Vision Encoders or Language Models?
Kun Zhao, Yang Du, Liang Zhan, Haoteng Tang, et al.
SAIMBio Workshop @ ICDM 2025 | **First author**

[6] Interpretable Spatio-Temporal Embedding for Brain Structural-Effective Network with Ordinary Differential Equation
Haoteng Tang, Guodong Liu, Siyuan Dai, Kai Ye, **Kun Zhao**, Wenlu Wang, Carl Yang, Lifang He, Alex Leow, Paul Thompson
MICCAI 2024

[7] SLIDE: A Framework Integrating Small and Large Language Models for Open-Domain Dialogues Evaluation
Kun Zhao, Bohao Yang, Chen Tang, Chenghua Lin, Liang Zhan
ACL 2024 Findings | **First author**

[8] Effective Distillation of Table-Based Reasoning Ability from LLMs
Bohao Yang, Chen Tang, **Kun Zhao**, Chenghao Xiao, Chenghua Lin
LREC-COLING 2024

[9] Evaluating Open-Domain Dialogues in Latent Space with Next Sentence Prediction and Mutual Information
Kun Zhao, Bohao Yang, Chenghua Lin, Wenge Rong, Aline Villavicencio, Xiaohui Cui
ACL 2023 Main Conference | **First author · Oral presentation**

[10] A Latent Variable Model with Hierarchical Structure and GPT-2 for Long Text Generation
Kun Zhao, Hongwei Ding, Kai Ye, Xiaohui Cui, Zhongwang Fu
International Conference on Artificial Neural Networks (ICANN) 2021 | **First author**

Journal Articles

[11] DRE: An Effective Dual-Refined Method for Integrating Small and Large Language Models in Open-Domain Dialogue Evaluation
Kun Zhao, Bohao Yang, Chen Tang, et al.
Neural Networks, *2026, 109574* · ***In press; available online*** | **First author**

[12] Interpretable Multimodal Learning for Integrating Neuroimaging and Genetic Data in Alzheimer's Disease
Kun Zhao, Siyuan Dai, Yingying Zhang, Guodong Liu, Pengfei Gu, Chenghua Lin, Paul M. Thompson, Alex Leow, Heng Huang, Lifang He, Liang Zhan, Haoteng Tang
Frontiers in Radiology, 2026 | **First author**

[13] Constrained Multiview Contrastive Learning for Jointly Supervised Representation Learning
Siyuan Dai, Kai Ye, **Kun Zhao**, Yang Du, Haoteng Tang, Liang Zhan
Meta-Radiology, 4(3):100216, 2026

[14] A Transformer-Based Hierarchical Variational AutoEncoder Combined Hidden Markov Model for Long Text Generation
Kun Zhao, Hongwei Ding, Kai Ye, Xiaohui Cui
Entropy, 23(10):1277, 2021 | **First author**

Manuscripts Under Review

[15] HERO: Hierarchical Evidential Reasoning Optimization for Radiology Report Generation via Reason-then-Summarize
Kun Zhao, Guodong Liu, Hui Ji, Siyuan Dai, Pan Wang, Jifeng Song, Chenghua Lin, Liang Zhan, Haoteng Tang
arXiv:2601.03321 · ***Under review**, AAAI 2027* | **First author**

Academic Service

Organizer, BioLaySumm Shared Task, BioNLP Workshop @ ACL 2025
Task design, benchmark construction, and evaluation protocol (biolaysumm.org).

Reviewer, ACL Rolling Review (ARR), NeurIPS, AAAI

Technical Skills

Languages	Python, C/C++, Bash, LaTeX
ML/LLM	PyTorch, Hugging Face Transformers, TRL, DeepSpeed (ZeRO-3), vLLM, PEFT/LoRA, LLaVA, LLaMA-Factory
Medical AI	Medical MLLMs, radiology report generation and evaluation, neuroimaging–genomics integration, interpretable multimodal learning
Post-Training	SFT, RLHF/GRPO, fine-grained reward design, distributed training and inference
Systems	Linux, Slurm, Docker, Git