Zhiyi Shi

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Research Interests: Multimodal Learning, LLM, Medical Imaging.

EDUCATION

Carnegie Mellon University Pittsburgh, US
Master of Science in Mobile and Internet of Things Engineering (GPA: 3.85/4.0) 09/2022 – 05/2024
- Related Coursework: Deep Learning System, Machine Learning and Sensing, Image Synthesis.

Southeast University Nanjing, China
Bachelor of Science in Computer Science (GPA: 3.83/4.0) 09/2018 – 06/2022
- Related Coursework: Computer Vision, Machine Learning, Pattern Recognition, Reinforcement Learning.
- Awards: Chien-shiung Wu Honor Scholarship (Ranking: 1/123)

SELECTED PUBLICATIONS

[1] **Zhiyi Shi**, Junsik Kim, Wanhua Li, Yicong Li, Hanspeter Pfister. MoRA: LoRA Guided Multi-Modal Disease Diagnosis with Missing Modality. *MICCAI 2024*.
[2] Junsik Kim, **Zhiyi Shi**, Davin Jeong, Johannes Knittel, Helen Y Yang, Yonghyun Song, Wanhua Li, Hanspeter Pfister. Multimodal Learning for Embryo Viability Prediction in Clinical IVF. *MICCAI 2024*.
[3] **Zhiyi Shi**, Kaiwen Geng, Xiaoyan Zhao, Farhad Mahmoudi, Jiantao Pu. XRayWizard: Reconstructing 3‐D lung surfaces from a single 2‐D chest x‐ray image via Vision Transformer. *Medical Physics 2023.*
[4] **Zhiyi Shi***, Junsik Kim*, Hanspeter Pfister. Spatial-Temporal Pre-Training for Embryo Viability Prediction Using Time-Lapse Videos. Submitted to *Medical Image Analysis*, under review.
[5] Chongjie Si*, **Zhiyi Shi***, Hanspeter Pfister, Wei Shen. Unleashing the Power of Task-Specific Directions in Parameter Efficient Fine-tuning. *arXiv preprint arXiv:2409*.01035. Submitted to *ICLR 2025,* under review.
[6] **Zhiyi Shi**, Junsik Kim, Davin Jeong, Hanspeter Pfister. Surprisingly Simple: Large Language Models are Zero-Shot Feature Extractors for Tabular and Text Data. Submitted to *ICLR 2025,* under review.

RESEARCH EXPERIENCE

Embryo Viability Prediction of In-vitro Fertilization using AI Models Cambridge, US
Research Assistant at **Harvard University** (Advisor: Hanspeter Pfister) 01/2024 – Present
- Developed a multimodal model to fuse time-lapse video data with Electronic Health Records (EHRs) for embryo viability prediction, for the first time using these two modalities for IVF prediction. (Publication [2])
- Proposed a two-stage unsupervised pre-training method to leverage large volumes of unlabeled data from 23027 time-lapse videos, significantly reducing computational demands for long video representation learning and improving the performance for videos with semantic misalignments. (Publication [4])
- Designed a framework based on Large Language Models (LLMs) to incorporate tabular and textual data, firstly discovering the zero-shot feature extraction ability of LLMs and demonstrating our framework's robustness to missing tabular data. (Publication [6])

Parameter Efficient Fine-Tuning Using Low-Rank Adaptation Cambridge, US
Research Assistant at **Harvard University** (Advisor: Hanspeter Pfister) 01/2024 – Present
- Provided a clear definition of task-specific directions for parameter efficient fine-tuning; designed a novel approach, LoRA-Dash, which maximizes the impact of task-specific directions during the fine-tuning process, enhancing model performance on downstream tasks. (Publication [5])
- Proposed Modality-aware Low-Rank Adaptation (MoRA) to disease diagnosis, which minimizes required computational resources and significantly improves performance with missing modality. (Publication [1])

3D Lung Surfaces Reconstruction via Vision Transformer Pittsburgh, US
Research Assistant at **University of Pittsburgh Medical Center** (Advisor: Jiantao Pu) 09/2022 - 08/2023
- Introduced XRayWizard, a novel model that employs transformer modules to encode 2D x-ray images, capturing global information and establishing long-range relationships to enhance the accuracy of 3D reconstruction. (Publication [3])
- Created a new method to incorporate subject demographics as an auxiliary input, resulting in SOTA accuracy of 3D lung volume reconstruction. Improved Dice coefficient from 0.688 to 0.769.

ACADEMIC SERVICE

Teaching Assistant for *Deep Learning System* guided by Tianqi Chen and Zico Kolter at CMU 09/2023 - 12/2023
Reviewer of *Medical Physics* 10/2022
Reviewer of *Computers in Biology and Medicine* 01/2024

SKILLS

Open Source: Torch, Tensorflow, Keras, OpenCV2, YOLO, Llama3, scikit-learn, nnUnet.
Machine Learning Model: LoRA, Blip2, Transformer, GAN, Diffusion Model, Masked Autoencoder, SimCLR.

OTHER PUBLICATIONS

[7] Kaiwen Geng*, **Zhiyi Shi***, Xiaoyan Zhao, Alaa Ali, Jing Wang, Joseph Leader, Jiantao Pu. BeyondCT: A deep learning model for predicting pulmonary function from chest CT scans. *arXiv preprint arXiv:2408.05645*. Submitted to *Medical Physics,* under review.

[8] Leheng Sheng, Wenhan Wang, **Zhiyi Shi**, Jichao Zhan, Youyong Kong. BrainNetFormer: Decoding brain cognitive states with spatial-temporal cross attention. *ICASSP 2023*.

[9] Shangsi Ren, Cameron Beeche, Kartik Iyer, **Zhiyi Shi**, Quentin Auster, James M Hawkins, Joseph K Leader, Rajeev Dhupar, Jiantao Pu. Graphical modeling of causal factors associated with the postoperative survival of esophageal cancer subjects. *Medical Physics 2023*.

[10] Jatin Singh, Cameron Beeche, **Zhiyi Shi**, Oliver Beale, Boris Rosin, Joseph Leader, Jiantao Pu. Batch-balanced focal loss: a hybrid solution to class imbalance in deep learning. *Journal of Medical Imaging*.

[11] Shangsi Ren, Cameron Beeche, **Zhiyi Shi**, Maria Acevedo Garcia, Katherine Zychowski, Shuguang Leng, Pedram Roghanchi, Jiantao Pu. Causal Relationship Network of Risk Factors Impacting Workday Loss in Underground Coal Mines. *arXiv preprint arXiv:2402.05940.*