Zhicheng He

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Education

Beijing Jiaotong University, BJTU **2021.09 ~ 2025.06** ***(expected)***
Joint Program with Lancaster University, UK
Major: Computer Science and Technology, School of Computer and Information Technology
Current Ranking: Top 10%,
Overall score: GPA: 3.71/4.0, 87.3/100, (CGPA in Lancaster University: 3.81/4.0)
English Proficiency: TOEFL 106 (Reading 30, Listening 28, Speaking 24, Writing 24), **GRE** 326 (V: 156, Q: 170)
Teaching Assistant for Computer Network course, Lancaster University presented by Dr. Anna Li
- ✧ Supported course instruction and student queries

Selected Honorary Award

- ✧ Second-class Academic Scholarship (2021), Third-Class Academic Scholarship (2022, 2023), Scholarship for Discipline Competition (2021), Merit Student at School-level (2021), School-level Excellent League Member (2021), Second Class Scholarship for Social Work (2023), Third Class Scholarship for Social Work (2022)
- ✧ Provincial Third Prize for Mathematical Modeling Competition (2022, 2023)

Publication

He, Z.*, Li, Y., & Zhang, D. (2023). ***Transformer-Based Visual Question Answering Model Comparison***. International Conference on Software Engineering and Machine Learning (CONF-SEML 2023). ***(published)***
He, Z.*, Li, X., & Wang, Y. (2024). ***Deep Learning-based Detection of Impacted Teeth on Panoramic Radiographs.*** **SCI** Biomedical Engineering and Computational Biology, https://doi.org/10.1177/11795972241288319. ***(published)***
He, Z., & Chen, X. (2024). ***Automatic Pricing and Replenishment Decision of Vegetable Products Based on Heuristic Optimization Algorithm.*** Highlights in Business, Economics, and Management, 24, 12-17. ISSN: 2957-952X. ***(published)***
Bai, L., Tan, Q., Chen, T., Nah, W. J., Li, Y., **He, Z.**, et al. (2024). ***EndoUIC: Promptable Diffusion Transformer for Unified Illumination Correction in Capsule Endoscopy***. Medical Image Computing and Computer Assisted Intervention Society (MICCAI 2024). ***(published)***
Lin, H., Zhou, Y., Hu, H., **He, Z.**, Wu, R., & Lvu, X. (2024). ***Graph Matching Based Graph Self-Supervised Learning for Molecular Property Prediction***, 2024 IEEE International Conference on Bioinformatics and Biomedicine. IEEE. ***(accepted)***

Patents

Deng, Z., **He, Z.**, Zhu, M., & Cao Y. (2024). ***The Invention Relates to a Health Condition Identification Method, Device and a Readable Storage Medium. Registration*** No. 202410871874.8. (Invention Patent)
Deng, Z., **He, Z.**, Zhu, M., & Cao Y. (2024). ***A Mirror Used at Home to Detect Changes in Facial Skin Color and Texture Features. Registration*** No. 202421547281.8. (Utility Model Patent)
Li, X., Wang, Y, & **He, Z**. (2024). ***Teeth Segmentation Software Based on CT Images. Version 1.0. Registration*** No.2024SR0700560. (Software Literature)

Research Experience

Multi-view Contrastive Learning on Time-Series Prediction Pretraining **2024.07 ~ 2024.10**
Advisor: Assist Prof Tengfei Ma, Department of Biomedical Informatics, Stony Brook University
- ✧ Developed and processed the PAMAP2 dataset by cleaning large volumes of data and creating a combined dataset from individual CSV files to gain consistent input for ViTST and PatchTST.
- ✧ Pretrained ViTST and PatchTST models as two different views on the PAMAP2 dataset, focusing on time-series data transformation and optimized feature extraction.
- ✧ Integrated and optimized representations through feature extraction from the last Transformer encoder layer, utilized dynamic memory clearing to ease storage pressure, and tailored loss functions to prevent overfitting.
- ✧ Successfully mapped both results into one potential space and produced an efficient pre-train model, saving the best-performing model's weights for future analysis.

Document Content Extraction and Comprehension Using LLM **2024.01 ~ 2025.04** ***(expected)***
Advisor: Prof. Xiaoqing Lv, Wangxuan Institute of Computer Technology, Peking University
- ✧ Developed an email parsing and recommendation system using LLM libraries like SpaCy and keyBERT to evaluate keyword importance and grammatical weights, creating a service that parses subscribed arXiv alerts; realized the delivery of personalized recommendation lists of research articles based on the parsed data.
- ✧ Linked the email parsing service to a self-developed GPT-4-based document digestion website system and enabled the system to extract illustrations from articles and generate descriptive PPT and video presentations for enhanced visualization.
- ✧ Deployed PaddleOCR for paper chart extraction and segmentation, parsing them into sub-graphs for further content analyses.

Next Step:
- ✧ Create a recommendation system integrating a Multimodal Knowledge Graph with a previous email system to analyze documents and generate personal paper alerts based on information including titles, abstracts, images dataset links, etc.

Orthodontics Image Classification Based on Adapter Learning **2024.05 ~ present**

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Advisor: Prof. Hongliang Ren, the Chinese University of Hong Kong

- ✧ Engaged in the adapter learning-based orthodontics image classification using MMPretrain to train mainstream pipelines, including ResNet50, Vision Transformer, Swin Transformer, and Surgical-Dino for classifying orthodontic diseases.
- ✧ Linked pre-trained model with Relational Graph Convolutional Network(RCGN) to enhance the classification performance.
- ✧ Combined two numerical indices with visual representations and simultaneously trained the model to decline the three losses together.
- ✧ Added CaGCN and Flag methods to calibrate the result.

Next Step:

- ✧ Fine-tune the trained models by editing the learning rate and dropout amount on limited orthodontics classification datasets to enhance their accuracy and robustness; evaluate model performance using metrics such as accuracy, precision, recall, and F1-score.

Low-Light Image Enhancement Based on Promptable Diffusion Transformer **2024.01 ~ 2024.04**

Advisor: Prof. Hongliang Ren, the Chinese University of Hong Kong

- ✧ Introduced EndoUIC, the Wireless Capsule Endoscopy (WCE) unified illumination correction solution using an end-to-end promptable diffusion transformer (DFT) model for low-light enhancement to correct both underexposed and overexposed regions in WCE images.
- ✧ Enabled the Adaptive Prompt Integration (API) and Global Prompt Scanner (GPS) modules to boost the concurrent representation learning between the prompt parameters and features.
- ✧ Employed two EC datasets and two LLIE datasets; compared the performance of the EndoUIC framework with various state-of-the-art (SOTA) LLIE and EC methodologies, validating its efficacy in performing endoscopic LLIE and EC tasks.

Common Dental Diseases Detection Based on Two-dimensional (2D) Dental X-ray **2023.04 ~ 2024.04**

Provincial Level in College Students' Innovative Entrepreneurial Training Plan Program, Beijing

Project Leader, Advisor: Prof. Jie Liu, BJTU

- ✧ Optimized the segmentation effect of X-ray images based on automatic threshold image segmentation technology and image edge segmentation in oral treatment and improved the efficiency of image processing.
- ✧ Constructed oral image segmentation algorithm, performed image morphological operations using the Canny edge detection algorithm, and conducted denoising and loopholes filling; obtained smooth and clear images.
- ✧ Constructed an oral image classification algorithm and compared it with the medical diagnosis results; detected the accuracy and feasibility of the optimized X-ray technology, automatically identified different tooth structures, and analyzed common dental diseases.
- ✧ Designed software front-end and back-end frameworks, debugged and improved graphics processing model functions.

Self-supervised Image Segmentation on Oral Images **2023.07 ~ 2024.03**

Main Contributor, Advisor: Prof. Xinze Luan, ETH

- ✧ Worked as both the first author and corresponding author to develop and fine-tune a Segment Anything (SAM) model based on MedSAM for precise segmentation of impacted teeth in panoramic X-ray images.
- ✧ Conducted the zero-shot segmentation using gravity center cues for intuitive tooth segmentation in dental imaging and carried out the center of mass extraction as a landmark for accurate and efficient zero-shot tooth detection.

Human Activity Classification Using Micro-Doppler Signatures and Ranging Techniques **2023.12 ~ 2024.02**

Main Contributor, Advisor: Dr. Anna Li, Lecturer (Assistant Professor), Lancaster University

- ✧ Proposed a Convolutional Neural Network (CNN) for feature extraction in micro-Doppler signature analysis and target classification, achieving accuracies of 97% to 100%.
- ✧ Built Long Short-term Memory (LSTM) and Temporal Convolutional Network (TCN) models for classifying trajectory samples, with TCN achieving the best overall accuracy of 99.49%.

Telemedicine-oriented Smart Mirror **2023.06 ~ 2024.06**

Main Contributor, Advisor: Prof. Bingyi Hu, BJTU (Patent Submitted)

- ✧ Introduced the adapted Multi-task Cascaded Convolutional Neural Network (MTCNN) to capture human face features and critical points. It was implemented on a smart mirror to obtain objective and diagnostic data for medical conclusions.
- ✧ Used the Gaussian Mixture Model to compare the color card of the face diagnosis image with the face color after correction and denoising, integrating white balance adjustments to mitigate dark environment influences and accurately trace targeted human faces.
- ✧ Detected abnormal color changes and reported the result to experts to judge, while also sending alerts to users for help.

Transformer-Based Visual Question Answering Model Comparison **2023.01 ~ 2023.05**

Project Leader, Advisor: Prof. Lei Wang, Institute of Computational Linguistics, Peiking University

- ✧ Led research on the VQA model with Vision-Language Learning and single-task models, including comparing and fine-tuning Transformer-based models LXMERT and UNITER.
- ✧ Conducted experiments on the COCO dataset, evaluated VQA performance, reviewed VQA literature, and explored optimization through fine-tuning.

Technical Skills

Computer Skills: Proficient in Python, PyTorch, SQL, C, C++, C#, Java, Assembly Language, MATLAB, Erlang, JavaScript, and Git; Self-learned development tools such as Unreal engine, Unity, C4D, Maya, Blender, CAD, Inventor, Tableau.