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: 87.3/100, **GPA:** 3.71/4.0
English Proficiency: TOEFL 106 (Reading 30, Listening 28, Speaking 24, Writing 24), **GRE** 326 (V: 156, Q: 170)
Selected Honorary Awards:

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

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.
Teaching Assistant for Computer Network course, Lancaster University presented by Dr. Anna Li

- ✧ Supported course instruction and student queries

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., & 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)***
He, Z.*, Li, X., & Wang, Y. (2024). ***Deep Learning-based Detection of Impacted Teeth on Panoramic Radiographs.*** Biomedical Engineering and Computational Biology. ***(submitted)***
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)***
Zhou, Y., Lia, R., Lin, H., Hu, H., **He, Z.**, & Lyu, X. (2024). ***SignFlow Bipartite Subgraph Network for Large-scale Signed Bipartite Graph Link Prediction***. NeurIPS 2024 Conference. ***(submitted)***

Research Experience

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.
- ✧ Introduced the SignFlow Bipartite Subgraph Network (SBSN) using a new subgraph sampling-based training strategy to predict link signs with complexity that does not scale with the size of the input graph.
- ✧ Linked the email parsing service to a self-developed GPT-4-based document digestion system and enabled the system to extract illustrations from articles and generate descriptive PPT and video presentations for enhanced visualization.

Next Step:

- ✧ Develop databases to support multiple users and categories, enhancing robustness and scalability and expanding service from arXiv.org to include bioarXiv.org and conferences like CVPR for broader applicability.
- ✧ Create a system integrating Knowledge Graph with LLaMA 3 8B to analyze documents and generate voice-supported mind maps summarizing key content.
- ✧ Implement interactive illustration interpretation, allowing readers to use a cursor to select sections and directly query the LLM for clarification.

Orthodontics Image Classification Based on Adapter Learning **2024.05 ~ present**
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 pretrained model with Relational Graph Convolutional Network(RCGN) to enhance the classification performance.

Next Step:

- ✧ Fine-tune the trained models 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

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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 (Anticipated SCI Journal Publication (3rd Quartile))

- ✧ 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.
- ✧ Achieved exceptional performance metrics, including a 98.33% F1-score, a 96.72% IoU, a 97.38% recall, and a 96.73% accuracy on the test set.

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 two-directional two-dimensional principal component analysis (2D2PCA) for feature extraction in micro-Doppler signature analysis and built a Convolutional Neural Network (CNN) for target classification, achieving accuracies of 97% to 100%.
- ✧ Used two-dimensional LiDAR for indoor human activity detection; clustered LiDAR points into human and non-human classes and tracked human trajectories with the Kalman filter.
- ✧ 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 feature 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.

Hybrid Heuristic Optimization Framework for Enhanced Retail Decision-Making **2023.09 ~ 2023.10**

China Undergraduate Mathematical Contest in Modeling

- ✧ Investigated and applied heuristic algorithms for optimizing pricing and replenishment strategies in vegetable products.
- ✧ Used Discrete Particle Swarm Optimization (DPSO) as the core, integrating Genetic Algorithm (GA) and Simulated Annealing (SA) into a hybrid optimization framework.
- ✧ Developed a simulation model to maximize supermarket profitability, factoring in item choices, replenishment quantities, and pricing strategies with a demonstrated effectiveness of the hybrid optimization approach.

Disinfection Robot For Automatic Cruise and Target Detection **2023.06 ~ 2023.09**

Third Prize in the 6th China International College Students' "Internet+" Innovation and Entrepreneurship Competition

- ✧ Led to adopt the RTAB-Map technology to realize robot positioning and environment map construction, combined with sensor data and intelligent algorithms to realize autonomous obstacle avoidance and optimal path planning.
- ✧ Used Yolov5 object recognition algorithm to identify various objects, with an accuracy rate of 98.5%.

Machine Learning Based Remote Water Quality Testing Robot **2023.04 ~ 2023.08**

Second Prize in the 13th "Challenge Cup" Chinese College Students Entrepreneurship Competition, Beijing

- ✧ Developed a remote water quality monitoring robot, incorporating image and data processing.
- ✧ Established a water quality evaluation model using decision trees and support vector machines (SVM) to analyze watercolor, extract image features, and classify water quality.
- ✧ Detected water quality with pH, TDS, and turbidity sensors, transmitting data via wireless Bluetooth and processing it with an optimized fuzzy neural network for classification results.

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.