

# ZHENRONG SHEN

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## EDUCATION

### [Shanghai Jiao Tong University](#) (SJTU)

Shanghai, China

Ph.D. in Biomedical Engineering; Advisor: [Qian Wang](#)

Sep. 2020 - Jun. 2025

- **Ph.D. Thesis:** Research on Controllable Medical Image Synthesis Methods for Intelligent Disease Diagnosis.

### [Beihang University](#) (BUAA)

Beijing, China

B.Eng. in Biomedical Engineering

Sep. 2016 – Jun. 2020

## HONORS & AWARDS

- [Young Scientist Award](#), MICCAI 2024 Oct. 2024
- Academician Yazhu Chen Scholarship, School of Biomedical Engineering, SJTU Dec. 2023
- 2nd Prize in Student Academic Forum, Medical Imaging Computing Seminar (MICS 2023) Jul. 2023
- 3rd Prize in Student Academic Forum, Medical Imaging Computing Seminar (MICS 2022) Jul. 2022
- 2nd Prize, 17th China Post-graduate Mathematical Contest in Modeling Dec. 2020
- Outstanding Graduate Award, BUAA Jun. 2020
- 1st Prize, National Biomedical Engineering Innovation Design Competition for College Students Jul. 2019
- Meritorious Winner, Interdisciplinary Contest in Modeling (ICM) Apr. 2019
- Meritorious Winner, Interdisciplinary Contest in Modeling (ICM) Apr. 2018

## RESEARCH EXPERIENCE

### Chest X-ray Lung Nodule Synthesis for Lung Nodule Detection

2020 – 2022

- Proposed an inpainting-based lung nodule synthesis network and a synthetic sample selection network to select effective synthetic samples for augmenting lung nodule detection. This work was accepted by *PRCV 2021*.
- Proposed a lung nodule synthesis framework that disentangles nodule attributes (*i.e.*, shape, size, and texture) and synthesize nodules in a controllable manner, and leveraged such controllability to design a hard example mining strategy for augmenting lung nodule detection. This work was accepted by *Medical Image Analysis*.

### Cervical Cytological Image Synthesis for Cervical Abnormality Screening

2022 – 2025

- Proposed CellGAN, a conditional GAN that generates cytological images of various cervical cell types including NILM, ASC-US, ASC-H, LSIL, and HSIL cells for augmenting patch-level cervical cell classification. This work was accepted by *MICCAI 2023 (early accept)*.
- Incorporated CellGAN into a knowledge distillation framework for multi-class cervical cell detection, which facilitates the class-balanced pre-training of a teacher network. This work was accepted by *Neural Networks*.
- Proposed a two-stage diffusion-based framework that hierarchically generates global cervical cytological image and local abnormal cervical cells for augmenting image-level abnormal cervical cell detection. This work was submitted to *Neural Networks (major revision)*.

### Image Super-resolution for Arbitrary MRI Inter-Slice Spacing Reduction

2022 – 2024

- Proposed HiFi-Diff, a diffusion model for arbitrary MRI inter-slice spacing reduction, which generates in-between MR slices from adjacent MR slices in the through-plane direction. This work was accepted by *MLMI 2023*.
- Proposed SA-INR, an implicit neural representation method for arbitrary MRI inter-slice spacing reduction in any direction. This work was accepted by *Medical Image Analysis*.

### Cross-modality PET Image Synthesis for Parkinson's Disease (PD) Diagnosis

2023 – 2025

- Proposed a Metabolism-aware Anomaly Detection (MetaAD) framework, which leverages a cyclic modality

translation workflow to identify metabolism anomalies of PD in  $^{18}\text{F}$ -FDG PET scans. This work was accepted by *MICCAI 2024 (Young Scientist Award)*.

- Propose a two-stage framework that synthesizes  $^{11}\text{C}$ -CFT PET images from real  $^{18}\text{F}$ -FDG PET scans for multi-modal PD diagnosis, which was based on the correlation between dopaminergic deficiency in the striatum and increased glucose metabolism in PD patients. This work was accepted by *European Journal of Nuclear Medicine and Molecular Imaging*.

#### **Whole-body MR-to-CT Synthesis for PET Attenuation Correction in PET/MR Imaging** 2024 – 2025

- Proposed a whole-body MR-to-CT synthesis framework that integrates structural guidance, spatial alignment, and semantic constraint to enhance synthetic CT image quality, thus facilitating PET attenuation correction. This work was accepted by *Medical Image Analysis*.

### **JOURNAL PUBLICATIONS**

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1. **Cross-Modality PET Image Synthesis for Parkinson's Disease Diagnosis: A Leap from  $^{18}\text{F}$ FDG to  $^{11}\text{C}$ CFT Using Deep Learning**  
Zhenrong Shen\*, Jing Wang\*, Haolin Huang, Jiaying Lu, Jingjie Ge, Honglin Xiong, Ping Wu, Zizhao Ju, Huamei Lin, Yuhua Zhu, Yunhao Yang, Fengtao Liu, Yihui Guan, Kaicong Sun, Qian Wang, Chuantao Zuo.  
*European Journal of Nuclear Medicine and Molecular Imaging*, January 2025.
2. **Image Synthesis with Disentangled Attributes for Chest X-ray Nodule Augmentation and Detection**  
Zhenrong Shen, Xi Ouyang, Bin Xiao, Jie-Zhi Cheng, Dinggang Shen, Qian Wang.  
*Medical Image Analysis*, February 2023.
3. **Two-stage Cytopathological Image Synthesis for Augmenting Cervical Abnormality Screening**  
Zhenrong Shen\*, Manman Fei\*, Xin Wang, Jiangdong Cai, Sheng Wang, Lichi Zhang, Qian Wang.  
*Neural Networks (major revision)*.
4. **Structure-Guided MR-to-CT Synthesis with Spatial and Semantic Alignments for Attenuation Correction of Whole-Body PET/MR Imaging**  
Jiaxu Zheng\*, Zhenrong Shen\*, Lichi Zhang, Qun Chen.  
*Medical Image Analysis*, April 2025.
5. **Distillation of Multi-class Cervical Lesion Cell Detection via Synthesis-aided Pre-training and Patch-level Feature Alignment**  
Manman Fei, Zhenrong Shen, Zhiyun Song, Xin Wang, Maosong Cao, Linlin Yao, Xiangyu Zhao, Qian Wang, Lichi Zhang.  
*Neural Networks*, October 2024.
6. **Segment Anything Model for Medical Image Segmentation: Current Applications and Future Directions**  
Yichi Zhang, Zhenrong Shen, Rushi Jiao.  
*Computers in Biology and Medicine (Highly Cited Paper)*, March 2024.
7. **Improving Self-Supervised Medical Image Pre-Training by Early Alignment with Human Eye Gaze Information**  
Sheng Wang\*, Zihao Zhao\*, Zhenrong Shen, Bin Wang, Qian Wang, Dinggang Shen.  
*IEEE Transactions on Medical Imaging*, January 2025.
8. **Learning Contrast and Content Representations for Synthesizing Magnetic Resonance Image of Arbitrary Contrast**  
Honglin Xiong, Yulin Wang, Zhenrong Shen, Kaicong Sun, Yu Fang, Yan Chen, Dinggang Shen, Qian Wang.  
*Medical Image Analysis*, May 2025.
9. **Exploring Multi-Connectivity and Subdivision Functions of Brain Network via Heterogeneous Graph Network for Cognitive Disorder Identification**  
Dongdong Chen, Mengjun Liu, Zhenrong Shen, Linlin Yao, Xiangyu Zhao, Zhiyun Song, Haolei Yuan, Qian

Wang, Lichi Zhang.

*IEEE Transactions on Neural Networks and Learning Systems*, October 2024.

10. **sTBI-GAN: An Adversarial Learning Approach for Data Synthesis on Traumatic Brain Segmentation**  
Xiangyu Zhao\*, Di Zang\*, Sheng Wang, Zhenrong Shen, Kai Xuan, Zeyu Wei, Zhe Wang, Ruizhe Zheng, Xuehai Wu, Zheren Li, Qian Wang, Zengxin Qi, Lichi Zhang.  
*Computerized Medical Imaging and Graphics*, March 2024.
11. **Uni-COAL: A Unified Framework for Cross-Modality Synthesis and Super-Resolution of MR Images**  
Zhiyun Song, Zengxin Qi, Xin Wang, Xiangyu Zhao, Zhenrong Shen, Sheng Wang, Manman Fei, Zhe Wang, Di Zang, Dongdong Chen, Linlin Yao, Qian Wang, Xuehai Wu, Lichi Zhang.  
*Expert Systems with Applications*, December 2024.
12. **Spatial Attention-based Implicit Neural Representation for Arbitrary Reduction of MRI Slice Spacing**  
Xin Wang\*, Sheng Wang\*, Honglin Xiong, Kai Xuan, Zixu Zhuang, Mengjun Liu, Zhenrong Shen, Xiangyu Zhao, Lichi Zhang, Qian Wang.  
*Medical Image Analysis*, May 2024.
13. **DW-Net: A Cascaded Convolutional Neural Network for Apical Four-chamber View Ssegmentation in Fetal Echocardiography**  
Lu Xu, Mingyuan Liu, Zhenrong Shen, Hua Wang, Xiaowei Liu, Xin Wang, Siyu Wang, Tiefeng Li, Shaomei Yu, Min Hou, Jianhua Guo, Jicong Zhang, Yihua He.  
*Computerized Medical Imaging and Graphics*, May 2020.

## CONFERENCE PUBLICATIONS

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1. **CellGAN: Conditional Cervical Cell Synthesis for Augmenting Cytopathological Image Classification**  
Zhenrong Shen, Maosong Cao, Sheng Wang, Lichi Zhang, Qian Wang.  
*MICCAI 2023 (early accept)*, October 2023.
2. **Nodule Synthesis and Selection for Augmenting Chest X-ray Nodule Detection**  
Zhenrong Shen\*, Xi Ouyang\*, Zhuochen Wang, Yiqiang Zhan, Zhong Xue, Qian Wang, Jie-Zhi Cheng, Dinggang Shen.  
*Chinese Conference on Pattern Recognition and Computer Vision (PRCV)*, October 2021.
3. **MetaAD: Metabolism-Aware Anomaly Detection for Parkinson's Disease in 3D <sup>18</sup>F-FDG PET**  
Haolin Huang\*, Zhenrong Shen\*, Jing Wang\*, Xinyu Wang, Jiaying Lu, Huamei Lin, Jingjie Ge, Chuantao Zuo, Qian Wang.  
*MICCAI 2024 (Young Scientist Award)*, October 2024.
4. **Arbitrary Reduction of MRI Inter-slice Spacing Using Hierarchical Feature Conditional Diffusion**  
Xin Wang\*, Zhenrong Shen\*, Zhiyun Song, Sheng Wang, Mengjun Liu, Lichi Zhang, Kai Xuan, Qian Wang.  
*MICCAI 2023 Workshop on Machine Learning in Medical Imaging (MLMI 2023)*, October 2023.
5. **Refining Cervical Cell Classification with Cytological Knowledge and Optimal Attribute Descriptor Matching**  
Manman Fei, Zhenrong Shen, Mengjun Liu, Zhiyun Song, Yusong Sun, Xu Han, Zelin Liu, Haotian Jiang, Lu Bai, Qian Wang, Lichi Zhang.  
*MICCAI 2025*, September 2025.
6. **MeLo: Low-rank Adaptation Is Better Than Fine-tuning for Medical Image Diagnosis**  
Yitao Zhu, Zhenrong Shen, Zihao Zhao, Sheng Wang, Xin Wang, Xiangyu Zhao, Dinggang Shen, Qian Wang.  
*ISBI 2024 (oral)*, May 2024.
7. **One-Shot Traumatic Brain Segmentation with Adversarial Training and Uncertainty Rectification**  
Xiangyu Zhao, Zhenrong Shen, Dongdong Chen, Sheng Wang, Zixu Zhuang, Qian Wang, Lichi Zhang.  
*MICCAI 2023 (early accept)*, October 2023.

8. **Consistent 3D Medical Image Inpainting via Implicit Representation and Multi-View Sampling**  
Yuqi Hu, Zhenrong Shen, Zhiyun Song, Dongdong Chen, Liao Wang, Lichi Zhang.  
*ICICSP 2024, September 2024.*
9. **Weakly Semi-Supervised Cervical Lesion Cell Detection via Twin-Memory Augmented Multiple Instance Learning**  
Manman Fei, Zhiyun Song, Zhenrong Shen, Mengjun Liu, Qian Wang, Lichi Zhang.  
*MICCAI 2025, September 2025.*
10. **Learnable Subdivision Graph Neural Network for Functional Brain Network Analysis and Interpretable Cognitive Disorder Diagnosis**  
Dongdong Chen, Mengjun Liu, Zhenrong Shen, Xiangyu Zhao, Qian Wang, Lichi Zhang.  
*MICCAI 2023, October 2023.*
11. **Multi-Tracer Uptake Correction for PET-MR via Aligned-Feature Guidance and Multi-scale Pixel-adaptive Routing**  
Aocheng Zhong\*, Haolin Huang\*, Jing Wang\*, Zhenrong Shen, Haiyu Song, Yuhua Zhu, Yang Liu, Junlei Wu, Qian Wang, Chuantao Zuo.  
*MICCAI 2025 (early accept), September 2025.*
12. **Multi-task Screening for Cervical Diseases via Feature Routing and Asymmetric Distillation**  
Haotian Jiang\*, Haolin Huang\*, Jiangdong Cai, Zhenrong Shen, Manman Fei, Mengjie Xu, Xinyu Wang, Lichi Zhang, Qian Wang.  
*MICCAI 2025 (early accept), September 2025.*
13. **RSAD: Region-Specific Anomaly Detection in fMRI for Disease Diagnosis**  
Yusong Sun, Dongdong Chen, Mengjun Liu, Zhenrong Shen, Zhiyun Song, Yuqi Hu, Manman Fei, Xu Han, Zelin Liu, Xingkai Fang, Lu Bai, Lichi Zhang.  
*MICCAI 2025 (early accept), September 2025.*
14. **Self-supervised Learning with Adaptive Graph Structure and Function Representation for Cross-Dataset Brain Disorder Diagnosis**  
Dongdong Chen, Linlin Yao, Mengjun Liu, Zhenrong Shen, Yuqi Hu, Zhiyun Song, Qian Wang, Lichi Zhang.  
*MICCAI 2024, October 2024.*
15. **CAS-Net: Cross-View Aligned Segmentation by Graph Representation of Knees**  
Zixu Zhuang\*, Xin Wang\*, Sheng Wang\*, Zhenrong Shen, Xiangyu Zhao, Mengjun Liu, Zhong Xue, Dinggang Shen, Lichi Zhang, Qian Wang.  
*MICCAI 2023, October 2023.*
16. **Robust Cervical Abnormal Cell Detection via Distillation from Local-Scale Consistency Refinement**  
Manman Fei, Xin Zhang, Maosong Cao, Zhenrong Shen, Xiangyu Zhao, Zhiyun Song, Qian Wang, Lichi Zhang.  
*MICCAI 2023, October 2023.*
17. **MITracker: Multi-View Integration for Visual Object Tracking**  
Mengjie Xu\*, Yitao Zhu\*, Haotian Jiang, Jiaming Li, Zhenrong Shen, Sheng Wang, Haolin Huang, Xinyu Wang, Han Zhang, Qing Yang, Qian Wang.  
*CVPR 2025 (highlighted), June 2025.*
18. **Gaze-DETR: Using Expert Gaze to Reduce False Positives in Vulvovaginal Candidiasis Screening**  
Yan Kong\*, Sheng Wang\*, Jiangdong Cai, Zihao Zhao, Zhenrong Shen, Yonghao Li, Manman Fei, Qian Wang.  
*MICCAI 2024 (early accept), October 2023.*
19. **Longitudinal Image Synthesis for Early Brain Development with Age Awareness**  
Yu Fang, Honglin Xiong, Jiawei Huang, Xin Wang, Zhenrong Shen, Feihong Liu, Xinyi Cai, Han Zhang, Qian Wang.  
*ISBI 2025, April 2025.*

20. **Alias-Free Co-modulated Network for Cross-Modality Synthesis and Super-Resolution of MR Images**  
Zhiyun Song, Xin Wang, Xiangyu Zhao, Sheng Wang, Zhenrong Shen, Zixu Zhuang, Mengjun Liu, Qian Wang, Lichi Zhang.  
*MICCAI 2023 (early accept), October 2023.*

## **ACTIVITIES**

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- **Journal Reviewer**  
*Medical Image Analysis*  
*IEEE Transactions on Neural Networks and Learning Systems*  
*IEEE Transactions on Multimedia*  
*IEEE Journal of Biomedical and Health Informatics*  
*Neural Networks*  
*Computerized Medical Imaging and Graphics*  
*Medical & Biological Engineering & Computing*
- **Conference Reviewer**  
*Medical Image Computing and Computer Assisted Interventions (MICCAI)*  
*IEEE International Symposium on Biomedical Imaging (ISBI)*  
*IEEE International Symposium on Biomedical Imaging (ISBI)*
- **Teaching Assistant**  
*Computer Vision in Biomedical Engineering (SJTU BME7001) at Spring 2024*