

# ZHENRONG SHEN

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## EDUCATION

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

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

Shanghai, China

Sep. 2020 - Jun. 2025

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

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

B.Eng. in Biomedical Engineering

Beijing, China

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

### Controllable Lesion Data Synthesis

#### 1. 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**.

#### 2. Cervical Cytological Image Synthesis for Cervical Abnormality Screening

2022 – 2024

- 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**.

### Cross-modality Medical Image Synthesis

#### 1. PET Image Synthesis for Parkinson's Disease (PD) Diagnosis

2023 – 2025

- 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**.
- 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 early accepted by **MICCAI 2024 (Young Scientist Award)**.

## 2. Whole-body MR-to-CT Synthesis for PET Attenuation Correction

2023 – 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 in whole-body PET/MR Imaging. This work was accepted by *Medical Image Analysis*.

## Medical Image Quality Enhancement

### 1. MRI Super-resolution for Arbitrary MRI Inter-Slice Spacing Reduction

2022 – 2023

- Proposed HiFi-Diff, a diffusion model for arbitrary MRI inter-slice spacing reduction in the through-plane direction by generating in-between MR slices from adjacent MR slices. This work was accepted by *MLMI 2023*.

## JOURNAL PUBLICATIONS

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### 1. Cross-Modality PET Image Synthesis for Parkinson's Disease Diagnosis: A Leap from [<sup>18</sup>F]FDG to [<sup>11</sup>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. 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.

### 4. 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.

### 5. 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.

### 6. 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.

### 7. 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.

### 8. 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.

### 9. 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.

10. **A Deep Learning Framework for Synthesizing Longitudinal Infant Brain MRI During Early Development**  
Yu Fang\*, Honglin Xiong\*, Jiawei Huang, Feihong Liu, **Zhenrong Shen**, Xinyi Cai, Han Zhang, Qian Wang.  
*Radiology: Artificial Intelligence, August 2025.*
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 Segmentation 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.*

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## ACTIVITIES

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- **Journal Reviewer**

*Medical Image Analysis*  
*IEEE Transactions on Medical Imaging*  
*IEEE Transactions on Neural Networks and Learning Systems*  
*IEEE Transactions on Multimedia*  
*IEEE Journal of Biomedical and Health Informatics*  
*Information Fusion*  
*Pattern Recognition*  
*Neural Networks*  
*NeuroImage*  
*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)*

- **Teaching Assistant**

*Computer Vision in Biomedical Engineering (SJTU BME7001)* at Spring 2024