# 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*

## 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 $^{18}$F-FDG PET scans. This work was accepted by ***MICCAI 2024 (Young Scientist Award)***.
- Propose a two-stage framework that synthesizes $^{11}$C-CFT PET images from real $^{18}$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

1. **Cross-Modality PET Image Synthesis for Parkinson's Disease Diagnosis: A Leap from [$^{18}$F]FDG to [$^{11}$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

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 $^{18}$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. **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*.

6. **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*.

7. **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*.

8. **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*.

9. **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*.

10. **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*.

11. **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*.

12. **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*.

13. **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*.

14. **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*.

15. **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

- **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

## 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*
- (Twice) Meritorious Winner, Interdisciplinary Contest in Modeling (ICM) *2018 & 2019*