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 (expected)*

- **Ph.D. Thesis:** Research on Controllable Image Synthesis for Medical Images of Diseases.

Beihang University (BUAA) **Beijing, China**

B.Eng. in Biomedical Engineering *Sep. 2016 – Jun. 2020*

RESEARCH EXPERIENCE

Cervical Cytological Image Synthesis for Cervical Lesion 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.
- Incorporated CellGAN into a knowledge distillation framework for multi-class abnormal cervical cell detection, which facilitates the class-balance pre-training of a teacher network.
- One paper accepted by ***MICCAI 2023 (early accept)***; one paper accepted by ***Neural Networks***.

Chest X-ray Lung Nodule Synthesis for Lung Nodule Detection *2020 – 2022*

- Proposed an inpainting-based lung nodule synthesis network and a classification-based sample selection network to select effective synthetic samples for augmenting lung nodule detection.
- Proposed a lung nodule synthesis framework that disentangles nodule attributes (*i.e.*, shape, size, and texture) and synthesize nodules in a controllable manner. Leveraged the controllability of the framework to design a hard example mining strategy for data augmentation on lung nodule detection.
- One paper accepted by ***PRCV 2021***; one paper accepted by ***Medical Image Analysis***.

Cross-Modality PET Image Synthesis for Parkinson's Disease (PD) Diagnosis *2023 – 2024*

- Propose a two-stage framework that synthesizes ^{11}C-CFT PET images from real ^{18}F-FDG PET scans for automatic PD diagnosis, which was based on the correlation between dopaminergic deficiency in the striatum and increased glucose metabolism in PD patients.
- 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.
- One paper accepted by ***MICCAI 2024 (early accept)***; one paper submitted to ***npj Digital Medicine*** *(in submission).*

Whole-body MR-to-CT Synthesis for PET Attenuation Correction *2023 – 2024*

- Proposed a whole-body MR-to-CT synthesis framework that integrates structural guidance, spatial alignment, and semantic authenticity to enhance synthetic CT image quality, thus facilitating PET attenuation correction.
- One paper submitted to ***IEEE Transactions on Medical Imaging*** *(in submission).*

MR Image Super-resolution for Arbitrary Inter-slice Spacing Reduction *2022 – 2023*

- Proposed HiFi-Diff, a diffusion-based MRI super-resolution model for arbitrary inter-slice spacing reduction, which generates any desired in-between MR slice from hierarchical features of adjacent MR slices.
- Proposed SA-INR, which represents an MR image as a continuous implicit function of 3D coordinates and performs arbitrary inter-slice spacing by sampling the coordinates in 3D space.
- One paper accepted by ***MLMI 2023***; one paper accepted by ***Medical Image Analysis***.

JOURNAL PUBLICATIONS

1. **Cross-Modality PET Image Synthesis toward 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.
   npj Digital Medicine (in submission).

2. **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 (under review).
3. **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.
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.
   IEEE Transactions on Medical Imaging (in submission).
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, March 2024.
7. **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.
8. **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.
9. **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.
10. **AdLER: Adversarial Training with Label Error Rectification for One-Shot Medical Image Segmentation**
    Xiangyu Zhao, Sheng Wang, Zhiyun Song, **Zhenrong Shen**, Linlin Yao, Haolei Yuan, Qian Wang, Lichi Zhang.
    IEEE Transactions on Neural Networks and Learning Systems (under review).
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 (under review).

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 (early accept), 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. **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.
8. **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.
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. **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.
11. **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.
12. **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**
  IEEE Transactions on Multimedia
  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)
- **Teaching Assistant**
  Computer Vision in Biomedical Engineering (SJTU BME7001) at Spring 2024

HONORS & AWARDS

- Academician Yazhu Chen Scholarship, SJTU *Dec. 2023*
- 2nd Prize of Student Academic Forum, Medical Imaging Computing Seminar (MICS 2023) *Jul. 2023*
- 3rd Prize of 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*