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

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***.

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***.

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

- 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.
- 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.
- One paper accepted by ***MICCAI 2024 (early accept & oral & Best Paper Award Nomination)***; one paper submitted to ***European Journal of Nuclear Medicine and Molecular Imaging*** *(under review)*.

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*** *(under review)*.

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

- Proposed HiFi-Diff, an MR image super-resolution diffusion model for arbitrary reduction of inter-slice spacing, which generates any desired in-between MR slice from hierarchical features of adjacent MR slices.
- One paper accepted by ***MLMI 2023***.

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. *European Journal of Nuclear Medicine and Molecular Imaging (under review)*.
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 (under review).
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 Artificial Intelligence (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 & oral & Best Paper Award Nomination), 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*