# Jiangjie Wu

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## Research Interests

**Fetal MRI**

o Fetal MRI Reconstruction, Motion Correction, Fetal Atlas Construction, Fetus development, etc.

**Model-based Deep Learning for Medical Imaging**

o Deep Image Prior, Neural Representation, Diffusion Model, etc.

## Education

**ShanghaiTech University**                                                           **Sep. 2020 - present**

o *Ph.D. Candidate in Computer Science*; Advisor: Prof. Yuyao Zhang

**Yunnan University**                                                                 **Sep. 2016 - July 2020**

o *B.Eng. in Software Engineering*; Outstanding Graduate

## Research Experience

**Fetal Brain MRI Artifacts Decoupling**                                            **May. 2023 – Present**

Advisor: *Prof. Yuyao Zhang*                                                        ShanghaiTech University

o Proposed an unsupervised method to remove the intra-slice artifacts of fetal brain MRI from the acquired artifact-corrupted slices.
o Incorporated a differentiable MRI slice acquisition model with a local-global motion correction module and an artifact decoupling module into an implicit neural representation (INR) framework, enabling the reconstruction of high-quality slices.
o Experimented on simulated and clinical data. Achieved outstanding performance in artifact removal.

**High-resolution 3D Isotropic Fetal Brain MRI Reconstruction**                     **July. 2021 – July 2023**

Advisor: *Prof. Yuyao Zhang* | Venue: *IEEE ISBI 2023, IEEE TMI (major revision)*   ShanghaiTech University

o Proposed an unsupervised iterative SVR-SRR framework for reconstruction from multiple motion-corrupted stacks of 2D thick slices without using external databases.
o Incorporated the MRI acquisition model into the SVR network to accurately predict the spatial transformation matrix aligning 2D slices to 3D volumes, providing a good initial volume for SRR.
o Utilized decoding network of DIP framework for SRR process to represent and reconstruct HR 3D volumes.
o Outperformed SOTA methods in four metrics on both simulated and clinical data.

**Age-specific Fetal Brain Atlas Reconstruction**                                   **May. 2020 – July 2021**

Advisor: *Prof. Hongjiang Wei*,*Prof. Yuyao Zhang* | Venue: *IEEE EMBC 2021, NeuroImage*   ShanghaiTech University

o Proposed a quantitative fetal brain cortex analysis pipeline and built the fetal brain atlas to analyze the fetal brain development of the Chinese population and identify abnormalities in fetal brains.
o Generated a set of age-specific Chinese fetal atlases between 21-35 weeks of gestation based on the ANTs.
o Developed an automatic fetal brain cortex reconstruction and quantitative growth parameter measurement tool based on FreeSurfer.
o Utilized the proposed atlases as a reference for representing characteristic development to identify abnormalities of fetal brains.

**Motion Correction in Parallel MRI with Score-Based Diffusion Model**              **May. 2023 – Sep. 2023**

Advisor: *Prof. Hongjiang Wei*, *Prof. Yuyao Zhang* | Venue: *IEEE TMI (under review)*   ShanghaiTech University

o Proposed an unsupervised method jointly estimating the motion parameters and coil sensitivity maps for accelerated MRI reconstruction.
o Introduced score-based diffusion models as powerful priors and leveraged the physical acquisition process in multi-coil MRI to efficiently constrain the solution space, enabling accurate estimation and reconstruction.
o Outperformed traditional model-based and contemporary score-based SOTA methods on the fastMRI dataset.

**Longitudinal Brain Atlas Construction via Implicit Neural Representation**         **July. 2021 – July 2023**

Advisor: *Prof. Yuyao Zhang* | Venue: *MICCAI Workshop PIPPI 2022, IEEE TMI (under review)*      ShanghaiTech University

- Alleviated the temporal inconsistency issue caused by independently averaging brain images at discrete time points in existing longitudinal atlas construction methods.
- Formulated the time inconsistency issue as a 4D image denoising task, and used implicit neural representation to construct continuous and noise-free longitudinal brain atlases.
- Improved temporal consistency while maintaining accurate representation of brain structures on two modalities of brain atlases (QSM adult and T2 fetus atlases).

## Publications

1. Jiangjie Wu, Lixuan Chen, Zhenghao Li, Lihui Wang, Rongpin Wang, Hongjiang Wei, Yuyao Zhang ● *"SUFFICIENT: A Scan-specific Unsupervised Deep Learning Framework for High-resolution 3D Isotropic Fetal Brain MRI Reconstruction"* ● IEEE Transactions on Medical Imaging (**IEEE TMI**) ● Major Revision

2. Jiangjie Wu, Lixuan Chen, Zhenghao Li, Lihui Wang, Rongpin Wang, Hongjiang Wei, Yuyao Zhang ● *"ASSURED: A Self-supervised Deep Decoder Network for Fetus Brain MRI Reconstruction"* ● IEEE 20th International Symposium on Biomedical Imaging (**IEEE ISBI 2023**) ● PDF

3. Jiangjie Wu, Taotao Sun, Boliang Yu, Zhenghao Li, Qing Wu, Yutong Wang, Zhaoxia Qian, Yuyao Zhang, Ling Jiang, Hongjiang Wei, ● *"Age-specific structural fetal brain atlases construction and cortical development quantification for Chinese population"* ● (**NeuroImage 2021**) ● PDF

4. Jiangjie Wu, Boliang Yu, Lihui Wang, Qing Yang, Yuyao Zhang ● *"Longitudinal Chinese population structural fetal brain atlases construction: toward precise fetal brain segmentation"* ● 2021 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (**EMBC 2021**) ● PDF

5. Lixuan Chen, Jiangjie Wu, Qing Wu, Hongjiang Wei, Yuyao Zhang ● *"COLLATOR: Consistent Spatial-Temporal Longitudinal Atlas Construction via Implicit Neural Representation"* ● IEEE Transactions on Medical Imaging (**IEEE TMI**) ● Under Review

6. Lixuan Chen, Xuanyu Tian, Jiangjie Wu, Ruimin Feng, Guoyan Lao, Yuyao Zhang, Hongjiang Wei ● *"JSMoCo: Joint Coil Sensitivity and Motion Correction in Parallel MRI with a Self-Calibrating Score-Based Diffusion Model"* ● IEEE Transactions on Medical Imaging (**IEEE TMI**) ● Under Review ● PDF

7. Lixuan Chen, Jiangjie Wu, Qing Wu, Hongjiang Wei, Yuyao Zhang ● *"Continuous Longitudinal Fetus Brain Atlas Construction via Implicit Neural Representation"* ● International Workshop on Preterm, Perinatal and Paediatric Image Analysis (**MICCAI workshop PIPPI 2022**) ● Best Paper Honorable Mention Award ● PDF

## Internship Experience

**MED-X Research Institute**                                      **May 2020 - July. 2021**
Research Intern; Supervisor: *Prof. Hongjiang Wei*

- Quantitative analysis of the fetal brain with Fetal Growth Restriction (FGR).
- Developed an automated tool for fetal MRI processing, encompassing volume and cortex reconstruction, brain tissue segmentation, and measurement of quantitative growth parameters.
- Utilized in clinical FGR data and effectively employed for subsequent analytical purposes.

## Teaching Experience

**BME2101: Medical image processing and analysis, Fall 2021**        **ShanghaiTech University**
Teaching Assistant

- Designing projects, assignments, and quizzes; Grading homework and exams.

## Skills

- **Programming Language**: Python, Matlab, C++, C, Java
- **Tools & Framework**: ITK-SNAP, FreeSurfer, ANTs, LaTeX, PyTorch
- **Language**: Mandarin (Native), English (Fluent)
- **Other**: Operation of the MRI scanner.