

# Zhangxing Bian

JOHNS HOPKINS UNIVERSITY · WHITING SCHOOL OF ENGINEERING

Baltimore, MD, USA

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## Summary

Have a wide range of project experience, including **medical image analysis, signal processing, and machine learning**. Have strong desire to attack cutting-edge research problems and learn new technologies and tools if the need arises. My skill sets: programming (python, C, C++), deep learning framework (Pytorch), mechanical analysis (finite element softwares), data annotation and visualization (3D slicer, vtk, paraview), Linux system.

## Education

### Johns Hopkins University

Baltimore, USA

PHD CANDIDATE IN ECE (WITH SPECIALIZATION IN MEDICAL IMAGE ANALYSIS)

Sep. 2021 - Dec. 2025 (Expected)

- Selected Courses: Medical Imaging System | Machine Perception | Medical Image Analysis | Deep Learning

### University of Michigan–Ann Arbor

Ann Arbor, USA

M.S. IN ELECTRICAL AND COMPUTER ENGINEERING (WITH SPECIALIZATION IN COMPUTER VISION)

Sep. 2019 - Apr. 2021

- Cumulative GPA: **4.0/4.0**
- Selected Courses: Deep Learning for Computer Vision | Prob&Random Process | Matrix Theory | Machine Learning | Data Science in Python

**Southeast University** Ranked at 21 globally in Automation according to [ARWU](#).

Nanjing, China

B.E. IN AUTOMATION (ELECTRICAL & COMPUTER ENGINEERING)

Sep. 2015 - June. 2019

- Cumulative GPA: **90.04/100** Rank: Top **1/36** National Scholarship, Outstanding Graduate

## Work Experience

### Dept. of Radiology, University of Michigan

Ann Arbor, USA

RESEARCH ASSISTANT, ADVISOR: PROF. NICHOLAS BURRIS

Mar. 2020 - Sep. 2021

- Innovated a technique to decouple **thoracic aortic aneurysm** (TAA) growth into longitudinal and radial components, enhancing disease surveillance accuracy through validation with both computational phantom models and real-patient CT datasets.
- Demonstrated the clinical potential of **anatomically-oriented Jacobian** analysis for assessing TAA disease progression, offering new insights into aneurysm pathophysiology and risk assessment.
- Designed and implemented a CNN-based network incorporating an original **implicit topology** loss for enhanced aortic landmark detection, achieving higher localization accuracy over state-of-the-art Unet architectures on a 207 CTA dataset, with minimal parameter increase.
- Demonstrated the network's clinical application potential by automating aortic **centerline generation** and anatomic sub-region delineation, streamlining processes for aortic disease analysis and assessment of aortic size and growth.
- Validated the proposed pipeline (Vascular Deformation Mapping, VDM) pipeline by engineering 76 synthetic TAA growth phantoms via **Blender** (a 3D modeling software), affirming the method's precision over traditional diameter assessments.
- Demonstrated the robustness of VDM against variables affecting CT data quality, such as respiratory motion and slice thickness, and demonstrated its **superior accuracy** in TAA measurement compared to **manual expert evaluations** with statistically significant results.

## Research Experience

### Dept. of ECE, Johns Hopkins University

Baltimore, USA

RESEARCH ASSISTANT, ADVISOR: PROF. JERRY L. PRINCE

Sep. 2021 - Present

- Developed an efficient algorithm for extracting connectivity information from **diffusion-weighted MRIs**, achieving a significant speedup of 30 to 120 times over traditional methods without sacrificing quality, validated on the Human Connectome Project dataset.
- Introduced a novel **visual representation**, termed "pie-glyph," for neuroimaging connectivity data, significantly enhancing the **interpretability** of intricate neural pathways in subcortical structures for neuroscientific research.
- Developed an innovative deep learning model, **DRIMET**, for **3D incompressible motion estimation** in tagged MRI, addressing challenges like tag fading by introducing a novel sinusoidal transformation of harmonic phase image and a Jacobian determinant-based learning objective.
- Validated DRIMET's efficacy through rigorous validation on **tongue tagged MRI** datasets, encompassing both healthy individuals and glossectomy patients, thereby illustrating its critical role in evaluating and understanding the functional outcomes of oral cancer treatments on speech dynamics.
- Extending DRIMET, developed a pioneering "momenta, shooting, and correction" framework (MomentaMorph) for Lagrangian motion estimation from tagged MRI, leveraging **Lie algebra and Lie group** principles for improved accuracy in the presence of **large motions** and **repetitive patterns**.
- Demonstrated MomentaMorph framework excelled in precision motion field estimation on both synthetic and real tagged MRI data, indicating its promising applicability to a spectrum of dynamic imaging modalities, e.g., cardiac imaging and pulmonary 4DCT scans.

- Developed a unified self-supervised learning model for **optical flow**, **keypoint tracking**, and **video object segmentation** by innovating a multiscale contrastive random walk approach, integrating hierarchy into pixel-level space-time graphs.
- Demonstrated that the model is on par with state-of-the-art **unsupervised** methods for optical flow and video object segmentation, and surpasses current self-supervised models in pose tracking through extensive benchmarking.
- Proposed **a new loss function** that eliminates the need for hand-crafted features and utilized **cycle-consistency** as an additional learning signal, which, combined with multi-frame training, enhanced the performance of two-frame optical flow estimation.

**School of Automation, Southeast University**

- Developed a novel **weakly supervised** framework for **segmentation** of vitiligo lesion in **skin image**, leveraging image-level labels to generate precise saliency maps via saliency propagation on superpixel-based graphs.
- **Created** Vit2019, a meticulously annotated vitiligo **image dataset**, unprecedented in scale as of 2018 with 2,000 images, facilitating the training and benchmarking of the model.
- Demonstrated the effectiveness of the proposed framework against complex challenges including indistinct lesion borders, inconsistent illumination. The model surpassed existing state-of-the-art methods in automated vitiligo lesion segmentation.

**Publications**See Full List: [Google Scholar](#)**Published & Accepted (partial)**

- “Is Registering Raw Tagged-MR Enough for Strain Estimation in the Era of Deep Learning?” **SPIE-MI 2024 (Best Paper Award)**  
*Zhangxing Bian, Ahmed Alshareef, Shuwen Wei, Junyu Chen, Yuli Wang, Jonghye Woo, Dzung L Pham, Jiachen Zhuo, Aaron Carass, Jerry L Prince*
- “MomentaMorph: Unsupervised Spatial-Temporal Registration with Momenta, Shooting, and Correction,” **MICCAI workshop: MTSAIL 2023 (Oral)**  
*Zhangxing Bian, Shuwen Wei, Yihao Liu, Junyu Chen, Jiachen Zhuo, Fangxu Xing, Jonghye Woo, Aaron Carass, Jerry L Prince*
- “DRIMET: Deep Registration-based 3D Incompressible Motion Estimation in Tagged-MRI with Application to the Tongue,” **MIDL 2023 (Oral)**  
*Zhangxing Bian, Fangxu Xing, Jinglun Yu, Muhan Shao, Yihao Liu, Aaron Carass, Jiachen Zhuo, Jonghye Woo, Jerry L Prince*
- “FastCod: Fast Brain Connectivity in Diffusion Imaging,” **SPIE-MI 2023 (Best Paper Award)**  
*Zhangxing Bian, Muhan Shao, Jiachen Zhuo, Rao P Gullapalli, Aaron Carass, Jerry L Prince*
- “Learning Pixel Trajectories with Multiscale Contrastive Random Walks,” **CVPR 2022**  
*Zhangxing Bian, Allan Jabri, Alexei A Efros, Andrew Owens*
- “LitCall: Learning Implicit Topology for CNN-based Aortic Landmark Localization,” **SPIE-MI 2022**  
*Zhangxing Bian, Jiayang Zhong, Yanglong Lu, Chuck R Hatt, Nicholas S Burris*
- “Validation of a Robust Method for Quantification of Three-Dimensional Growth of the Thoracic Aorta Using Deformable Image Registration,” **Medical Physics 2022 (IF: 4.5)**  
*Zhangxing Bian, Jiayang Zhong, Jeffrey Dominic, Gary E Christensen, Charles R Hatt, Nicholas S Burris*
- “Vascular Deformation Mapping for CT Surveillance of Thoracic Aortic Aneurysm Growth,” **Radiology 2022 (IF: 29.1)**  
*Nicholas S Burris (PI), Zhangxing Bian, Jeffrey Dominic, Jiayang Zhong, Ignas B Houben, Theodorus MJ van Bakel, Himanshu J Patel, Brian D Ross, Gary E Christensen, Charles R Hatt*
- “A Deformable Image Registration Based Method to Assess Directionality of Thoracic Aortic Aneurysm Growth,” **SPIE-MI 2021**  
*Zhangxing Bian, Jiayang Zhong, Charles R Hatt, Nicholas S Burris*
- “Weakly Supervised Vitiligo Segmentation in Skin Image through Saliency Propagation,” **IEEE Bioinformatics and Biomedicine (BIBM) 2019**  
*Zhangxing Bian, Siyu Xia, Chao Xia, Shao Ming*

**Media Coverage****Newsletter**

- [April 2024] Is registering raw tagged-MRI enough for strain estimation in the era of deep learning? [[Computer Vision News](#)]
- [Nov. 2022] Accurate and Reliable Measurement of Thoracic Aortic Aneurysm Growth [[SIAM News](#)]
- [Feb. 2022] New technique outperforms manual assessment of thoracic aortic aneurysm growth [[Vascular News](#)]
- [Oct. 2021] Improved CT Surveillance of Thoracic Aortic Aneurysm Growth [[Radiology, Editorial](#)]

**Honors & Awards**

2024	<b>Best Student Paper Award (First Place)</b> , 2024 SPIE Medical Imaging, sponsored by Philips	San Diego, USA
2023	<b>Best Student Paper Award (Second Place)</b> , 2023 SPIE Medical Imaging, sponsored by Philips	San Diego, USA
2018	<b>Mitacs Scholarship</b> , Summer Research Fellowship funded by Canada Gov.	Canada
2016	<b>National Scholarship</b> , The top honor for Chinese university student	China

**Academic Service**

- Reviewer for CVPR, Medical Image Analysis (journal), ACM Multimedia (ACM-MM), Image and Vision Computing (IVC), IEEE International Conference on Machine Learning and Applications (IEEE ICMLA), Computational Intelligence Magazine (CIM), IEEE World Congress on Computational Intelligence (WCCI)