Bohua Wan

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EDUCATION

Johns Hopkins University **GPA: 4.0/4.0** Baltimore, MD
Ph.D. in Computer Science Exp. May 2027

- **Advisors:** Prof. Junghoon Lee & Prof. Russell H. Taylor
- **Key Coursework:** Medical Imaging Systems (A+), Vision as Bayesian Inference (A+), Deep Learning (A), Algorithms for Sensor-Based Robotics (A), Adv. Machine Learning (A+).

Johns Hopkins University **GPA: 4.0/4.0** Baltimore, MD
M.S.E. in Computer Science May 2022

China University of Petroleum **GPA: 91/100** Beijing, China
B.E. in Computer Science and Technology June 2020

RESEARCH EXPERIENCE

Johns Hopkins University Baltimore, MD
Graduate Research Assistant May 2022 – Present

Generative AI for Virtual Clinical Trials (Digital Twins & Simulation)

- Architected a **Conditional Latent Diffusion Model** with a **Stacked VQ-VAE** to synthesize high-fidelity, **full-body 3D CT volumes** (768^3 resolution, $1 \times 1 \times 3\text{mm}^3$ spacing) from the **NMDID dataset (∼800 scans)**.
- Developed a **Synthetic Imaging Trial** framework that accurately predicted a **3x increase in model error** (1.2% to 3.7% MAE) when deploying body composition algorithms to out-of-distribution populations, mirroring real-world deployment challenges.

Deep Learning for Disease Prognosis & Treatment Planning (Clinical Decision Support)

- Engineered a **3D ResNet** framework to predict Xerostomia on **839 patients**, achieving state-of-the-art accuracy (**AUC** = **0.77**) and built an **ITK/Elastix** anatomy normalization pipeline for robust multi-patient registration.
- Developed a **High-Resolution Class Activation Map (CAM)** to visualize voxel-level toxicity risks, utilizing **blur pool** and **adaptive average pooling** to mitigate aliasing artifacts and ensure precise feature localization.
- Implemented a personalized plan optimization technique using CAM-derived contours and **gradients of outcome to dose (∇_{dose})**, successfully converting **7/9** predicted toxicity cases to negative predictions, directly improving treatment planning workflows.

Deep Learning for Pediatric Neuro-Oncology (Cerebellar Mutism Syndrome)

- Adapted the 3D ResNet framework to predict CMS, achieving an **AUC of 0.83**.
- Analyzed model interpretability via **CAM**, identifying the **tumor-brainstem intersection** as a critical risk region to inform pre-surgical planning and risk assessment (Presented at **AAPM**).

Surgical Data Science & Video Understanding

- Designed a **Spatial-Temporal Attention** network supervised by instrument tip locations, achieving a benchmark **AUC of 0.88** in surgical skill assessment.
- Evaluated **Unsupervised and Semi-Supervised Domain Adaptation** methods across diverse datasets (Cataract-101, D99) to ensure model generalizability across different clinical sites and scanner types.

SELECTED PUBLICATIONS

- **B. Wan***, B. D. Killeen*, et al. "Towards Virtual Clinical Trials of Radiology AI with Conditional Generative Modeling." *Submitted to Science Advances (Under Review)*, 2025.
- **B. Wan**, T. McNutt, H. Quon, J. Lee. "Deep learning xerostomia prediction model with anatomy normalization and high-resolution class activation map." *SPIE Medical Imaging*, 2025.
- Z. Gong*, **B. Wan***, et al. "Evaluating the generalizability of video-based assessment of intraoperative surgical skill in capsulorhexis." *International Journal of Computer Assisted Radiology and Surgery (IJCARS)*, 2025.
- **B. Wan**, M. Peven, G. Hager, S. Sikder, S.S. Vedula. "Spatial-temporal attention for video-based assessment of intraoperative surgical skill." *Scientific Reports*, 2024.
- **B. Wan**, T. McNutt, R. Ger, H. Quon, J. Lee. "Deep learning prediction of radiation-induced xerostomia with supervised contrastive pre-training and cluster-guided loss." *SPIE Medical Imaging: Computer-Aided Diagnosis*, 2024.
- **B. Wan**, B. Caffo, S.S. Vedula. "A Unified Framework on Generalizability of Clinical Prediction Models." *Frontiers in Artificial Intelligence*, 2022.
- L. Zhu, **B. Wan**, C. Li, G. Tian, Y. Hou, K. Yuan. "Dyadic relational graph convolutional networks for skeleton-based human interaction recognition." *Pattern Recognition*, 2021.

TECHNICAL SKILLS

Deep Learning:	PyTorch (DDP, Lightning), MONAI, TensorFlow, Diffusion Models, Transformers (ViT), 3D CNNs, Graph Neural Networks (GCN).
Deployment:	C++, CUDA, Docker, Linux, Multi-GPU Optimization, HPC.
Medical Imaging:	ITK/SimpleITK, 3D Slicer, DICOM standards, Registration (Deformable/Rigid).
Programming:	Python, C++, MATLAB, LaTeX, Git, Shell Scripting.

TEACHING EXPERIENCE

Johns Hopkins University Baltimore, MD
Teaching Assistant, Computer Integrated Surgery I Fall 2025

- Led technical instruction for **90+ graduate students**, focusing on the implementation and optimization of **surgical navigation algorithms** (e.g., ICP, pivot calibration) using **Python** and **C++**.
- Reinforced mastery of fundamental concepts in computer-integrated surgery, including **3D coordinate transformations**, **spatial registration**, **medical image analysis**, and **robot kinematics**, helping students bridge the gap between theory and clinical application.