Heyuan Huang

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SUMMARY

- Application of ML/AI in medical imaging for artifact reduction and image quality improvement.
- 5+ years of research experience in medical image reconstruction, processing, and analysis.
- Hands-on experience with medical imaging devices including flat panel detectors and CT systems.

EXPERIENCE

Graduate Research Assistant, Johns Hopkins University, Baltimore, MD 07/2020-now

- Developed learning-based autofocus algorithm for motion artifact reduction in cone-beam CT, leveraging deep CNN for image feature extraction, encouraging realism of reconstructed anatomies.
- Advanced efficient encoding of spatial-temporal 4D information via adaptive sampling strategy and implicit neural representation, which are applied to modeling of patient motion and blood flow.
- Built mathematical foundation for diffusion of quantum noise in projection domain of CT, based on imaging physics, which provides groundwork for noise reduction in CT via stable diffusion methods.
- Adapted image reconstruction and processing pipelines to the Autograd framework of PyTorch, allowing gradient propagation between different domains for fast and reliable optimization.
- Conducted experiments on clinical CT systems, scanning cadavers and realistically built phantoms.
- Collected and processed real patient data obtain from collaboration with radiologists in JH Hospital.

Research Intern, Siemens Healthineers, Princeton, NJ 06/2024-now

- Delivered two prototype foundation models for machine learning based deformable image registration, including preparation of large-scale data, parallel training, evaluation, and ablation study.
- Designed novel network architectures for image registration tasks and filed two invention disclosures.
- Presented progress and findings of assigned projects (won the 2nd place in the Best Intern Poster).
- Communicated with customers, demonstrating our engineering solutions and prototype performance.

Physics Intern, GE Healthcare, Troy, NY 06/2018-08/2018

- Investigated improvement in thallium doping control during production of flat panel X-ray detectors through experimentation of production conditions such as temperature, pressure, and doping duration.
- Built data management toolkit to organize, visualize, and analyze X-ray panel postproduction data for quality control and examination of potential factors affecting the production quality.

Undergraduate Researcher, University of Illinois & Carle Hospital, Urbana, IL 09/2017-09/2019

- Investigated quantitative Positron Emission Tomography (PET) protocols and algorithms.
- Published research in development of amorphous Selenium-based flat panel X-ray detectors.

EDUCATION

Ph.D. in Biomedical Engineering, Johns Hopkins University Expected 04/2025

Research topic: Learning-based Autofocus for Motion Compensation in CT

Coursework: Human Anatomy, Machine Learning, Principles of X-ray Imaging, Medical Image Analysis, Image Processing, Information Theory, Nonlinear Optimization

BSc in Physics, University of Illinois Urbana-Champaign (UIUC) 05/2020 (GPA: 3.90/4.00)

Coursework: Classical Mechanics, Quantum Mechanics, Electrodynamics, Optics, Electronic Circuits

BSc in Nuclear, Plasma, and Radiological Engineering, UIUC 05/2020 (GPA: 3.90/4.00)

Coursework: Imaging Sensors, Radiation Interaction, Radiological Instruments, Biology, Chemistry

PUBLICATION (Google Scholar Page)

Journal Articles

H. Huang, Y. Liu, J.H. Siewerdsen, A. Lu, Y. Hu, W. Zbijewski, M. Unberath, C.R. Weiss, A. Sisniega, "Deformable Motion Compensation in Interventional Cone-Beam CT with a Context-Aware Learned Autofocus Metric," *Med Phys*., 51: 4158–4180, 2024. https://doi.org/10.1002/mp.17125.

H. Huang, J.H. Siewerdsen, W. Zbijewski, C. R. Weiss, M. Unberath, T. Ehtiati, A. Sisniega, "Reference-free learning-based similarity metric for motion compensation in cone-beam CT," in *Physics in Medicine & Biology*, 67 (12), 125020, 2022. https://doi.org/10.1088/1361-6560/ac749a

H. Huang and S. Abbaszadeh, "Recent Development of Amorphous Selenium-Based X-ray Detectors: A Review," in *IEEE Sensors Journal*, 20 (4), 1694-1704, 2019. https://doi.org/10.1109/JSEN.2019.2950319

A. Lu, **H. Huang**, Y. Hu, W. Zbijewski, M. Unberath, J.H. Siewerdsen, C.R. Weiss, A. Sisniega, "Vessel-targeted compensation of deformable motion in interventional cone-beam CT," Medical Image Analysis, 97, 103254, 2024. https://doi.org/10.1016/j.media.2024.103254

Conference Proceedings

H. Huang, A. Lu, F. Gonzalez, T. Ehtiati, J. H. Siewerdsen, A. Sisniega, "Motion Compensation for 4D Digital Subtraction Angiography via Deep Autofocus and Implicit Neural Motion Models," in *8th International Conference on Image Formation in X-Ray Computed Tomography,* CT2024-114, accepted as oral presentation (available upon request).

H. Huang, J. H. Siewerdsen, A. Lu, Y. Hu, W. Zbijewski, M. Unberath, C. R. Weiss, and A. Sisniega, "Multi-stage Adaptive Spline Autofocus (MASA) with a learned metric for deformable motion compensation in interventional cone-beam CT", Proc. SPIE 12463, Medical Imaging 2023: Physics of Medical Imaging, 1246314 (April 2023). https://doi.org/10.1117/12.2654361

H. Huang, J.H. Siewerdsen, W. Zbijewski, C. R. Weiss, M. Unberath, A. Sisniega, "Context-Aware, Reference-Free Local Motion Metric for CBCT Deformable Motion Compensation," in *Proceedings of 7th International Conference on Image Formation in X-Ray Computed Tomography* (June 2022). https://ct-meeting.org/wp-content/uploads/2022/06/CTMeetingProceedings2022.pdf

H. Huang, J.H. Siewerdsen, W. Zbijewski, C. R. Weiss, T. Ehtiati, A. Sisniega, "Reference-Free, Learning-Based Rigid Motion Compensation in Cone-Beam CT for Interventional Neuroradiology," in *AAPM 63rd Annual Meeting & Exhibition.* (July 2021). https://w4.aapm.org/meetings/2021AM/programInfo/programAbs.php?sid=9204&aid=58688

H. Huang, J.H. Siewerdsen, W. Zbijewski, C. R. Weiss, T. Ehtiati, A. Sisniega, "Reference-Free, Learning-Based Image Similarity: Application to Motion Compensation in Cone-Beam CT," in *Proceedings of the 16th Virtual International Meeting on Fully 3D Image Reconstruction in Radiology and Nuclear Medicine* (July 2021). https://arxiv.org/abs/2110.04143