Muhammad Ahmad Sultan, M.S.

Ph.D. Candidate (Final Year), Electrical & Biomedical Engineering

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Education

- **Ph.D. Biomedical Engineering | Post-candidacy** *Dec 2026*
  The Ohio State University, Columbus, OH, USA *(Expected)*
  - GPA: 3.90/4.00
  - Advisor: Rizwan Ahmad, Ph.D., Lab: Cardiovascular Magnetic Resonance Lab [🌐]
  - **Research Focus**: Development of self-supervised deep learning methods for accelerated cardiac MRI reconstruction to improve image quality, reduce scan time, and streamline acquisition workflows.
- **M.S. Biomedical Engineering** *Dec 2024*
  The Ohio State University, Columbus, OH, USA
  - GPA: 3.90/4.00
  - **Relevant Coursework**: Reinforcement Learning, Optimization, Probability Theory, Machine Learning in BME, MR Spectroscopy & Imaging, Medical Imaging & Analysis
- **B.S. Electrical & Computer Engineering | Gold Medalist** *May 2021*
  University of Engineering and Technology, Lahore, Pakistan
  - GPA: 3.90/4.00, Class Rank: 1/180

Relevant Experience

- **Graduate Research Associate @ Cardiovascular Magnetic Resonance Lab [🌐]** *Aug 2022 – Present*
  The Ohio State University, Columbus, OH, USA
  - Developed DISCUS, a self-supervised generative deep learning reconstruction framework, enabling accelerated dynamic MRI reconstruction by combining deep image prior and temporal manifold learning of image series, demonstrating improved diagnostic image quality using NMSE & SSIM as well as cardiologist scoring for single-shot free-breathing LGE imaging. | **Paper** | **Code**
  - Extending ML-DIP framework, a multi-dynamic low-rank deep learning-based generative DIP, to motion-robust 3D LGE imaging with explicit deformation fields for respiratory and cardiac motion, integrating Dixon fat-water modeling for multi-echo and joint sensitivity maps estimation, trained on multi-GPU cluster with NVIDIA H100s, for accelerated ~5-minutes image-navigated (iNAV) acquisition, with better arrhythmia handling. | **MLE-DIPS Abstract** | **Cine ML-DIP Paper**
- **Research Assistant @ Signal, Image & Video Processing Lab** *Aug 2021 – July 2022*
  Lahore University of Management Sciences, Lahore, Pakistan
  - Developed a machine learning pipeline for a Vitals Monitoring System using only PPG time-series data, derived spectro-temporal features, applied regression for cough-less blood pressure estimation, achieved better MAE compared to state-of-the-art methods, integrated vitals in a fingertip oximeter in collaboration with embedded team, enabling continuous and non-invasive monitoring with one wearable sensor outside of a hospital setting. | **Paper**

Skills

- **Research Areas:** Cardiovascular MRI, Accelerated Image Reconstruction, Unsupervised Deep Learning, Time-Series Modeling, Medical Imaging, Generative Modeling, Motion-Robust Imaging, Signal & Image Processing, Inverse Problems
- **Programming Languages & Data Analysis:** Python, C, C++, MATLAB, SQL, Verilog, JMP (DOE)
- **Frameworks & Libraries:** PyTorch, TensorFlow, Multi-GPU training, Keras, Caffe, Scikit-learn, Numpy, Pandas

Journal Publications

- C. Chen, M. Vornehm, Z. Bu, P. Chandrasekaran, **M.A. Sultan**, et al. "A multi-dynamic low-rank deep image prior (ML-DIP) for real-time 3D cardiovascular MRI." *Journal of Cardiovascular Magnetic Resonance Imaging (**JCMR**)*, Nov 2025. | **Paper**
- M. Vornehm, C. Chen, **M.A. Sultan**, et al. "Multi-dynamic deep image prior for cardiac MRI." *Magnetic Resonance in Medicine (**MRM**)*, 94 (6): 2668-2679, July 2025. | **Paper** | **Code**
- **M.A. Sultan**, C. Chen, et al. "An unsupervised method for MRI recovery: Deep image prior with structured sparsity." *Magnetic Resonance Materials in Physics, Biology and Medicine (**MAGMA**)*, 38: 859-871, May 2025. | **Paper** | **Code**
- **M.A. Sultan**, & W. Saadeh, "Continuous patient-independent estimation of respiratory rate and blood pressure using robust spectro-temporal features derived from photoplethysmogram only." *IEEE Open Journal of Engineering in Medicine and Biology (**EMB**)*, 5: 637-649, Nov 2023. | **Paper**

Conference Publications

- **M.A. Sultan**, C. Chen, Y. Liu, et al. "Deep image prior with structured sparsity for dynamic MRI reconstruction." 2024 *IEEE International Symposium on Biomedical Imaging **(ISBI)***, Athens, Greece, 1-5. | **Paper**
- X. Lei, P. Schniter, C. Chen, **M.A. Sultan**, et al. "Surface coil intensity correction for MRI." 2024 *IEEE International Symposium on Biomedical Imaging **(ISBI)***, Athens, Greece, 1-5. | **Paper**
- **M.A. Sultan**, & W. Saadeh, "Robust estimation of respiratory rate from photoplethysmogram with respiration quality analysis." 2022 *IEEE International Symposium on Circuits and Systems **(ISCAS)***, Austin, Texas, USA, 65-69. | **Paper**

Inventions & Patents

- R. Ahmad, **M.A. Sultan**, & S.M. Arshad, "3D real-time cardiovascular magnetic resonance imaging (CMR)." Patent pending, filed on Nov 2025, Application number: PCT/US2025/054129.
- R. Ahmad, **M.A. Sultan**, et al. "Systems and methods for dynamic image reconstruction." Patent pending, filed on Nov 2024, Application number: 63/716,363.

Peer-Reviewed Abstracts

- **M.A. Sultan**, et al. "A motion-robust dual-echo 3D LGE reconstruction framework." *Journal of Cardiovascular Magnetic Resonance (**JCMR**)*, 28. Presented at **SCMR** 2026 Annual Scientific Sessions, Rio de Janeiro, Brazil. | **Link**
- M. Vornehm, C. Chen, **M.A. Sultan**, et al. "Motion-Guided Deep Image Prior for Dynamic Cardiac MRI." 2025 ***ISMRM & ISMRT** Annual Meeting & Exhibition*, Honolulu, Hawai'i, USA. | **Link**
- C. Chen, **M.A. Sultan**, et al. "FlowDIP: Real-time phase-contrast MRI reconstruction with flow-conditional deep image prior." *Journal of Cardiovascular Magnetic Resonance (**JCMR**)*, 27: 101504. Presented at **SCMR** 2025 Annual Scientific Sessions, Washington, DC. | **Link**
- **M.A. Sultan**, et al. "Deep image prior with structured sparsity for dynamic MRI reconstruction." 2023 ***ISMRM & ISMRT** Annual Meeting & Exhibition*, Toronto, Canada. | **Link**

Oral Presentations

- **M.A. Sultan** et al. "Motion-robust whole-heart MRI-based late gadolinium enhancement (LGE) reconstruction framework for accurate assessment of heart fibrosis." 2026 *Edward F. Hayes Advanced Research Forum*, The Ohio State University, Columbus, OH, USA.
- **M.A. Sultan**, C. Chen, Y. Liu, et al. "Deep image prior with structured sparsity for dynamic MRI reconstruction." 2024 *IEEE International Symposium on Biomedical Imaging **(ISBI)***, **Athens, Greece**, 1-5. | **Paper**

Poster Presentations

- **M.A. Sultan**. "Motion-robust 3D late gadolinium enhancement Imaging (LGE)." 2025 *Davis Heart and Lung Research Institute (DHLRI) Research Day'25*, Columbus, OH, USA.
- X. Lei, P. Schniter, C. Chen, **M.A. Sultan**, et al. "Surface coil intensity correction for MRI." 2024 *IEEE International Symposium on Biomedical Imaging **(ISBI)***, **Athens, Greece**, 1-5. | **Paper**
- **M.A. Sultan**, et al. "Deep image prior with structured sparsity for dynamic MRI reconstruction." 2023 ***ISMRM & ISMRT** Annual Meeting & Exhibition*, **Toronto, Canada**. | **Link**

- **M.A. Sultan**, & W. Saadeh, "Robust estimation of respiratory rate from photoplethysmogram with respiration quality analysis." 2022 *IEEE International Symposium on Circuits and Systems* ***(ISCAS)***, **Austin, Texas, USA**, 65-69. | **Paper**

Funding, Honors & Awards

- **NIH-funded PHD Position – Cardiovascular Magnetic Resonance Lab [🌍]** *Aug 2022 - Present*
  The Ohio State University, Columbus, OH, USA
  ◦ Secured a fully-funded GRA Position in CMR Lab by contributing to advisor's grants.
- **Honorable Mention – Top 5 Oral Presenters** *March 2026*
  Edward F. Hayes Advanced Research Forum, Columbus, OH, USA
  ◦ Recognized among the top 5 oral presenters for research presentation excellence.
- **Academic Excellence – Gold Medalist** *July 2021*
  University of Engineering and Technology, Lahore, Pakistan
  ◦ Awarded 5 gold medals for highest departmental GPA across semesters.
- **Merit Scholarship – Top 5 Students** *2017 – 2021*
  University of Engineering and Technology, Lahore, Pakistan
  ◦ Dean's merit scholarship awarded to top 5 undergraduate students each semester.
- **Best Semester Project – ML Class** *Dec 2020*
  University of Engineering and Technology, Lahore, Pakistan
  ◦ Recognized for top project "NLP-based Fake News Detector" for machine learning class.

Pre-doctoral Fellowships Submitted

- **American Heart Association (AHA)**, "Motion-robust dual-echo magnetic resonance imaging-based 3D late gadolinium enhancement." Sept 2025.
- **The Ohio State University Presidential Fellowship**, "Accurate, Comprehensive Assessment of Heart Fibrosis Using 3D Motion-robust MRI-based Late Gadolinium Enhancement (LGE)." Oct 2025.

Professional Services

- **Paper Reviewer**
  Journal of Imaging Informatics in Medicine (JDIM) *April 2026*
  ◦ Reviewed one full-length manuscript.
  Medical Image Computing and Computer Assisted Intervention (MICCAI) conference 2026 *April 2026*
  ◦ Reviewed three conference papers (8 page limit).
  The IEEE International Conference on Multimedia and Expo (ICME) conference 2026 *Feb 2026*
  ◦ Reviewed one conference paper (6 page limit).
  Medical Imaging with Deep Learning (MIDL) conference 2026 *Jan 2026*
  ◦ Reviewed five validation track full-length papers (14 page limit).

Workshops & Seminars

- Participated in NVIDIA Deep Learning Workshop on Accelerated Data Science held at EE, LUMS. *Dec 2021*

Additional Information

Languages: English, Urdu, Hindi, Punjabi

References

1. **Rizwan Ahmad** (Ph.D. Advisor)
   Professor, Biomedical Engineering Department
   The Ohio State University, Columbus, OH, USA
   Email: ahmad.46@osu.edu | Website: https://u.osu.edu/ahmad/ | Scholar: https://scholar/ahmad/
2. **Orlando P. Simonetti** (Ph.D. Mentor)
   Professor of Radiology and Internal Medicine
   The Ohio State University, Columbus, OH, USA
   Email: simonetti.9@osu.edu | Website: https://u.osu.edu/simonetti/ | Scholar: https://scholar/simonetti/