Muhammad Ahmad Sultan, M.S.

Ph.D. Candidate (4th Year), Biomedical Engineering
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CV last updated: Sept 2025

Career Objective

My research has focused on developing unsupervised deep learning image reconstruction methods for motion-robust accelerated real-time cardiac MRI to streamline image acquisition and reconstruction processes. I am passionate about advancing medical imaging technology using advanced AI techniques, with the ultimate goal of enhancing patient care through my imaging developments.

Research Experience

- **Graduate Research Associate @ Cardiovascular Magnetic Resonance Lab [🌍]** *Aug 2022 – Present*
  The Ohio State University, Columbus, OH, USA
  - Developed DISCUS, a self-supervised deep learning reconstruction framework, enabling accelerated dynamic MRI reconstruction by combining deep image prior and manifold discovery, demonstrating improved diagnostic image quality for single-shot free-breathing LGE. | **Paper** | **Code**
  - Extending ML-DIP framework, a multi-dynamic low-rank DIP, to motion-robust volumetric LGE, integrating Dixon fat-water modeling for multi-echo and joint sensitivity maps estimation, for accelerated ~5-minutes iNAV acquisition, with better arrhythmia handling. | **M-DIP-2D Paper** | **Code**

- **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 signal, engineered features, applied regression for cough-less blood pressure estimation, integrated vitals in a fingertip oximeter, enabling continuous and non-invasive monitoring with one wearable sensor. | **Paper**

Education

- **Ph.D. Biomedical Engineering | Post-candidacy** *May 2027*
  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**: MR Spectroscopy & Imaging, Medical Imaging & Analysis, Optimization, Probability Theory, Reinforcement Learning

- **B.S. Electrical & Computer Engineering | Gold Medalist** *May 2021*
  University of Engineering and Technology, Lahore, Pakistan
  - GPA: 3.90/4.00, Class Rank: 1/200
  - **Relevant Coursework**: Signal Processing, Machine Learning, Calculus, Linear Algebra, Embedded Systems

Skills

- **Research Areas:** Image Reconstruction, Unsupervised Deep Learning, Signal/Image Processing, Inverse Problems
- **Languages:** Python, MATLAB, C, SQL, Verilog
- **Libraries:** Pytorch, Tensorflow, Keras, Scikit-learn, Numpy, Pandas

Journal Publications

- C. Chen, M. Vornehm, P. Chandrasekaran, **M.A. Sultan**, et al. "A multi-dynamic low-rank deep image prior (ML-DIP) for real-time 3D cardiovascular MRI." *arXiv*, July 2025, under-review at JCMR. | **Preprint**
- M. Vornehm, C. Chen, **M.A. Sultan**, et al. "Multi-dynamic deep image prior for cardiac MRI." *Magnetic Resonance in Medicine (**MRM**)*, July 2025. | **Paper** | **Code**
- **M.A. Sultan**, C. Chen, Y. Liu, et al. "An unsupervised method for MRI recovery: Deep image prior with structured sparsity." *Magn Reson Mater Phy (**MRMP**)*, 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 & Oral Presentations

- **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**. | **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**. | **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**. | **Paper**

Peer-Reviewed Abstracts & Poster Presentations

- 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*, Volume 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**

Inventions & Patents

- R. Ahmad, M. Vornehm, C. Chen, **M.A. Sultan**, et al. "Systems and methods for dynamic image reconstruction." Patent pending, filed on Nov 2024, Application number: 63/716,363.
- R. Ahmad, C. Chen, **M.A. Sultan**, & S.M. Arshad, "3D Real-Time Cardiovascular Magnetic Resonance Imaging (CMR)." Patent pending, filed on Sept 2025.

Certifications

- **Computer Vision & NLP Projects** *July 2020*
  - Completed **3 projects** using keras and scikit-learn: twitter sentiment analysis (NLP), house price prediction (regression), and image classification with data augmentation & transfer learning. | **Coursera**
- **Deep Learning Specialization by Andrew Ng** *May 2020*
  - **5-course** track covering neural networks, CNNs, sequence models, hyperparameter tuning, and model optimization with hands-on programming assignments. | **Coursera**

Honors & Awards

- **Tutor – AI Introductory Class** *Mar 2022*
  Lahore University of Management Sciences, Lahore, Pakistan
  - Tutored three undergraduate students in foundational AI concepts as part of an introductory course.
- **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.
- **Cricket Tournament – Best Bowler Award** *Mar 2019*
  University of Engineering and Technology, Lahore, Pakistan
  - Best bowling performance in the champion team of Cricket tournament, ElectroCup2k19.
- **Merit-based Laptop Award** *May 2017*
  - Awarded by Government of Punjab, Pakistan, for outstanding high-school performance.
- **Merit-based Scholarship Award** *2015 – 2017*
  - Super-section, Punjab Group of Colleges, Lahore for maintaining outstanding high-school performance.

Workshops & Seminars

- Attending **weekly seminars** in BME department at The Ohio State University. *Aug 2022 – Present*
- Attended **Research Enhancement Sessions** on IEEE Xplore database & publications at EE, LUMS. *Jan 2022*
- Participated in NVIDIA Deep Learning Workshop on **Accelerated Data Science** held at EE, LUMS. *Dec 2021*

Additional Information

Languages: English, Urdu, Hindi, Punjabi
Interests & Activities: Cooking, reading scientific articles, media analysis, data storytelling (memes)

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. **Wala Saadeh** (Research Advisor)
   Assistant Professor, Electrical and Computer Engineering
   Western Washington University, Bellingham, WA, USA
   Email: saadehw@wwu.edu | Website: https://u.wwu.edu/saadeh/ | Scholar: https://scholar/saadeh/