# Muhammad Zubair

m.zubair@psu.edu
zubairm@illinois.edu
+1 582-203-8823
Austin, TX 78712
zubair-research.github.io

**Department of Computer Science**
**Gates-Dell Complex (GDC)**
**University of Texas at Austin**

**Beckman Institute for Advanced Science and Technology**
**University of Illinois Urbana-Champaign**

**Department and Institutional Affiliation(s)**
Department of Computer Science, University of Texas at Austin
Materials Research Laboratory, University of Illinois Urbana-Champaign
Department of Biomedical Engineering, Pennsylvania State University


## HIGHLIGHTS

- Muhammad Zubair defended his Ph.D. at Penn State in September 2026 and **conducted most of his doctoral research at UIUC**, advised by Prof. Cunjiang Yu. He will join the Department of Computer Science at UT Austin as a Postdoctoral Fellow under Prof. Yudai Tanaka in January 2027. His research develops intelligent wearable interfaces that combine conformal biointerfaces with physiological AI.
- During Ph.D., he integrated AI with conformal wearable biointerfaces to overcome variability in physiological sensing and translate muscle, brain, and autonomic signals into prosthetic control, ambulatory stress monitoring, and at-home sleep monitoring.
- Authored or coauthored 12 journal articles and manuscripts, including seven first or co-first author manuscripts during Ph.D. Published work has appeared in ***Science Advances***, ***National Science Review***, ***IEEE Transactions on Artificial Intelligence***, and ***IEEE Sensors Journal***, with major doctoral studies submitted to or under consideration at ***Nature Biomedical Engineering***, ***Nature Machine Intelligence***, ***Science Advances***, and ***Advanced Healthcare Materials***.
- Mentored 11 undergraduate, master's, and research trainees, taught two BME undergrad-level courses at Penn State, reviewed 50+ journal manuscripts, and delivered an invited talk at Rice University.

## A. EDUCATIONAL BACKGROUND

| | | |
|---|---|---|
| **The Pennsylvania State University**<br>Ph.D., Biomedical Engineering | University Park, PA | January 2022 – Dec 2026<br>**Advisor: Dr. Cunjiang Yu** |
| **Jawaharlal Nehru Technological University**<br>B.Tech, Electronics and Communication Engineering | Kakinada, AP, India | May 2017 – July 2021 |

## B. POSITIONS HELD

| | | |
|---|---|---|
| **Postdoctoral Fellow** | **University of Texas at Austin** | **January 2027 – Current** |
| **Research Affiliate** | **University of Illinois Urbana-Champaign** | **August 2024 – Current** |
| Graduate Teaching Assistant | Pennsylvania State University | August 2026 – Dec 2026 |
| Graduate Research Assistant | Pennsylvania State University | August 2023 – Aug. 2026 |
| Graduate Teaching Assistant | Pennsylvania State University | January 2023 – May 2023 |
| Graduate Research Assistant | Pennsylvania State University | January 2022 – Dec 2022 |
| Research Assistant | University of Tabuk, Saudi Arabia | July 2021 – Dec 2021 |
| Research Assistant | Indian Institute of Technology Guwahati | Jan 2021 – July 2021 |
| Summer Intern | Indian Institute of Technology Guwahati | May 2020 – July 2020 |
| Summer Intern | Indian Institute of Technology Guwahati | May 2019 – July 2019 |

## C. RESEARCH EXPERIENCE

**University of Illinois Urbana-Champaign** *Research Affiliate* August 2024 – Current
*Advisor: Dr. Cunjiang Yu*

*Project 1:* **A fully wireless, AI-assisted drawn-on-scalp multimodal system for at-home sleep staging**
I have developed a fully wireless, drawn-on-scalp wearable system for multimodal neurophysiological monitoring using EEG, EMG, and EOG signals. The project integrates drawn-on-skin electrodes with embedded wireless data acquisition hardware to enable comfortable, long-duration sleep recording outside the laboratory environment and uses AI models for automated sleep stage classification. The goal is to create an at-home, app-based sleep monitoring platform that enables accurate, accessible, and scalable sleep assessment without traditional polysomnography setups.

*Project 2:* **Drawn-on-Skin (DoS) neural interface to enable motion artifact-free ambulatory stress monitoring in natural settings**
Developed experimental paradigms for ambulatory stress monitoring using draw-on-skin (DoS) neural interface electrodes. Performed multimodal electrophysiological experiments on various subjects. I have analyzed the acquired ambulatory EEG/ECG/EDA data and derive state-of-the-art stress quantification measures using various signal processing and deep learning algorithms.

*Project 3:* **Drawn-on-Skin (DoS) electrode array for acupuncture point localization via bioimpedance mapping**
Involved in (1) designing DoS array, measuring impedance at PC6 point, (2) processing the impedance data using regression models, and (3) drafting the manuscript from the achieved outcomes.

*Project 4:* **Drawn-on-Skin (DoS) electrode array for measuring electromyography (EMG) activity via hand gestures from hairy regions of the arm**
Involved in (1) drawing process of DoS array on arms, (2) recording of EMG data from hairy regions on various subject's arm while they perform hand gestures, (3) processing the EMG data and classifying the gestures using machine learning models, and (4) drafting the manuscript.

*Project 5:* **Optoelectronic bioink for remote, optical, and nongenetic cell modulation**
Developed extensive signal processing algorithm for identifying R-peaks in the cardiomyocytes data to measure hear rate across different stimulation frequencies. The beating of cardiomyocyte cells was stimulated by an optical signal. Also worked on computing QRS morphologies of cardiomyocytes data under sub-threshold stimulation.

**The Pennsylvania State University** *Graduate* January 2022 – July 2024
*Advisors: Dr. Cunjiang Yu*

*Project 1:* **Real-time prosthetic hand control via high-density electromyography from drawn-on-skin electrode arrays**
Implemented various signal processing and deep learning feature extraction algorithms on EMG data recorded using DoS sensors. Developed deep encoding networks to recognize hand gestures in real-time. This model was used in real-time closed-loop control of prosthetic hands.

## D. JOURNAL PUBLICATIONS

My prior research has been published in leading journals including ***Science Advances***, ***IEEE Transactions on Artificial Intelligence***, and ***IEEE Sensors Journal***. My doctoral work on wearable biointerfaces, neurophysiological monitoring, and AI-enabled human-machine interfaces is currently submitted to or under consideration at ***Nature Biomedical Engineering***, ***Nature Machine Intelligence***, ***Science Advances***, and ***Advanced Healthcare Materials***, which are highly selective venues for advances in biomedical engineering, artificial intelligence, and healthcare technologies.

† These authors contributed equally.

1. **Muhammad Zubair †**, Shubham Patel †, Shiyuan Duan, Longping Chen, Haojun Xu, Mike Yu, Sumi Sekhar, Phillip Comeaux, Lei Gonzalez, Luis Contreras, Faheem Ershad, Cunjiang Yu*, **Long-Hair Compatible, Imperceptible Drawn-on-Scalp Interfaces for Wireless Multimodal Neurophysiology and Ambulatory Stress Quantification**, *Submitted,* ***Nature Biomedical Engineering***, 2026
2. **Muhammad Zubair**, Shubham Patel, Sumi Sekhar, Long Meng, Xiaogang Hu, Faheem Ershad, Cunjiang Yu*, **Real-Time Control of Prosthetic Hand via Drawn-on-Skin High-Density EMG Arrays and Deep Encoding Networks**, *Submitted,* ***Nature Machine Intelligence***, 2026

3. **Muhammad Zubair**†, Shubham Patel †, Shiyuan Duan, Longping Chen, Diego Hernandez, Haojun Xu, Cunjiang Yu*, **A Fully Wireless, AI-Assisted Drawn-on-Scalp Multimodal Neurophysiological Monitoring Device for At-Home Sleep Staging**, *Under consideration, **Science Advances***, 2026
4. Shubham Patel †, **Muhammad Zubair †**, M. Hussain, Luis Contreras, X. Wang, Y. Lu, W. Zhu, Faheem Ershad, Cunjiang Yu, **High fidelity electrophysiological sensing on non-glabrous skin with drawn-on-skin bioelectronics**, *Under Consideration, **Advanced Healthcare Materials***, 2026
5. **Muhammad Zubair †**, Nittin Murthi Dhekshinamoorthy †, Shubham Patel, Diego Hernandez, Cunjiang Yu*, **WearBioRAG: A Retrieval-Augmented Multi-Agent Assistant for Grounded Wearable Bioelectronics Design, Fabrication, and Biosignal Analysis**, *Under Consideration, **Advanced Intelligent Systems***, 2026
6. Moinul Islam †, **Muhammad Zubair †***, **Generative forecasting of neuromuscular recovery after stroke from EMG recordings of real and virtual patients**, *Under Consideration, **Nature Machine Intelligence***, 2026
7. **Muhammad Zubair †**, Shubham Patel †, Longping Chen, Cunjiang Yu*, **Toward Intelligent Skin Haptics: The Emerging Role of Artificial Intelligence in Human-Machine Interaction**, *To be submitted*, 2026
8. Faheem Ershad, Zhoulyu Rao, Sushila Maharajan, Fernanda C. Paccola Mesquita, Junkyu Ha, Lei Gonzalez, Tahir Haideri, Ernesto Curty da Costa, Angel Moctezuma-Ramirez, Yuqi Wang, Seonmin Jang, Yuntao Lu, Shubham Patel, Xiaoyang Wang, Yifan Tao, Joshua Weygant, Carlos Ezio Garciamendez-Mijares, Luis Carlos Orrantia Clark, **Muhammad Zubair**, Xiaojun Lance Lian, Abdelmotagaly Elgalad, Jian Yang, Camila Hochman-Mendez, Yu Shrike Zhang*, and Cunjiang Yu*, **Bioprinted optoelectronically active cardiac tissues**, ***Science Advances***, 2025 Jan 24;11(4):eadt7210
9. Yu Cheng, Yifei Zhan, Fangyi Guan, Junli Shi, Jingxiao Wang, Yi Sun, **Muhammad Zubair**, Cunjiang Yu, Chuan Fei Guo, **Displacement-pressure biparametrically regulated softness sensory system for intraocular pressure monitoring**, ***National Science Review***, Volume 11, Issue 6, June 2024, nwae050, https://doi.org/10.1093/nsr/nwae050
10. **M. Zubair**†, Umesh Kumar Naik M†, Rajesh Kumar Tripathy, S. Alzahrani, M. Alhartomi, S. R. Ahamed. **Detection of Sleep Apnea from ECG Signals Using Sliding Singular Spectrum Based Subpattern Principal Component Analysis,"** in ***IEEE Transactions on Artificial Intelligence***, vol. 5, no. 6, pp. 2897- 2906, June 2024, doi: 10.1109/TAI.2023.3329455.
11. S. Agarwal and **M. Zubair**, "**Classification of Alcoholic and Non-Alcoholic EEG Signals Based on Sliding-SSA and Independent Component Analysis**," in ***IEEE Sensors Journal***, vol. 21, no. 23, pp. 26198- 26206, 1 Dec.1, 2021, doi: 10.1109/JSEN.2021.3120885.
12. **M. Zubair** et al., "**Detection of Epileptic Seizures from EEG Signals by Combining Dimensionality Reduction Algorithms with Machine Learning Models**," in ***IEEE Sensors Journal***, vol. 21, no. 15, pp. 16861-16869, 1 Aug.1, 2021, doi: 10.1109/JSEN.2021.3077578.

## E. CONFERENCE PUBLICATIONS

1. **M. Zubair**, Tanisha B. Antariksh T. Umesh Kumar Naik M. **"Detection of Lung Nodules in Chest Radiographs using Wiener Filter and D-CNN Model,"** ***Proceedings of the International Conference on Interdisciplinary Research in Technology and Management (IRTM, 2021)***, 26-28 February,2021, Kolkata, India (1st ed.). CRC Press. https://doi.org/10.1201/9781003202240
2. **M. Zubair**, M. Umesh Kumar Naik and G. N. V. S. C. Mouli, **"Facile Diabetic Retinopathy Detection using MRHE-FEED and Classification using Deep Convolutional Neural Network,"** 2020 ***IEEE 15th International Conference on Industrial and Information Systems (ICIIS)***, RUPNAGAR, India, 2020, pp. 247-252, doi: 10.1109/ICIIS51140.2020.9342676.
3. **M. Zubair**, G. N. V. S. Chandra Mouli and R. A. Shaik, **"Removal of Motion Artifacts from ECG signals by Combination of Recurrent Neural Networks and Deep Neural Networks,"** 2020 ***2nd International Conference on Electrical, Control and Instrumentation Engineering (ICECIE)***, Kuala Lumpur, Malaysia, 2020, pp. 1-7, doi: 10.1109/ICECIE50279.2020.9309609.
4. **M. Zubair**, U. Kumar Naik M and R. Ahamed Shaik, **"EMG Artifacts Removal from Multi-Channel EEG Signals using Multi-Channel Singular Spectrum Analysis,"** 2020 ***IEEE Applied Signal Processing Conference (ASPCON)***, Kolkata, India, 2020, pp. 183-187, doi: 10.1109/ASPCON49795.2020.9276684.

## F. BOOK CHAPTERS

Shrey Agarwal, Yashaswi Upmon, **Muhammad Zubair**, Umesh Kumar Naik Mudavath,
Chapter 6 - **A robust peak detection algorithm for localization and classification of heart sounds in PCG signals**,
Editor(s): Rajesh Kumar Tripathy, Ram Bilas Pachori, ***Signal Processing Driven Machine Learning Techniques for Cardiovascular Data Processing***, Academic Press, 2024, Pages 81-97, ISBN 9780443141416,

https://doi.org/10.1016/B978-0-44-314141-6.00011-6.

## G. TEACHING EXPERIENCE

**BME 301: Analysis of Physiological Systems Laboratory** *Penn State* August 2026 – Dec 2026
Taught laboratory sections on physiological system modeling and analysis using MATLAB and Simulink. Developed instructional slides, quizzes, worked solutions, and simulation demonstrations; guided students through laboratory exercises and evaluated their assignments and technical reports.

**BME 403: Biomedical Instrumentation Laboratory** *Penn State* January 2023 – May 2023
Taught undergraduate students in designing, constructing, and testing biomedical instrumentation circuits. Provided hands-on support with laboratory experiments, circuit troubleshooting, and technical concepts, and assisted with the preparation and evaluation of examinations, projects, and assignments.

## H. HONORS AND AWARDS

1. Our work on ***Bioprinted Optoelectronically Active Cardiac Tissues*** was featured as a Science Highlight by the National Institute of Biomedical Imaging and Bioengineering (NIBIB) (2025)
2. Best thesis award for undergraduate project work (2021)
3. Featured article in IEEE Sensors Journal for Classification of Alcoholic and Non-Alcoholic EEG Signals Based on Sliding-SSA and Independent Component Analysis (2021)
4. All India Council of Technical Education (AICTE) - Vishwakarma Award (2020)

## I. STUDENT MENTORING

[10] **Zainab Ashraf** (M.S. student, CS, UET, Pakistan) | **now: applying to Ph.D. programs** Sep. 2026–Present
[9] **Laiba Shabbir** (undergraduate student, CS, ELTE, Hungary) | **now: applying to Ph.D. programs** Sep. 2026–Present
[8] **Safia Ahmad Khan** (undergraduate student, CS, AMU, India) | **now: applying to Ph.D. programs** Sep. 2026–Present
[5] **Nittin Murthi Dhekshinamoorthy** (undergraduate student, CS, UIUC) Sep. 2025–Present
[4] **Haojun Xu** (M.S. student, ECE, UIUC) | **now: industry** Sep. 2024–Jul. 2026
[3] **Aksa Fathima** (Research Associate, IISc, India) | **now: applying to Ph.D. programs** Sep. 2024–Present
[2] **Longping Cheng** (M.S. student, ME, UIUC) | **now: Ph.D. student at HKUST** Aug 2024–May 2026
[1] **Sumi Sekhar** (M.S. student, Biomed. Eng., Penn State) | **now: industry** Jan. 2023–Jul. 2024

## J. INVITED TALKS

1. **Rice University** (hosted by Prof. Momona Yamagami) April 2026

## K. PROFESSIONAL ORGANIZATIONS

1. IEEE Graduate Student Member (2022-Current)
2. IEEE Student Member (2020-Current)
3. IEEE Engineering in Medicine and Biology Society Member (2020-Current)
4. IEEE Signal Processing Society Member (2020-Current)
5. IEEE Biometrics Council (2020-Current)
6. IEEE Young Professionals (2020-Current)
7. IEEE Council on RFID (2020-Current)

## L. JOURNAL PEER REVIEWER

Reviewed more than 50 articles from the following journals:

1. IEEE Transactions on Instrumentation and Measurement
2. IEEE Transactions on Biomedical Engineering
3. IEEE Sensors Journal
4. IEEE Sensors Letters
5. Biomedical Signal Processing and Control

6. Nature Scientific Reports
7. Signal, Image and Video Processing
8. Clusters Computing