Umair Mohammad

Postdoctoral Associate
Knight Foundation School of Computing and Information Sciences
Florida International University
11200 SW 8th St, CASE 261, Miami, FL 33199, USA
E-mail: umohamma@fiu.edu; umairmy305@gmail.com
Phone: (+1) 208-892-4262

LinkedIn
Google Scholar
ResearchGate
ORCID

Summary and Current Activities

Umair Mohammad is a post-doctoral fellow at SaeedLab which is part of the Knight Foundation School of Computing and Information Sciences (KFSCIS) at Florida International University. Umair earned his PhD degree in Electrical Engineering from the University of Idaho in 2020 where he was a fully funded research assistant. Prior to that, he earned his Master's degree in Telecommunication Engineering and his Bachelor's degree in Electrical Engineering from King Fahd University of Petroleum and Minerals in 2016 and 2013, respectively. Umair has published several articles in top-tier peer-reviewed journals including the IEEE Transactions on Mobile Computing and IEEE Transactions on Green Communications and Networking. Umair has also served as a peer reviewer for several top journals including IEEE Communications Magazine, IEEE Transactions on Services Computing and IEEE Communication Letters. Other than scholarly activities, Umair led the lab's technology commercialization efforts which resulted in three technology translation related grants from the National Science Foundation (NSF), one invention disclosure and a patent filing.

Currently, Umair leads the SaeedLab's effort for designing, developing, and testing machine-learning/artificial intelligence (ML/AI)-based early epileptic seizure prediction models using the most advanced deep learning (DL) techniques and only wearable electroencephalography (EEG) data. The objective of this work is to discover predictive models which can predict seizures using wearables in a time-sensitive energy-efficient way so that they are affordable and usable for home-care settings. To that end, he has one published model called SPERTL that achieved a higher sensitivity compared to the state-of-the-art, one invention disclosure, a patent application filed, and one publicly available dataset. In parallel, his research focus is on wireless edge computing; specifically designing and developing optimal protocols for training such advanced ML/AI models at the resource-constrained heterogeneous wireless edge. Umair's current objective is to successfully earn a senior research scientist position where he can apply his ability to conduct scientific research and win research grants for advancing the state of ML/AI; specifically, for real-time biomedical and health related applications.

Current Research Interests

1. **ML Algorithm Development**: Development of advanced DL algorithms including residual neural nets (ResNets), dense neural nets (DenseNets) and transformer architectures including attention mechanisms.
2. **ML/AI-based Bioinformatics**: ML models for early epileptic seizure detection and prediction from EEG sensors, event detection from other medical sensors e.g. ECG.
3. **Distributed ML at the edge**: Specifically, the design of delay-aware energy-efficient federated learning (FL) techniques with an emphasis on biomedical applications and real-time edge inference for continuous monitoring.
4. **Distributed Edge Architectures for Big Data**: Methods for real-time processing of biological big data on the edge such as proteomics and genomics for easier search, querying and feature extraction.

Professional Experience

1. **Postdoctoral Associate (Advisor: Dr. Fahad Saeed)**
   KFSCIS, Florida International University, Miami, FL, USA   Nov. 2020 – Present

   - Leading the efforts to develop early epileptic seizure (ES) prediction models based on advanced deep learning
   - Developed MLSPredBench – a python-based tool to convert and benchmark seizure detection data for the purposes of seizure prediction in an ML-ready manner
   - Developed SPERTL – an early ES prediction model based on ResNets, transfer learning and scalp EEG data
   - Working on optimal resource allocation methods for seizure prediction at the edge with federated learning

- Developed a simulation testbed for evaluating the performance of distributed big data access in proteomics
- Lead for the lab's technology commercialization efforts including serving as the entrepreneurial Lead (EL) for the NSF innovation-Corps (I-Corps) programs
- Represented KFSCIS at the Knight Foundation Fellowship in Healthcare Technology Innovation
- Mentoring capstone students for the Master's in Data Science Program and other graduate and undergraduate researchers

2. **Research Assistant**
   University of Idaho, Moscow, ID, USA   Jul. 2018 – Aug. 2020
   - Developed techniques for optimal task offloading in hierarchical mobile edge computing
   - Designed a new paradigm for machine learning at the edge called Mobile Edge Learning (MEL)
   - Significantly improved ML model performance in MEL; specifically, federated learning (FL)
   - Successfully developed high performance optimization strategies for executing MEL under time-constraints in an energy-efficient manner
   - Designed, developed and tested metrics for vendor-independent communication evaluation

3. **Teaching Assistant**
   University of Idaho, Moscow, ID, USA   Jan. 2018 – Jul. 2018
   - Instructor for the Communication Engineering (EE370) and Digital Logic Design (EE200) Laboratories
   - Contributed to the new lab curriculum for both EE370 and EE200 labs
   - TA for ENGR 240 - Electric Circuits for non-Electrical Engineers' class
   - Duties included tutoring, grading, and proctoring exams

4. **Lecturer-B**
   King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia   Sep. 2016 – Aug. 2017
   - Computer Engineering Department
   - Analysed data related to core course outcomes including student performance, attendance and participation
   - Helped the department course committee ensure all courses meet the National Accreditation Board standards

5. **Teaching Assistant**
   King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia   Sep. 2013 – Aug. 2015
   - Instructor for the Communication Engineering (EE370) and Digital Logic Design (EE200) Laboratories
   - Contributed to the new lab curriculum for both EE370 and EE200 labs
   - Helped transition the EE200 from breadboards to field programmable gate array (FPGA) based instruction
   - Developed a completely online system for assignment/exam submission with 90% automated grading

Education (Ordered by degree level)

University of Idaho, Moscow, ID, USA   Jan. 2018 – Aug. 2020
PhD in Electrical and Computer Engineering, GPA: 4.0/4.0
Advisors: Dr. Sameh Sorour and Dr. Mohamed Hefeida (Co-advisor)

King Fahd University of Petroleum & Minerals, Saudi Arabia   Sep. 2013 – May 2016
Master of Science in Telecommunication Engineering, GPA: 3.63/4.0
Advisor: Dr. Samir Al-Ghadhban

King Fahd University of Petroleum & Minerals, Saudi Arabia   Feb. 2009 – Jan. 2013
Bachelor of Science in Electrical Engineering (EE), GPA: 3.48/4.0 (**2nd Distinction**)
Advisor: Dr. Mohamed Sharawi

Research Funding

1. **National Institutes of Health (NIH) GRANT 13970445 [US$ 298,852]**, "SBIR Phase I: Real-time machine-learning model development for Epileptic Seizure prediction", Fahad Saeed (Co-PI) and **Umair Mohammad** *(Co-PI)*, **Pending**, (Proposed October 1, 2024 – September 30, 2026)

2. **National Science Foundation (NSF) IIP-2143515 [US$ 275,000]**, "STTR Phase I: Patient-Specific System for Early Detection and Identification of Epileptic Seizures", Fahad Saeed (Co-PI) and **Umair Mohammad** *(Senior Personnel)*, **Awarded**, (October 1, 2023 – September 30, 2024)
3. **National Science Foundation (NSF) IIP-2213951 [US$ 250,000]**, "PFI-TT: Artificial Intelligence enabled Real-time System for Early Epileptic Seizure Detection and Prediction", Fahad Saeed (Co-PI) and **Umair Mohammad** *(Senior Personnel)*, **Awarded**, (August 1, 2022 – July 31, 2024)
4. **National Science Foundation (NSF) IIP-2143515 [US$ 50,000]**, "I-Corps: Utilizing Machine learning and Artificial Intelligence (AI) for Early Detection and Identification of Mental Disorders", Fahad Saeed (PI) and **Umair Mohammad** *(Entrepreneurial Lead)*, Sept 1, 2021 - August 31, 2023

Publications

Invention Disclosures and Patents

1. **U. Mohammad** and F. Saeed "Systems and Methods for Patient-Specific Epileptic Seizure Prediction", *filed* with the *United States Patent and Trademark Office (USPTO)*, U.S. Department of Commerce, July 2023 (Application # **US 18/341,967**)
2. **U. Mohammad** and F. Saeed "SPERTL: Epileptic Seizure Prediction using EEG with ResNets and Transfer Learning", *FIU Technology Management and Commercialization*, Reference No. Disclosure D2022-0051

Peer-reviewed Articles

1. **U. Mohammad** and F. Saeed, " MLSPred-Bench: Machine Learning (ML)-Ready Seizure Prediction Benchmark Data-Suite for Model Training and Evaluation using Repurposed Seizure Detection Data," submitted to the *IEEE Transactions on Biomedical Engineering*, (2024).
2. **U. Mohammad**, S. Sorour and M. Hefeida, "Energy Aware Task Allocation for Semi-Asynchronous Mobile Edge Learning," in *IEEE Transactions on Green Communications and Networking*, vol. 7, no. 4, pp. 1766-1777, Dec. 2023. [Online]. Available: Link
3. **U. Mohammad**, S. Sorour and M. Hefeida, "Dynamic Task Allocation for Mobile Edge Learning," in *IEEE Transactions on Mobile Computing*, vol. 22, no. 12, pp. 6860-6873, Dec. 2023. [Online]. Available: Link
4. A. Ahmad Tarar, **U. Mohammad**, and S. K. Srivastava, "Wearable Skin Sensors and Their Challenges: A Review of Transdermal, Optical, and Mechanical Sensors," *Biosensors*, vol. 10, no. 6, p. 56, May 2020. Link
5. F. E. Madkour, **U. Mohammad**, S. Sorour, M. Hefeida and A. Abdel-Rahim, "Vendor-Independent Reliability Testing Model for Vehicle-to-Infrastructure Communications", *Transportation Research Record*, 2674(9), 898–912, 2020. Available: Link
6. U. Baroudi, M. Bin-Yahya, M. Alshammari and **U. Yaqoub**, "Ticket-based QoS routing optimization using genetic algorithm for WSN applications in smart grid", *Journal of Ambient Intelligence and humanized computing*, Springer. Link
7. **U. Yaqub**, A. Al-Nasser and T. R. Sheltami, "Implementation of a hybrid wind-solar desalination plant from an Internet of Things (IoT) perspective on a network simulation tool", *Applied Computing and Informatics*, vol. 15, no. 1, pp. 7–11, Jan. 2019. Link

Peer-reviewed Conference Proceedings

1. **U. Mohammad** and F. Saeed, " Robustness of ML-Based Seizure Prediction Using Noisy EEG Data from Limited Channels," *presented* at *The 20th Annual International Conference on Distributed Computing in Smart Systems and the Internet of Things (DCOSS-IoT 2024),* Abu Dhabi, United Arab Emirates, 2024.
2. A. Bhattarai, **U. Mohammad** and F. Saeed, "Communication Evaluation of a Wireless 4-Channel Wearable EEG for Brain-Computer Interface (BCI) and Healthcare Applications," *IEEE SoutheastCon 2024*, Atlanta, GA, USA, 2024, pp. 902-903. [Online]. Available: Link
3. **U. Mohammad** and F. Saeed, "Energy Efficient AI/ML based Continuous Monitoring at the Edge: ECG and EEG Case Study," *2023 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*, Istanbul, Turkiye, 2023, pp. 3313-3320. [Online]. Available: Link

4. **U. Mohammad** and F. Saeed, "SPERTL: Epileptic Seizure Prediction using EEG with ResNets and Transfer Learning," *2022 IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI)*, Ioannina, Greece, 2022, pp. 1-5. [Online]. Available: Link

5. **U. Mohammad** and F. Saeed, "Simulation Testbed for Evaluating Distributed Querying and Searching of Mass Spectrometry Big Data in a Network-based Infrastructure," *2021 IEEE Seventh International Conference on Big Data Computing Service and Applications (BigDataService)*, Oxford, United Kingdom, 2021, pp. 137-142. Link

6. **U. Mohammad** and F. Saeed, 'Search Feasibility in Distributed MS-Proteomics Big Data', in *Proceedings of the 12th ACM Conference on Bioinformatics, Computational Biology, and Health Informatics*, Gainesville, Florida, 2021. Available: Link

7. **U. Mohammad**, S. Sorour and M. Hefeida, "Optimal Task Allocation for Mobile Edge Learning with Global Training Time Constraints," *2021 IEEE 18th Annual Consumer Communications & Networking Conference (CCNC)*, Las Vegas, NV, USA, 2021, pp. 1-4. Link

8. **U. Mohammad**, S. Sorour and M. Hefeida, "Task Allocation for Mobile Federated and Offloaded Learning with Energy and Delay Constraints," *2020 IEEE International Conference on Communications Workshops (ICC Workshops)*, Dublin, Ireland, 2020, pp. 1-6. Link

9. **U. Mohammad** and S. Sorour, "Adaptive Task Allocation for Mobile Edge Learning," *2019 IEEE Wireless Communications and Networking Conference Workshop (WCNCW)*, Marrakech, Morocco, 2019, pp. 1-6. Link

10. **U. Yaqub** and S. Sorour, "Multi-Objective Resource Optimization for Hierarchical Mobile Edge Computing," *2018 IEEE Global Communications Conference (GLOBECOM)*, Abu Dhabi, United Arab Emirates, 2018, pp. 1-6. Link

11. **U. Yaqub** and S. Al-Ghadhban, "OFDM with Generalized Index Shift Keying," *2017 9th IEEE-GCC Conference and Exhibition (GCCCE)*, Manama, Bahrain, 2017, pp. 1-9. Link

12. **M. U. Yaqub** and M. S. Al-Ahmadi, "Application of Combined ARMA-Neural Network Models to Predict Stock Prices", in *Proceedings of The 3rd Multidisciplinary International Social Networks Conference on Social Informatics 2016, Data Science 2016 (MISNC, SI, DS 2016),* New Jersey, USA, Article 40, 1-5, 2016. Link

Abstracts, Pre-prints and Posters

1. **U. Mohammad** and F. Saeed, "Towards real-world ML/AI models for epileptic seizure prediction from wearable EEG", accepted as a poster at the *USF Artificial Intelligence + X (AI+X) Symposium*, University of South Florida, Tampa, FL, USA, September 2023.

2. **U. Mohammad**, S. Sorour, and M. Hefeida, "Task allocation for asynchronous mobile edge learning with delay and energy constraints". Available: Link

3. S. Sorour, **U. Mohammad**, A. Abutuleb and H. Hassanein, "Returning the Favor: What Wireless Networking Can Offer to AI and Edge Learning". [Online]. Available: Link

4. **U. Mohammad** and S. Sorour, "Adaptive Task Allocation for Asynchronous Federated and Parallelized Mobile Edge Learning". Available: Link

5. **U. Mohammad** and U.A. Shaikh, "Near Field Communication: Its Applications and Implementation in KSA", *Undergraduate Engineering and Sciences Category at the 3rd Saudi Students' Scientific Conference (SSSC3)*, May 2012, Al-Khobar, Saudi Arabia. Link

Book Chapters, Dissertations and Technical Reports

1. **Mohammad, U.**, Saeed, F. (2024). Heterogeneity Aware Distributed Machine Learning at the Wireless Edge for Health IoT Applications: An EEG Data Case Study. In: Amini, M.H. (eds) Distributed Machine Learning and Computing. Big and Integrated Artificial Intelligence, vol 2. Springer, Cham. Link

2. **U. Mohammad**, "On Task Allocation in Mobile Edge Computing with a Focus on Machine Learning Applications", Ph.D. Dissertation, College of Eng., Univ. of Idaho, Moscow, ID USA, 2020. Link

3. **U. Mohammad**, "Design and Performance Evaluation of Trans-receive Schemes for OFDM with Index Modulation", M.S. Thesis, College of Eng., King Fahd Univ. of Petroleum and Minerals (KFUPM), Dhahran, Kingdom of Saudi Arabia (KSA), 2016. Link

4. **U. Mohammad**, F. Madkour, A. Abdel-Rahim, S. Sorour, M. Hefeida and M. Khanal, "Field evaluation of V2I connected vehicle deployment in Ada County, Idaho: Validating Communication Architecture and control

technology readiness", *United Stated Department of Transportation Repositories and Open Science (rosaP)*, 1-20, (2020). Link

5. **U. Mohammad** and U.A. Shaikh, "Near Field Communication Its Applications and Implementation in K.S.A", *The 3rd Saudi Students' Scientific Conference (SSSC3)*, May 2012. Link

6. **U. Mohammad**, "CS504: Image Processing Spring 2018 Final Report (Milestone 2) Cancer MNIST (HAM10000) Dataset Classification", *University of Idaho*, May 2019. Link

7. **U. Mohammad** and M. Al-Mouhamed, "Simulation Acceleration of Index Modulation Using a Cluster of NVIDIA Tesla K-80," *ResearchGate*, 2017, pp. 1-7, doi: 10.13140/RG.2.2.29865.62567. [Online]. Available: Link

8. **U. Mohammad** and M. Al-Mouhamed, " Simulation Acceleration of Index Modulation using NVIDIA GeForce GTX 960M," *ResearchGate*, 2016, pp. 1-6, doi: 10.13140/RG.2.2.33221.06883. [Online]. Available: Link

Data Science and ML/AI Related

1. Conducted two hands-on lectures on "Introduction to Machine Learning" for the ACCESS STEP 1 (May 2023 and May 2024), a two-hour training session to prepare newcomers to ML/AI implement advance ML algorithms using Python-based libraries (Material available via Google Colab link upon request)

2. Led the efforts to re-envision the Temple University Seizure Corpus into a prediction corpus to include a more diverse cohort of patients and seizure types

3. Developed a new dataset for epileptic seizure prediction from the annotated Children's Hospital Boston – Massachusetts Institute of Technology datatset that enforces an improved cross-validation strategy which considers class imbalance and streaming nature of the data in real-time seizure prediction

4. Leading the efforts to re-train the lab's previously published award-winning model ASD-DiagNet with competitive accuracy for diagnosing autism spectrum disorder using only Magnetic Resonance Imaging (MRI) data with multi-site Federated Learning

Student Supervision

- Paras Parani – Project: Epileptic Seizure Prediction with Large Language Models   May 2024 – Present
- Abishek Bhattarai – Project: Hardware Implementation of ML-based Prediction   Sep. 2023 – May 2024
- Abhilash Rana and Carlos Castillo – Master's in Data Science Capstone Mentor   Jun. 2022 – Apr. 2023
  Thesis Title: "Seizures Detection for Epilepsy Patients"
- Hermes Bonilla – Undergraduate Research Assistant in ML/AI   Jun. 2021 – May 2022

Awards

- Knight Foundation Baptist Health Healthcare Technology Innovation Fellow as of June 2023 (placed *second* in the final pitch competition on a tiebreaker)
- Won a joint UI Graduate Students' Professional Association (GPSA) publication Award in the amount of $900 for the manuscript "Wearable Skin Sensors and Their Challenges: A Review of Transdermal, Optical, and Mechanical Sensors" for publication in Biosensors, MDPI. (2020)
- Won GPSA travel award in the amount of $700 for travel to IEEE WCNC 2019 in Marrakech, Morocco. (2019)
- Won second-place prize at the *3rd Saudi Students' Scientific Conference (May 2012)* in the Undergraduate Engineering and Sciences Category for the project poster titled "Near Field Communication: Its Applications and Implementation in KSA"

Skills

- **High-Level languages/environments**: Python, C, MATLAB, Java, Anaconda/Jupyter
- **ML/AI Libraries**: PyTorch, TensorFlow, Keras, scikit-learn, MATLAB Deep Learning Toolbox, WEKA
- **Parallel programming**: CUDA, OpenMP
- **Network design/analysis tools**: CISCO Packet Tracer, Wireshark, OPNET
- **Assembly/Hardware**: Intel 8086, MIPS, Arduino (intermediate), Verilog (basic), Xilinx FPGA (basic)

Professional Services and Memberships

- **Reviewer for international journals:**
  IEEE Communications Magazine; IEEE Transactions on Services Computing; IEEE Transactions on Mobile Computing; IEEE Transactions on Vehicular Technology; IEEE Communication Letters; IET Communications; IET Image Processing; International Journal of Computing and Digital Systems.
- **Member of professional societies:**
  - IEEE Member (S' 12, M' 23)
  - ACM Member (2021-2022)
- **Member of conference technical program committees (TPCs):**
  - TPC member 22nd IEEE International Workshop on High Performance Computational Biology (HiCOMB 2023)
  - TPC member 4th International Workshop on High Performance Computing, Big Data Analytics and Integration for Multi-Omics Biomedical Data (HPC-BOD 2022)
  - TPC member IEEE ICC WS-21: Workshop on Wireless Networking Innovations for Mobile Edge Learning
  - TPC member International Conference on Decision Aid Sciences and Application (DASA 2019, 2020 and 2022)
  - IEEE Middle East & North Africa COMMunications Conference (IEEE MENACOMM 2019 and 2021)