Mohammad Mahmudur Rahman Khan, Ph.D.

[Google Scholar] [LinkedIn] [GitHub]
Office phone number: (615) 327-5816
E-mail: mohammadmahmudurrahman.khan@mmc.edu

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Current Position
Assistant Professor of Computer Science and Data Science
School of Applied Computational Sciences
Meharry Medical College
Nashville, Tennessee

Education
Ph.D., Vanderbilt University, Nashville, Tennessee	2018- 2024
M.S., Mississippi State University, Starkville, Mississippi	2016- 2018
B.S., Islamic University of Technology, Dhaka, Bangladesh	2010- 2013

Academic Appointments
Assistant Professor of Computer Science and Data Science   2024 - Present
School of Applied Computational Sciences
Meharry Medical College
Nashville, Tennessee

Research Assistant   2018 - 2024
Department of Electrical and Computer Engineering
Vanderbilt University
Nashville, Tennessee

Teaching Assistant   2019
Department of Electrical and Computer Engineering
Vanderbilt University
Nashville, Tennessee

Teaching Assistant   2016 - 2018
Department of Electrical and Computer Engineering
Mississippi State University
Starkville, Mississippi

Lecturer   2014 - 2016
Department of Electrical and Electronic Engineering
International University of Business, Agriculture and Technology
Dhaka, Bangladesh

Professional Positions and Experience
Image Analytics Intern   2023
Siemens Healthineers
Malvern, Pennsylvania

Educational Activities

Graduate Teaching Assistant   01/2019- 05/2019
Vanderbilt University, Nashville, Tennessee
  Courses taught:
  EECE 3214: Signals and Systems
  - Mentored students in course projects based on MATLAB
  - Invigilated the examinations
  - Evaluated 200+ student examination papers

Graduate Teaching Assistant   08/2016- 07/2018
Mississippi State University, Starkville, Mississippi
  Courses taught:
  ECE 3714 Digital Devices and Logic Design
  ECE 3724 Microprocessors
  ECE 3413 Circuits I Lab
  - Served 1 time as a tutorial and 3 times as a laboratory teaching assistant
  - Mentored students in course and lab projects based on MATLAB, Python, and Assembly Language
  - Evaluated 300+ student examination papers

Lecturer   01/2014- 07/2016
International University of Business Agriculture and Technology
Dhaka, Bangladesh
  Courses taught:
  EEN 407: Feedback Control System Analysis and Design
  EEN 408: Feedback Control System Analysis and Design Lab
  EEN 265: Electronic Analysis and Design I
  EEN 266: Electronic Analysis and Design I Lab
  EEN 183: Circuit Analysis I
  EEN 184: Circuit Analysis I Lab
  - Conducted lectures and weekly lab practicum for more than 1400 students
  - Created and administered examinations
  - Mentored 24 students in industrial practicum

Honors and Awards

Best Poster- 2nd Runner Up Award, Vanderbilt University, Nashville, Tennessee	2024
Faculty of Engineering Travel Award, Vanderbilt University, Nashville, Tennessee	2023
Faculty of Engineering Travel Award, Vanderbilt University, Nashville, Tennessee	2021
Graduate Research Fellowship, Mississippi State University, Starkville, Mississippi	2016
Industrial Training Award from Ghorasal Training Center	2013
Bangladesh Power Development Board (BPDB), Bangladesh	
Organization of Islamic Cooperation (OIC) Awared Scholarship During B.Sc. Studies	2010- 2013
Islamic University of Technology, Bangladesh	
University Grant Commission Scholarship	2010- 2013
Ministry of Education, Bangladesh	
Government Scholarship in Secondary School Certificate examination	2007- 2009
Ministry of Education, Bangladesh	

Research Activities

Doctoral Researcher   08/2018- Present
Biomedical Image Analysis for Image Guided Interventions Laboratory
(BAGL), Vanderbilt Institute for Surgery and Engineering (VISE), Vanderbilt
University, Nashville, Tennessee

- Developed a weakly supervised deep neural network-based algorithm (multi-tasking 3D U-Net model) for intra-operative tip fold-overs detection in CT images
- Implemented advanced deep learning architectures (i.e., Diffusion Model, Variational Auto Encoder (VAE), and Generative Adversarial Network (Gan)) in PyTorch for medical image analysis
- Designed a Filtered Back Projection (FBP) based framework for generating synthetic CTs with realistic metal artifacts
- Developed an automated model to generate surgical text guidance modules by analyzing intra-cochlear structures from preoperative CT segmentation
- Gained expertise through working with Cochlear Implant surgeons at Vanderbilt University Medical Center (VUMC) and Medical University of South Carolina (MUSC)
- Led the surgical guidance project to facilitate surgeons in preoperative planning for optimal electrode array positioning which significantly improved the surgical outcome
- Developed a data driven model for preoperatively predicting the insertion depth. Optimal positioning of the electrode array was achieved in cochlear implant surgeries through the predictive model which can lead to improved hearing outcome
- Demonstrated proficiency in programming languages including Python, SQL, and MATLAB and in the Python Data Analytics package consisting of PyTorch, TensorFlow, Pandas, Numpy, Scipy, Sklearn, and Mat-plotlib

Image Analytics Intern   05/2023- 08/2023
Siemens Helathineers, Malvern, Pennsylvania

- Developed an innovative approach in collaboration with Siemens Healthineers, USA, focused on leveraging deep learning for synthetic CT generation. The primary objective of this project was to train a neural network model capable of generating synthetic CT images with realistic nodules of diverse sizes, shapes, and types
  Key Achievements:
  - Designed and implemented a Wasserstein Generative Adversarial Network (WGAN) based model featuring two discriminators and one classifier, with subsequent *patent* documentation
  - Developed a Vector Quantized Generative Adversarial Network (VQGAN) based framework incorporating a double encoder, resulting in *patent* documentation

M.Sc. Researcher   08/2016- 07/2018
Mississippi State University, Starkville, Mississippi

- Developed machine learning approaches for energy disaggregation using MATLAB
- Implemented convolutional neural network for power consumption signal analysis

Professional Memberships and Activities

Student Member   2023 - Present
Medical Image Computing and Computer-Assisted Intervention (MICCAI)

Student Member   2021 - 2022
Journal of Medical Imaging

Graduate Student Member   2018 - Present
Biomedical Image Analysis for Image Guided Interventions Laboratory (BAGL),
Vanderbilt University

Graduate Student Member   2018 - Present
Vanderbilt Institute for Surgery and Engineering (VISE),
Vanderbilt University

Publications

Featured Peer-Reviewed Publications:

1. **Khan, M.M.**, Fan, Y., Dawant, B.M. and Noble, J.H., 2023, October. Cochlear Implant Fold Detection in Intra-operative CT Using Weakly Supervised Multi-task Deep Learning. In International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI) (pp. 249-259). Cham: Springer Nature Switzerland. [**This paper was among the top 14% of all the submitted papers at MICCAI 2023, one of the top tier conferences in medical image processing**].

2. Cass, N.D., Mason, H.G., **Khan, M.M.**, Lindquist, N.R., Noble, J.H. and Tawfik, K.O., 2023. Endoscope-Assisted Visualization of the Internal Auditory Canal Using the Middle Fossa Approach. Otology & Neurotology, 44(8), pp.822-825. (IF: 2.31)

3. Fan, Y., **Khan, M.M.**, Liu, H., Noble, J.H., Labadie, R.F. and Dawant, B.M., 2023, April. Temporal bone CT synthesis for MR-only cochlear implant preoperative planning. In Medical Imaging 2023 (Vol. 12466, pp. 358-363). SPIE.

4. **Khan, M.M.**, Banalagay, R., Labadie, R.F. and Noble, J.H., 2022, April. Sensitivity of intra-cochlear anatomy segmentation methods to varying image acquisition parameters. In Medical Imaging 2022 (Vol. 12034, pp. 111-116). SPIE.

5. **Khan, M.M.**, Labadie, R.F. and Noble, J.H., 2020. Preoperative prediction of angular insertion depth of lateral wall cochlear implant electrode arrays. Journal of Medical Imaging, 7(3), pp.031504-031504. (IF: 2.40)

6. **Khan, M.M.**, Labadie, R.F. and Noble, J.H., 2020, March. Preoperative prediction of insertion depth of lateral wall cochlear implant electrode arrays. In Medical Imaging 2020: Image-Guided Procedures, Robotic Interventions, and Modeling (Vol. 11315, pp. 719-725). SPIE.

7. **Khan, M.M.**, Labadie, R.F. and Noble, J.H., 2020, March. Preoperative angular insertion depth prediction in case of lateral wall cochlear implant electrode arrays. In Medical Imaging 2020: Image-Guided Procedures, Robotic Interventions, and Modeling (Vol. 11315, pp. 452-455). SPIE.

8. **Khan, M.M.**, 2018, Non-Parametric Learning for Energy Disaggregation. Theses and Dissertations. 3307. https://scholarsjunction.msstate.edu/td/3307

Other Conference Proceedings:

9. Sakib, S., Siddique, M.A.B., **Khan, M.M.**, Yasmin, N., Aziz, A., Chowdhury, M. and Tasawar, I.K., 2021, October. Transfer learning based method for automatic COVID-19 cases detection in chest x-ray images. In 2021 2nd International Conference on Smart Electronics and Communication (ICOSEC) (pp. 890-895). IEEE.

10. Sakib, S., Yasmin, N., Tasawar, I.K., Aziz, A., Siddique, M.A.B. and **Khan, M.M.**, 2021, September. Performance analysis of machine learning approaches in diabetes prediction. In 2021 IEEE 9th Region 10 Humanitarian Technology Conference (R10-HTC) (pp. 1-6). IEEE.

11. **Khan, M.M.**, Sakib, S., Siddique, M.A.B., Chowdhury, M., Hossain, Z., Aziz, A. and Yasmin, N., 2020, December. Automatic detection of covid-19 disease in chest x-ray images using deep neural networks. In 2020 IEEE 8th R10 Humanitarian Technology Conference (R10-HTC) (pp. 1-6). IEEE.

12. Sakib, S., Siddique, M.A.B., **Khan, M.M.**, Yasmin, N., Aziz, A., Chowdhury, M. and Tasawar, I.K., 2020. Detection of COVID-19 disease from chest X-ray images: a deep transfer learning framework. MedRxiv, pp.2020-11.

13. Siddique, M.A.B., Sakib, S., **Khan, M.M.**, Tanzeem, A.K., Chowdhury, M. and Yasmin, N., 2020, October. Deep convolutional neural networks model-based brain tumor detection in brain MRI images. In 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC) (pp. 909-914). IEEE.

14. **Khan, M.M.**, Siddique, M.A.B., Sakib, S., Aziz, A., Tanzeem, A.K. and Hossain, Z., 2020, October. Electrocardiogram heartbeat classification using convolutional neural networks for the detection of cardiac Arrhythmia. In 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC) (pp. 915-920). IEEE.

15. **Khan, M.M.**, Siddique, M.A.B. and Sakib, S., 2019, December. Non-intrusive electrical appliances monitoring and classification using K-nearest neighbors. In 2019 2nd International Conference on Innovation in Engineering and Technology (ICIET) (pp. 1-5). IEEE.

16. **Khan, M.M.**, Siddique, M.A.B., Arif, R.B. and Oishe, M.R., 2018, September. ADBSCAN: Adaptive density-based spatial clustering of applications with noise for identifying clusters with varying

densities. In 2018 4th international conference on electrical engineering and information & communication technology (iCEEiCT) (pp. 107-111). IEEE.

Manuscripts In Preparation:
17. **Khan, M.M.**, Kareem O. Tawfik, Ankita Patroa, Miriam R. Smetak, David Haynes, Robert F. Labadie, and Jack H. Noble. Automatic Preoperative Cochlear Implant Electrode Insertion Plans Improve Surgical Placement of Slim Pre-curved Arrays.
18. **Khan, M.M.**, Labadie, R.F. and Noble, J.H. Insertion Depth Prediction Model Based on the Sensitivity of Intra-cochlear Anatomy Segmentation Method to Varying Image Acquisition Parameters.

Oral Presentations

Society of Photo-Optical Instrumentation Engineers (SPIE) conference proceeding	08/2022
Society of Photo-Optical Instrumentation Engineers (SPIE) conference proceeding	02/2022

Poster Presentations

Vanderbilt Institute for Surgery and Engineering (VISE) Symposium	12/2023
Medical Image Computing and Computer-Assisted Intervention (MICCAI) conference proceeding	10/2023
Vanderbilt Institute for Surgery and Engineering (VISE) Symposium	12/2022
Society of Photo-Optical Instrumentation Engineers (SPIE) conference proceeding	08/2020

Peer Review Activities

- Transactions on Multimedia Computing Communications and Applications (TOMM) 2020
- IEEE International Conference on Systems, Man, and Cybernetics (SMC) 2022 (3 reviews), Czech Republic
- IEEE International Conference on Systems, Man, and Cybernetics (SMC) 2021 (4 reviews), Melbourne, Australia
- IEEE International Conference on Systems, Man, and Cybernetics (SMC) 2020 (1 review), Toronto, Canada

Social Media

LinkedIn: https://www.linkedin.com/in/mohammad-mahmudur-rahman-khan-1199a477/
Facebook: https://www.facebook.com/mahmudurrahman.khan.1

Patents and Technology Transfer

1. Zhao, Y., **Khan, M.M.**, Farhand, S., "A GAN-based framework for generating synthetic class-conditional nodules," 2023E16673 U.S. (under review), 2023.
2. **Khan, M.M.**, Farhand, S., Zhao, Y., "Double Encoder conditional VQGAN framework for generating synthetic nodules," 2023E16863 U.S. (under review), 2023.

Professional Community Activities

Treasurer	2017- 2018
Bangladesh Association of Mississippi State University	
Social Media Organizer	
Bangladesh Student Association, Vanderbilt University	2023- 2024