K M Naimul Hassan

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RESEARCH INTEREST

Brain-Computer-Interface, Neuro AI, Audio and Speech Signal Processing, Speech Perception, AI for Healthcare, Multimodal Learning

WORK EXPERIENCE

Graduate Research Associate, The Ohio State University Aug. 2023 – Present
The ASPIRE Group @ OSU Columbus, Ohio, USA
Advisor: Prof. Donald Williamson

- **A Large-Scale Multimodal Dataset to Determine Physical and Neural Cues that Correlate with Speech Attention**
  - Conducted a large-scale multimodal study using synchronized EEG, eye gaze, head motion, audio, and video.
  - Collected hundreds of hours of human-subject data in a multi-loudspeaker setup with varying speaker locations and noise levels.
  - Developed custom experimental and synchronization software to analyze cross-modal attention cues.
- **Towards Generalizing Auditory Attention Detection**
  - Proposed a foundation model for learning generalizable auditory attention representations from EEG and speech.
  - Developed a self-supervised contrastive framework with dual EEG and audio encoders.
  - Pre-trained EEG-based Transformer models on public auditory EEG datasets.
- **Gaze-Conditioned Multimodal Auditory Attention Decoding**
  - Developing a multimodal attention decoding framework combining speech features, EEG, and eye gaze.
  - Designing a gaze-conditioned neural model with dynamic modulation of attention predictions.

Research Assistant, Bangladesh University of Engineering and Technology July 2021 – July 2023
Dhaka, Bangladesh

Advisor: Prof. Mohammad Ariful Haque

- **Privacy-Preserving Cough Detection from Audio Signals**
  - Built a speech-privacy-aware cough detection pipeline using audio source separation.
  - Implemented Wave-U-Net for cough-speech separation and downstream cough event detection.
  - Improved cough detection performance by up to 13.8% F1-score while preserving speech privacy.
- **Audio Spectrogram Fourier Network for Efficient Medical Sound Event Detection**
  - Designed an attention-free transformer for efficient medical sound event detection using Fourier-based encoding.
  - Replaced self-attention with FFT-based sublayers to reduce model complexity while improving detection performance.
  - Achieved a 16.8% relative mAP improvement with fewer parameters and smaller model size compared to Audio Spectrogram Transformer (AST).

EDUCATION

The Ohio State University Aug. 2023 – Present
Ph.D. in Computer Science and Engineering Columbus, Ohio
Current CGPA: 3.70/4.00
Selected Courses: Seminar in Speech and Hearing Science, Introduction to Artificial Intelligence, Machine Learning and Pattern Recognition, Computer Vision for HCI

Bangladesh University of Engineering and Technology Feb. 2016 – July 2023
M.Sc. and B.Sc. both in Electrical and Electronic Engineering Dhaka, Bangladesh
Selected Courses: Deep Learning: Models, Theory and Applications, Biomedical Signal Processing, Digital Signal Processing

NOTABLE PUBLICATIONS

Google Scholar

Published

- **K. M. N. Hassan** and M. A. Haque, "SS+CEDNet: A Speech Privacy Aware Cough Detection Pipeline by Separating Sources," 2022 IEEE 10th Region 10 Humanitarian Technology Conference (R10-HTC), 2022, pp. 32-37, doi: 10.1109/R10-HTC54060.2022.9929794.
  Repository Paper
- **K. M. N. Hassan** et al., "ALSNet: A Dilated 1-D CNN for Identifying ALS from Raw EMG Signal," ICASSP 2022 - 2022 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2022, pp. 1181-1185, doi: 10.1109/ICASSP43922.2022.9747366.
  Repository Paper
- A. B. A. Qayyum, **K. M. N. Hassan**, A. Anika et al., "DOANet: a deep dilated convolutional neural network approach for search and rescue with drone-embedded sound source localization," J AUDIO SPEECH MUSIC PROC. 2020, 16 (2020). https://doi.org/10.1186/s13636-020-00184-2.
  Repository Paper
- A. B. A. Qayyum, A. Anika, M. M. M. Miah, M. M. Rahman, **K. M. N. Hassan** et al., "Direction of Arrival Estimation through Noise Suppression: A Novel Approach using GSC Beamforming and Room Acoustic Simulation," 2019 IEEE International Conference on Signal Processing, Information, Communication & Systems (SPICSCON), 2019, pp. 104-108, doi: 10.1109/SPICSCON48833.2019.9065151.
  Paper
- **K. M. N. Hassan**, S. K. Biswas, M. S. Anwar, M. S. Iman Siam and C. Shahnaz, "A Dual-Purpose Refreshable Braille Display Based on Real Time Object Detection and Optical Character Recognition," 2019 IEEE International Conference on Signal Processing, Information, Communication & Systems (SPICSCON), 2019, pp. 78-81, doi: 10.1109/SPICSCON48833.2019.9065110.
  Repository Paper

Under Review

- **K. M. N. Hassan** and M. A. Haque, "ASFNet: Audio Spectrogram Fourier Network for Efficient Medical Sound Event Detection," IEEE/ACM Transactions on Audio, Speech, and Language Processing.

SKILLS SUMMARY

Programming Languages : Python, C, C++, MATLAB, PsychoPy, Shell Scripts, Assembly, JavaScript
ML-DL Frameworks : PyTorch, TensorFlow, Keras, scikit-learn, Pandas, OpenCV, Numpy
Hardware & IoT : AntNeuro EEG, Tobii Glasses, Arduino, Raspberry Pi, Microcontroller
Web Development : HTML, CSS

OTHER PROJECTS

Synthetic speech attribution
IEEE SP Cup 2022

Mentored a team which was able to develop a vector-to-vector similarity-based feature clustering network that processes Mel-spectrogram and x-vector audio features through convolutional and dense layers for speech attribute modeling.

Intelligent dialog management of social-bots
Amazon Alexa Prize SocialBot Grand Challenge 2022

Designed a modular social conversational agent with separate Natural Language Understanding, Dialog Management, and Response Generation components. Integrated intent/entity recognition, sentiment and emotion modeling, user persona embeddings, and neural response generation to enable engaging, context-aware conversations.

Unsupervised anomaly detection in multimodal autonomous systems
IEEE SP Cup 2020

Proposed two anomaly detection methods using IMU sensor data and video data, employing an LSTM autoencoder for sensor signals and a convolutional autoencoder on optical-flow features for video analysis, with a parametric anomaly score ranging from 0 (normal) to 1 (abnormal).

Search & rescue with drone-embedded sound source localization
IEEE SP Cup 2019

Designed a deep neural network for sound source localization that estimates direction of arrival from multi-channel audio signals. Utilized convolutional feature extraction to learn spatial relationships in microphone array recordings under noise.

Privacy protected office activity recognition from first-person-view body camera videos
IEEE VIP Cup 2019

Privacy-protected Activity recognition on body-camera videos - Employed CNN-based feature extraction with MLPs for classification, and used YOLOv3-based object detection with template matching and blurring for privacy protection.

Refreshable braille display based on real-time object detection and optical character recognition
Innovation Challenge, IEEE YESIST12 2019

Developed a dual-purpose assistive system for visually impaired users that performs real-time object detection and text recognition from camera input. Integrated CNN-based object detection and OCR with a refreshable Braille display to enable portable reading and environmental awareness.

HONORS AND AWARDS

- Center for Cognitive and Brain Sciences (CCBS) Summer Graduate Research Award (2025)
- IEEE Signal Processing Society (SPS) Scholarship (2024)
- CSE Scarlet and Gray Award (2023-Present)
- Post-graduate fellowship (M.Sc.) (2021-2023)
- Second runner-up, IEEE Signal Processing (SP) Cup (2020)
- First runner-up, IEEE Video and Image Processing (VIP) Cup (2019)
- World finalist & national champion, Innovation Challenge, IEEE YESIST12, 2019
- World ranked 10^{th}, IEEE Signal Processing (SP) Cup (2019)

REFERENCE

Donald Williamson
Associate Professor
Department of Computer Science and Engineering
The Ohio State University
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