K M Naimul Hassan

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RESEARCH INTEREST

Multimodal learning from brain and speech signals: aligning neural responses with speech, decoding auditory attention from EEG in real time, and building closed-loop brain-computer interfaces for neuro-steered hearing technology.

Keywords: Brain-Computer Interfaces, Neuro AI, EEG Decoding, Auditory Attention Decoding, Representation Learning, Multimodal Learning, Speech Perception, Speech & Audio Signal Processing, AI for Healthcare

EXPERIENCE

The Ohio State University — Columbus, Ohio
Graduate Research Associate, ASPIRE Group · Advisor: Prof. Donald S. Williamson — Aug 2023 – Present

Multimodal Sensing for Auditory Attention Decoding

- Led MAESTRO, the first attention-decoding dataset to pair EEG with natural gaze, egocentric video, and head motion; prior datasets record EEG alone.
- Improved four-speaker decoding by up to 13 points over EEG alone, beating it in 94% of unseen-subject cases.
- Showed these gains nearly double at shorter windows, where EEG alone has little context to work with.

Temporal Alignment of EEG Responses with Speech Stimuli

- Tackled EEG–speech temporal alignment, identifying which speech segment is time-locked to a neural response despite EEG noise and cross-subject variability, using supervised contrastive learning with cross-modal attention.
- Set a new state of the art on the ICASSP 2024 EEG decoding benchmark, raising unseen-subject accuracy from 62.8% to 69.3% and cutting cross-subject variability 3× (std. 4.6% vs. 14.7%).
- Outperformed the ICASSP 2023 challenge winner (86.1 vs. 82.1 total score).

Belief-State Reinforcement Learning for Auditory Attention Decoding

- Developing a POMDP-based reinforcement learning agent that decodes auditory attention from EEG and maintains a belief state for uncertainty-aware, real-time control of neuro-steered hearing aids.

Bangladesh University of Engineering and Technology — Dhaka, Bangladesh
Research Assistant, Department of Electrical and Electronic Engineering — Jul 2021 – Jul 2023

Privacy-Preserving Cough Detection with Source Separation

- Designed a cough detector for speech-filled audio, where background speech lowers accuracy and exposes conversations, by separating the two sources with Wave-U-Net.
- Improved cough-detection F1 from 87% to 99% and boosted all four detectors tested, without discarding overlapped audio.

Efficient Transformer for Medical Sound Event Detection

- Designed ASFNet, an attention-free transformer that replaces self-attention with FFT sublayers, for medical sound detection where scarce data and limited compute hold back standard transformers.
- Surpassed the Audio Spectrogram Transformer by 18% relative mAP (0.473 vs. 0.401) with 36% fewer parameters.

EDUCATION

The Ohio State University — Columbus, Ohio
Ph.D. in Computer Science and Engineering — Aug 2023 – Present

Bangladesh University of Engineering and Technology (BUET) — Dhaka, Bangladesh
M.Sc. in Electrical and Electronic Engineering — Jul 2021 – Jul 2023
B.Sc. in Electrical and Electronic Engineering — Feb 2016 – Feb 2021

NOTABLE PUBLICATIONS

NEURAL DECODING & BRAIN-COMPUTER INTERFACES

- **MAESTRO: A Multimodal Auditory-attention Egocentric Speech-TRacking Open corpus**
  K. M. N. Hassan, A. Alavi, D. Williamson · *Under Review, IEEE TASLP, 2026* · Ph.D. Research
- **SCANS: Supervised Contrastive Temporal Alignment of Neural Responses and Speech Stimuli**
  K. M. N. Hassan, D. Williamson · *Interspeech 2026* · Ph.D. Research

AUDIO & SPEECH PROCESSING

- **ASFNet: Audio Spectrogram Fourier Network for Efficient Medical Sound Event Detection**
  K. M. N. Hassan, M. A. Haque · *Preprint, TechRxiv 2023* · M.Sc. Thesis
- **SS+CEDNet: A Speech Privacy Aware Cough Detection Pipeline by Separating Sources**
  K. M. N. Hassan, M. A. Haque · *IEEE R10-HTC 2022* · M.Sc. Thesis
- **DOANet: A Deep Dilated CNN Approach for Search and Rescue with Drone-Embedded Sound Source Localization**
  A. B. A. Qayyum, *K. M. N. Hassan*, A. Anika et al. · *EURASIP Journal on Audio, Speech, and Music Processing, 2020*
- **Direction of Arrival Estimation through Noise Suppression: A Novel Approach using GSC Beamforming and Room Acoustic Simulation**
  A. B. A. Qayyum, A. Anika, M. M. M. Miah, M. M. Rahman, *K. M. N. Hassan* et al. · *IEEE SPICSCON 2019*

AI FOR HEALTHCARE & ACCESSIBILITY

- **ALSNet: A Dilated 1-D CNN for Identifying ALS from Raw EMG Signal**
  K. M. N. Hassan et al. · *ICASSP 2022*
- **A Dual-Purpose Refreshable Braille Display Based on Real Time Object Detection and Optical Character Recognition**
  K. M. N. Hassan, S. K. Biswas, M. S. Anwar, M. S. Iman Siam, C. Shahnaz · *IEEE SPICSCON 2019*

SKILLS

Programming	Python, C/C++, MATLAB, CUDA, Shell/Bash, JavaScript, HTML/CSS
ML Frameworks	PyTorch, HuggingFace, TensorFlow/Keras, scikit-learn, NumPy, Pandas, OpenCV
Training Infrastructure	Multi-node distributed training, Slurm, AWS, Git
Evaluation & Data	Benchmark design, Human evaluation protocols, Large-scale data curation
Hardware & Sensing	AntNeuro EEG, Tobii eye-tracking glasses, PsychoPy, Raspberry Pi, Microcontrollers

SELECTED PROJECTS

- **Synthetic Speech Attribution** (IEEE SP Cup 2022, team mentor): Mentored a team building a model that identifies which speech-synthesis system generated an audio clip.
- **Social Conversational Agent** (Amazon Alexa Prize SocialBot Grand Challenge 2022): Designed a chatbot for open-ended conversation, with modules for understanding intent, managing dialog, and generating responses.
- **Anomaly Detection in Autonomous Systems** (IEEE SP Cup 2020): Flagged abnormal behavior from motion-sensor and video data without labeled examples, using autoencoders.
- **Drone-Based Sound Source Localization** (IEEE SP Cup 2019): Estimated the direction of a sound source from a drone's microphone array in noise, for search and rescue.
- **Privacy-Protected Activity Recognition** (IEEE VIP Cup 2019): Recognized office activities from body-camera video while blurring sensitive objects.
- **Refreshable Braille Display** (IEEE YESIST12 2019): Built a portable device that reads text and detects objects for visually impaired users, with output on a Braille display.

HONORS & 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, The Ohio State University — 2023 – Present
- Post-graduate Fellowship (M.Sc.), BUET — 2021 – 2023
- Second Runner-up, IEEE Signal Processing (SP) Cup — 2020
- First Runner-up, IEEE Video and Image Processing (VIP) Cup — 2019
- World Ranked 10th, IEEE Signal Processing (SP) Cup — 2019
- World Finalist & National Champion, IEEE YESIST12 Innovation Challenge — 2019