Badhan Mazumder

Ph.D. Student | Georgia State University| Atlanta, GA

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Education

Present – Jan 2023 | **Ph.D. in Computer Science, Georgia State University, Atlanta, GA**
- Focus : Multimodal Learning of Brain Structure-Function Coupling | Advisor : Dr. Dong Hye Ye

Jan 2025 – Jan 2023 | **M.S. in Computer Science, Georgia State University, Atlanta, GA**
- Focus : Multimodal Deep Learning

Dec 2019 – Jan 2016 | **B.Sc. in CSE, Patuakhali Science and Technology University, Bangladesh**
- Focus : Digital Image Processing | Advisor : Dr. S.M.Taohidul Islam

Research Experience

Present – Jan 2025 | **Physics-Guided Multimodal Learning for Brain Connectivity and Cognition**

Mentor : Dr. Dong Hye Ye & Dr. Vince D. Calhoun
- Current research focuses on multimodal learning for physics-guided and cognition-aware modeling of longitudinal brain connectivity, emphasizing structure-function coupling and neural-behavioral alignment in neurodevelopment.
- Developed neural Koopman operator-based and multi-scale graph attention frameworks for multimodal connectomic fusion and cognitive modeling under prenatal drug exposure.[BHI-25, ICASSP-26]
- Developed Kuramoto-guided, Riemannian geometry-aware, and behavior-conditioned graph learning frameworks to capture dynamic and longitudinal brain connectivity patterns associated with substance use risk and neurodevelopmental vulnerability.[ISBI-26, ICASSP-26]

Multimodal Learning | Physics-Guided Learning | Graph Neural Network | Riemannian Manifold

Jan 2025 – Jan 2024 | **Multimodal Representation Learning of Brain Networks in Neuropsychiatric Disorder**

Mentor : Dr. Dong Hye Ye & Dr. Vince D. Calhoun
- Proposed graph-based multimodal brain connectomics fusion frameworks to model structural–functional coupling in schizophrenia-related network organization.[PRIME-MICCAI-2024, EMBC-25]
- Developed explainable multimodal frameworks integrating structural MRI, functional MRI, and genetic markers to uncover biologically interpretable neuropsychiatric signatures. [Front. Psych.-2024, ISBI-25]

Deep Learning | Multimodal Fusion | Representation Learning | Graph Neural Network | Physics-guided Learning

Dec 2023 – Jan 2023 | **Deep Multimodal MRI Fusion for Pediatric Mild Traumatic Brain Injury Prediction**

Mentor : Dr. Dong Hye Ye & Dr. Ashley L. Ware
- Proposed a multi-modal deep learning framework that fuses structural MRI and diffusion MRI for enhanced prediction of pediatric mild traumatic brain injury. [BHI-2023]

Deep Learning | Multi-modal Fusion | Representation Learning

Dec 2022 – Feb 2019 | **Wavelet based Feature Extraction for Digital Image Analysis**

Mentor : Dr. S.M.Taohidul Islam
- Proposed wavelet based feature extraction algorithms for agricultural plant disease detection using leaf images [IEE-ICECTE-2019][MIET-2022][Journal of Agriculture and Food Research-2023].
- Proposed wavelet- and shearlet-based feature extraction methods for medical image analysis, including early detection of multiple sclerosis from MRI and classification of breast microcalcifications from mammographic images [IEEE-ICAICT-2020], [IEEE-STI-2020].

Digital Image Processing | Medical Image Analysis | Feature Extraction | Wavelet Transform | Machine Learning

Publications

2026 Badhan Mazumder, Sir-Lord Wiafe, Vince D. Calhoun, and Dong Hye Ye, "NeuroBRIDGE : Behavior-Conditioned Koopman Dynamics with Riemannian Alignment for Early Substance Use Initiation Prediction from Longitudinal Functional Connectome," in 2026 IEEE 51th International Conference on Acoustics, Speech, and Signal Processing (ICASSP). [**Accepted**]

2026 Badhan Mazumder, Sir-Lord Wiafe, Aline Kotoski, Vince D. Calhoun, and Dong Hye Ye, "Learning Structural-Functional Brain Representations through Multi-Scale Adaptive Graph Attention for Cognitive Insight," in 2026 IEEE 51th International Conference on Acoustics, Speech, and Signal Processing (ICASSP). [**Accepted**]

2026 Badhan Mazumder, Lei Wu, Sir-Lord Wiafe, Vince D. Calhoun, and Dong Hye Ye, "KOCOBrain : Kuramoto-Guided Graph Network for Uncovering Structure-Function Coupling in Adolescent Prenatal Drug Exposure," in 2026 IEEE 23rd International Symposium on Biomedical Imaging (ISBI). [Accepted]

2025 Badhan Mazumder, Aline Kotoski, Vince D. Calhoun, and Dong Hye Ye, "NeuroKoop : Neural Koopman Fusion of Structural-Functional Connectomes for Identifying Prenatal Drug Exposure in Adolescents," in 2025 IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI). **[NSF-EMBS-Google NextGen Scholar Award]**

2025 Badhan Mazumder, Lei Wu, Vince D. Calhoun, and Dong Hye Ye, "Unified cross-modal attention-mixer based structural-functional connectomics fusion for neuropsychiatric disorder diagnosis," in 2025 47th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC). [Paper]

2025 Badhan Mazumder, Lei Wu, Vince D. Calhoun, and Dong Hye Ye, "Genetics encoded joint embedding of multimodal connectomes with explainable graph neural network for schizophrenia classification," in 2025 IEEE 22nd International Symposium on Biomedical Imaging (ISBI). IEEE, pp. 1-5. [Paper]

2025 Samrat Kumar Dey, Khandaker Mohammad Mohi Uddin, Arpita Howlader, Md Mahbubur Rahman, Hafiz Md Hasan Babu, Nitish Biswas, Umme Raihan Siddiqi, and Badhan Mazumder, "Analyzing infant cry to detect birth asphyxia using a hybrid CNN and feature extraction approach," Neuroscience Informatics : 100193. [Paper]

2024 Badhan Mazumder, Ayush Kanyal, Lei Wu, Vince D. Calhoun, and Dong Hye Ye, "Physics-guided multi-view graph neural network for schizophrenia classification via structural-functional coupling," in International Workshop on PRedictive Intelligence In MEdicine. Springer, pp. 61–73. **[PRIME-MICCAI Best Paper Award]**

2024 Ayush Kanyal, Badhan Mazumder, Vince D Calhoun, Adrian Preda, Jessica A Turner, Judith M Ford, and Dong Hye Ye, "Multi-modal deep learning from imaging genomic data for schizophrenia classification," Frontiers in Psychiatry, vol. 15, pp. 1384842. [Paper]

2024 Khandaker Mohammad Mohi Uddin, Md Nuzmul Hossain Nahid, Md Mehedi Hasan Ullah, Badhan Mazumder, Md Saikat Islam Khan, and Samrat Kumar Dey, "Machine learning-based chronic kidney cancer prediction application : A predictive analytics approach," Biomedical Materials & Devices, vol. 2, no. 2, pp. 1028–1048. [Paper]

2023 Badhan Mazumder, Deepan Krishna Tripathy, Keith Owen Yeates, Miriam H Beauchamp, William Craig, Quynh Doan, Stephen B Freedman, Catherine Lebel, Roger Zemek, Ashley L Ware, et al., "Multimodal deep learning for pediatric mild traumatic brain injury detection," in 2023 IEEE EMBS International Conference on Biomedical and Health Informatics (BHI). IEEE, pp. 1–4. **[NSF Student Travel Award]**

2023 Badhan Mazumder, Md Saikat Islam Khan, and Khandaker Mohammad Mohi Uddin, "Biorthogonal wavelet based entropy feature extraction for identification of maize leaf diseases," Journal of Agriculture and Food Research, vol. 14, pp. 100756. [Paper]

2022 Khandaker Mohammad Mohi Uddin, Samrat Kumar Dey, Nitish Biswas, Suman Chandra Das, Arpita Howlader, Umme Raihan Siddiqi, Badhan Mazumder, and Md Mahbubur Rahman, "Toward early detection of neonatal birth asphyxia utilizing ensemble machine learning approach," in International Joint Conference on Advances in Computational Intelligence. Springer, pp. 39 49. [Paper]

2022 Sarna Majumder, Badhan Mazumder, and SM Taohidul Islam, "Gabor wavelet based fused texture features for identification of mungbean leaf diseases," in International Conference on Machine Intelligence and Emerging Technologies. Springer, pp. 22–34. [Paper]

2020 Md Moshiur Rahman, Md Abdul Masud, and Badhan Mazumder, "Estimation of the number of clusters based on simplical depth," in 2020 2nd International Conference on Sustainable Technologies for Industry 4.0 (STI). IEEE, pp. 1–5. [Paper]

2020 Badhan Mazumder, SM Taohidul Islam, Md Moshiur Rahman, and Md Nurullah, "Stationary wavelet based energy feature extraction for detection and classification of mammographic microcalcifications," in 2020 2nd International Conference on Sustainable Technologies for Industry 4.0 (STI). IEEE, pp. 1–5. **[Best Paper Award]**

2020 Badhan Mazumder, SM Taohidul Islam, and Md Moshiur Rahman, "Non-subsampled shearlet entropy and logistic regression based multiple sclerosis detection," in 2020 2nd International Conference on Advanced Information and Communication Technology (ICAICT). IEEE, pp. 105–110. **[Best Paper Award]**

2020 Badhan Mazumder and Md Nurullah, "Wavelet based entropy features for facial expression recognition," in 2020 IEEE Region 10 Symposium (TENSYMP). IEEE, pp. 1347–1350. [Paper]

2019 SM Taohidul Islam and Badhan Mazumder, "Wavelet based feature extraction for rice plant disease detection and classification," in 2019 3rd International Conference on Electrical, Computer & Telecommunication Engineering (ICECTE). IEEE, pp. 53–56. [Paper]

Professional Experience

Present | **Graduate Teaching Assistant** at Georgia State University, Department of Computer Science | Course : CSC 8260 : Advanced Image Processing

Aug 2025

- Assisted with graduate-level instruction through recitation sessions, assignment and exam preparation, project support, and grading.
- Delivered guest lectures and independently conducted selected class sessions.

Graduate Instruction | Teaching | Mentoring

Present | **Graduate Research Assistant** at Georgia State University, Center for Translational Research in Neuroimaging and Data Science (TReNDS) | Mentor : Dr. Dong Hye Ye & Dr. Vince D. Calhoun

Jan 2023

- Developing physics-guided multimodal learning frameworks for longitudinal analysis of adolescent brain connectivity and structure-function coupling under substance-related neurodevelopmental risk.
- Proposed novel multimodal deep learning frameworks for classification of schizophrenia individual with multimodal brain networks and genetic marker.
- Developed a multimodal deep learning framework to predict individual outcome of mild traumatic brain injury.

Multimodal Fusion | Neuroimaging Analysis | Graph Neural Network | Physics Guided Learning

Dec 2022 | **Lecturer** at Department of CSE, Dhaka International University, Bangladesh

Mar 2021

- Conducted undergraduate-level instruction across core computer science subjects.
- Supervised undergraduate student's final year project/thesis.
- Co-ordinated and mentored assigned group of undergraduate students.

Teaching | Mentoring

Feb 2021 | **Undergraduate Research Assistant** at Patuakhali Science and Technology University, Bangladesh | Mentor : Dr. S.M.Taohidul Islam

Feb 2019

- Worked on developing advanced feature extraction algorithms to detect brain tumor using MRI scans and breast cancer from mammographic images.
- Developed algorithms for automated agricultural plant leaf disease detection. [Research Project ID-554, funded by BARC, NATP-2 and funded by Asi@Connect and TEIN*CC]

Machine Learning | Digital Signal Processing | Medical Image Analysis

Honors and Awards

2025 NSF-EMBS-Google Young Professional NextGen Scholar Award
2025 Martin D. Fraser Graduate Student Conference Travel Award : Georgia State University
2025 Dean's Graduate Research Grants : Georgia State University
2024 Best Paper Award : International Workshop on PRedictive Intelligence In MEdicine (PRIME -MICCAI).
2023 NSF Student Travel Award : International Conference on Biomedical and Health Informatics (BHI).
2020 Best Paper Award : International Conference on Advanced Information and Communication Technology.
2020 Best Paper Award : International Conference on Sustainable Technologies for Industry 4.0
2019 Dean's Merit Award : Patuakhali Science and Technology University.
2018 Dean's Merit Award : Patuakhali Science and Technology University.

Academic Service

- **Conference Reviewer :** International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), International Symposium on Biomedical Imaging (ISBI), International Conference on Image Processing (ICIP), Organization for Human Brain Mapping Annual Meeting (OHBM)
- **Journal Reviewer :** IEEE Transactions on Biomedical Engineering (TBME), IEEE Transactions on Neural Networks and Learning Systems, Healthcare Analytics

Technical Skills

- Deep Learning, Digital Image Processing
- Python, C++, C#, Java, R, Matlab
- Pytoch, Numpy, Pandas

Relevant Courses

Advanced Machine Learning | Advanced Algorithms | Advanced Image Processing | Deep Learning | Natural Language Processing