

Sayan Ghosal

CONTACT INFORMATION

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Linkedin | Website

PROFESSIONAL SUMMARY

- Data science researcher with 5+ years of experience in high dimensional data analysis which involves building data modality agnostic robust and interpretable models for biomedical and genetic data analysis.
- Developed and built a collaborative network with scientists across the globe, and engaged in multiple collaborative projects which led to 7 publications in peer reviewed conferences and journals.
- Passionate about finding the genetic foundation of risk propagation mechanisms in different neuropsychiatric diseases through data-driven learning and inference on imaging-genetics datasets.

EDUCATION

**Department of Electrical And Computer Engineering,
Johns Hopkins University, Ph.D., Spring 2023 (expected)**

- Advisor: Prof. Archana Venkataraman

**Department of Applied Mathematics And Statistics,
Johns Hopkins University, M.S.E., Spring 2021**

- GPA: 4.0/4.0

**Department of Electronics and Telecommunication Engineering,
Jadavpur University, B.E., 2017**

- Honors Thesis: A novel non-rigid registration method for zebrafish larval images
- Advisor: Prof. Ananda Shankar Chowdhury
- CGPA: 9.3/10.0

RESEARCH INTERESTS

Diagnostic Modeling, Multiview Learning, Machine Learning, Graph Learning, Deep Learning, Imaging Genetics, Genomic Association Study

RESEARCH SKILLS

- Predictive modeling.
- Designing robust optimization algorithms.
- Building data modality agnostic transferable and generalizable models.
- Graph representation
- Genetic association analysis.
- Interpretable Deep Learning.
- Incorporating hierarchical structures in deeplearning models.
- Developing interpretable biomarker detection techniques.

RESEARCH EXPERIENCE

Johns Hopkins University

Graduate Research Assistant

2017 -

Advisor: Prof. Archana Venkataraman, Department of Electrical and Computer Engineering

- **GUIDE: A Biologically Interpretable Graph Convolutional Network to Link Genetic Risk Propagations and Imaging Biomarkers of Disease**
 - Developed a novel deep neural network for whole-brain and whole-genome analysis.

- Tracks the flow of genetic risk through the biological pathways using hierarchical graph convolution and attention operations.
- Fused the imaging and genetic embedding for disease classification.
- Implemented a Bayesian feature selection strategy to extract the discriminative biomarkers of each modality.
- **G-MIND: An End-to-End Multimodal Imaging-Genetics Framework for Biomarker Identification and Disease Classification**
 - Developed a novel deep neural network to integrate high dimensional multi-modal data like brain imaging and genetics data.
 - Performed a classification task, while handling missing data.
 - Identified and ranked features using an interpretable network.
- **Bridging Imaging, Genetics, and Diagnosis in a Coupled Low-Dimensional Framework**
 - Designed a novel generative-discriminative model for disease classification and feature selection.
 - Developed an ADMM based robust optimization strategy that enhances the reproducibility of the model.
 - Incorporated biological structures by using the interconnectedness information of different features.

University of Alberta, Canada

Research Assistant

2016

Advisor: Prof. Nilanjan Ray, Department of Computing Science Science.

- **Deep Deformable Image Registration**
 - Implemented a deep deformable registration algorithm for MRI images.
 - Improved the non-convex optimization of diffeomorphic demons by introducing Fully Convolutional Neural Networks (FCNN).

PUBLICATIONS

S. Ghosal, et al., "A Biologically Interpretable Graph Convolutional Network to Link Genetic Risk Pathways and Neuroimaging Markers of Disease". *bioRxiv*
Submitted in ICLR 2022

S. Ghosal, et al., "A Generative Discriminative Framework that Integrates Imaging, Genetic, and Diagnosis into Coupled Low Dimensional Space". *NeuroImage*: 238:118200, 2021

S. Ghosal, et al., "G-MIND: An End-to-End Multimodal Imaging-Genetics Framework for Biomarker Identification and Disease Classification", *Proc. SPIE, Medical Imaging 2021: Image Processing.* arXiv:2101.11656

Selected for Special Oral Presentation (<15% of Papers), and received best student paper award

S. Ghosal, et al., "Bridging Imaging, Genetics, and Diagnosis in a Coupled Low-dimensional Framework", in *MICCAI: Medical Image Computing and Computer Assisted Intervention*, 2019. **Selected for Early Acceptance (Top 18% of Submissions)**

S. Ghosal, et al., "A generative-predictive framework to capture altered brain activity in fMRI and its association with genetic risk: application to Schizophrenia", *Proc. SPIE 10949, Medical Imaging 2019: Image Processing.*

Sayan Ghosal, Nilanjan Ray, Deep deformable registration: Enhancing accuracy by fully convolutional neural net, Pattern Recognition Letters.

S. Ghosal, *et al.*, "A novel non-rigid registration algorithm for zebrafish larval images," 2017 39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC).

REVIEWER ACTIVITY	<ul style="list-style-type: none"> • NeuroImage • MICCAI: Intl Conference on Medical Image Computing and Computer Assisted Intervention 	
TUTORING AND MENTORSHIP	<ul style="list-style-type: none"> • Undergraduate Mentor • Signals, Systems and Learning (TA) • HopHacks2020 (Mentor) 	
HONORS AND AWARDS	<ul style="list-style-type: none"> • MICCAI Student Participation Award • Dept. of Electrical and Computer Engineering, JHU, PhD fellowship • Mitacs Globalink Research Fellowship Award 	2020 2017-2018 2016
RELEVANT SKILLS	Programming Languages: MATLAB, Python, L ^A T _E X Libraries: PyTorch, scikit-learn Genomic Tools: PLink, IMPUTE2	