

Sayan Ghosal

CONTACT INFORMATION

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PROFESSIONAL SUMMARY

- Data science researcher with 5+ years of experience in complex, high dimensional, and structured data analysis with an application focus on computational biology and genomics.
- Current contributions include novel models to embed structured data as graphs to regularize whole-brain whole-genome data for pattern detection and feature selection.
- Developed and built a collaborative network with scientists across the globe, and engaged in multiple collaborative projects ([Erdős Number 3](#)) which led to 7 publications in peer reviewed conferences and journals.
- Passionate about merging the gap between machine learning and the scientific domain by fusing *a priori* scientific information about real-world datasets with data-driven approaches.

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, Imaging Genetics, Genomic Association Study, Statistical Genetics, Machine Learning, Graph Learning, Deep Learning

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.

WORK EXPERIENCE

Siemens Healthineers
Machine Learning Intern

2021

Project: Cardiac Outcome Prediction from Multi-Modal Data Leveraging Prior Population Level Characteristics of the Disease
[ISMIRM 2022](#)

RESEARCH
EXPERIENCE

Department of Computing Science, University of Alberta

Mitacs Globalink Intern

2016

Project: Deformable registration of brain MRI using deep learning.

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 multimodal 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	<p>S. Ghosal, et al., "A Biologically Interpretable Graph Convolutional Network to Link Genetic Risk Pathways and Neuroimaging Markers of Disease".<i>bioRxiv Submitted in ICLR 2022</i></p> <p>S. Ghosal, et al., "A Generative Discriminative Framework that Integrates Imaging, Genetic, and Diagnosis into Coupled Low Dimensional Space". <i>NeuroImage</i>: 238:118200, 2021</p> <p>S. Ghosal, et al., "G-MIND: An End-to-End Multimodal Imaging-Genetics Framework for Biomarker Identification and Disease Classification", <i>Proc. SPIE, Medical Imaging 2021: Image Processing</i>. <i>arXiv:2101.11656</i></p> <p>Selected for Special Oral Presentation (<15% of Papers), and received best student paper award</p> <p>S. Ghosal, et al., "Bridging Imaging, Genetics, and Diagnosis in a Coupled Low-dimensional Framework", in <i>MICCAI: Medical Image Computing and Computer Assisted Intervention</i>, 2019. Selected for Early Acceptance (Top 18% of Submissions)</p> <p>S. Ghosal, et al., "A generative-predictive framework to capture altered brain activity in fMRI and its association with genetic risk: application to Schizophrenia", <i>Proc. SPIE 10949, Medical Imaging 2019: Image Processing</i>.</p> <p>Sayan Ghosal, Nilanjan Ray, Deep deformable registration: Enhancing accuracy by fully convolutional neural net, <i>Pattern Recognition Letters</i>.</p> <p>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).</p>		
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 2020 • Dept. of Electrical and Computer Engineering, JHU, PhD fellowship 2017-2018 • Mitacs Globalink Research Fellowship Award 2016 		
RELEVANT SKILLS	<p>Programming Languages: MATLAB, Python, \LaTeX</p> <p>Libraries: PyTorch, scikit-learn</p> <p>Genomic Tools: PLINK, IMPUTE2</p>		