Sayan Ghosal

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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 medical image analysis.
- Developed and built a collaborative network with scientists across the globe, and engaged in multiple collaborative projects which led to 5 publications in peer reviewed conferences and journals.
- Passionate about finding and decoding the risk propagation mechanism for different neuropsychiatric diseases through data-driven learning and inference on biomedical datasets.

Education

Department of Electrical And Computer Engineering,
Johns Hopkins University, Ph.D., 2022 (expected)

- Advisor: Prof. Archana Venkataraman

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

- GPA: 4.0/4.0 (ongoing)

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, Deep Learning

Research Skills

- Predictive Modeling.
- Designing robust optimization algorithms.
- Building data modality agnostic transferable and generalizable models.
- Graph representation
- Generative-discriminative modelling.
- Handling missing data.
- Incorporating hierarchical structures in deeplearning models.
- Developing interpretable feature 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 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.

- A Generative-Predictive Framework to Capture Altered Brain Activity in fMRI and its Association with Genetic Risk: Application to Schizophrenia
  - Implemented a generative-predictive framework that captures the differences in regional brain activity between a neurotypical cohort and a clinical population.
  - Incorporated polygenic risk scores to identify neuroimaging endophenotypes.

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).

Jadavpur University, India & University of Padova, Italy
Undergraduate Researcher 2015-2017
Advisor: Prof. Ananda Shankar Chowdhury, Department of Electronics and Telecommunication Engineering.

- A novel non-rigid registration method for zebrafish larval images
  - Proposed an unique patch based coarse-to-fine algorithm for non-rigid registration of volumetric zebrafish larval image datasets.
  - An overlapping patch based approach was taken to find accurate correspondence using minimum weight bipartite graphs.

Publications

S. Ghosal, *et al.*, "A Generative-Discriminative Framework that Integrates Imaging, Genetic, and Diagnosis into Coupled Low Dimensional Space", NeuroImage 2021. **(In submission)**

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 ("Deep Dive"), 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**

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

- NeuroImage
- MICCAI: Intl Conference on Medical Image Computing and Computer Assisted Intervention

Tutoring and Mentorship

- HopHacks2020 (Mentor)
- Signals, Systems and Learning (TA)

Honors and Awards

- MICCAI Student Participation Award 2020
- Mitacs Globalink Research Fellowship Award 2016

Relevant Skills

Programming Languages: MATLAB, Python, LaTeX
Libraries: PyTorch