

Shantanu Ghosh^(he/him)

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Personal website • 📄 Google scholar • Last updated on January 18, 2024

Research Interests

Reasoning in vision language models; Explainable AI (X-AI); Computer Vision; Medical Imaging;

Education

Boston University

Doctor of Philosophy, Electrical Engineering

Advisor(s): Dr. Kayhan Batmanghelich

Boston, Massachusetts, USA

Jan 2023 – Dec 2026 (Expected)

University of Pittsburgh (Transferred to BU)

Doctor of Philosophy, Intelligent Systems

Advisor(s): Dr. Kayhan Batmanghelich

Pittsburgh, Pennsylvania, USA

Aug 2021 – Dec 2022

Carnegie Mellon University

PCHE Cross registered student

Courses: *Foundations of Causation and Machine Learning (PHI 80625) and Visual Learning and Recognition (RI 16824)*

Pittsburgh, Pennsylvania, USA

Aug 2021 – Dec 2022

University of Florida

Master of Science, Computer Science, 3.88/4.00

Advisor: Dr. Mattia Proserpio

Gainesville, Florida, USA

Aug 2019 – May 2021

Publications

Conference Proceedings

1. **Distilling BlackBox to Interpretable models for Efficient Transfer Learning**
Shantanu Ghosh, Ke Yu, Kayhan Batmanghelich
International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), 2023. (Early accept, top ~ 14%) [Project] [Paper] [Code]
2. **Dividing and Conquering a BlackBox to a Mixture of Interpretable Models: Route, Interpret, Repeat**
Shantanu Ghosh, Ke Yu, Forough Arabshahi, Kayhan Batmanghelich
International Conference on Machine Learning (ICML), 2023. [Project] [Paper] [Code]
3. **DR-VIDAL - Doubly Robust Variational Information-theoretic Deep Adversarial Learning for Counterfactual Prediction and Treatment Effect Estimation**
Shantanu Ghosh, Zheng Feng, Jiang Bian, Kevin Butler, Mattia Proserpio
American Medical Informatics Association (AMIA) Symposium, 2022 (Oral). [Paper] [Code]
4. **Anatomy-Guided Weakly-Supervised Abnormality Localization in Chest X-rays**
Ke Yu, Shantanu Ghosh, Zhexiong Liu, Kayhan Batmanghelich
International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), 2022. [Paper] [Code]

5. **Causal AI with Real World Data: Do Statins Protect From Alzheimer's Disease Onset?**
Mattia Proserpi, **Shantanu Ghosh**, Zhaoyi Chen, Marco Salemi, Tianchen Lyu, Jiang Bian
International Conference on Medical and Health Informatics (ICMHI), 2021. [\[Paper\]](#)

Journal Articles

1. **Propensity Score Synthetic Augmentation Matching using Generative Adversarial Networks (PSSAM-GAN)**
Shantanu Ghosh, Christina Boucher, Jiang Bian, Mattia Proserpi
Journal of Computer Methods and Programs in Bio-medicine Update, 2021. [\[Paper\]](#) [\[Code\]](#)
2. **Deep Propensity Network using a Sparse Autoencoder for Estimation of Treatment Effects**
Shantanu Ghosh, Jiang Bian, Yi Guo, Mattia Proserpi
Journal of the American Medical Informatics Association (JAMIA), 2021. [\[Paper\]](#) [\[Code\]](#)

Peer reviewed workshops

1. **Tackling Shortcut Learning in Deep Neural Networks: An Iterative Approach with Interpretable Models**
Shantanu Ghosh, Ke Yu, Forough Arabshahi, Kayhan Batmanghelich
Workshop on Spurious Correlations, Invariance and Stability (SCIS), ICML, 2023.
[\[Paper\]](#) [\[Poster\]](#)
2. **Bridging the Gap: From Post Hoc Explanations to Inherently Interpretable Models for Medical Imaging**
Shantanu Ghosh, Ke Yu, Forough Arabshahi, Kayhan Batmanghelich
Workshop on Interpretable Machine Learning in Healthcare (IMLH), ICML, 2023.
[\[Paper\]](#) [\[Poster\]](#)

Research Experience

Batman Lab

Graduate Research Assistant

Boston, Massachusetts

Boston University

Jan 2023 – Present

- o **Advisor(s)**: Dr. Kayhan Batmanghelich
- o **Research Area**: Explainable AI; Computer Vision; Medical Imaging.
- o Currently developing a slice discovery algorithm using vision language (VLM) multimodal model (e.g., CLIP) to reason why a classifier makes mistakes while detecting breast cancer using breast mammograms and explain with large language models (LLMs).
- o Continuing my research by applying the mixture of interpretable models on a real-world Chest-X-Ray dataset – MIMIC-CXR to (1) eliminate the class imbalance problem; (2) transfer efficiently to an unseen domain with limited training data. **(Early) Accepted at MICCAI, 2023.**

Batman Lab

Graduate Student Researcher

Pittsburgh, Pennsylvania

University of Pittsburgh

August 2021 – December 2022

- **Advisor(s):** Dr. Kayhan Batmanghelich, Dr. Forough Arabshahi
- **Research Area:** Explainable AI; Computer Vision; Medical Imaging.
- Introduced an iterative algorithm to carve out a mixture of interpretable models from a Blackbox, each specializing in a different subset of data to provide instance-specific First-order logic-based explanations using human-understandable concepts. Also, our method effectively detected and removed the shortcut (biased) concepts from the Blackbox, making it robust. **Accepted at ICML, 2023.**
- Localized Pneumonia and Pneumothorax from **MIMIC-CXR** dataset by leveraging the anatomical landmarks (weak labels) using the **Stanford RadGraph NLP pipeline**. **Accepted at MICCAI, 2022.**
- Investigated why **lottery ticket hypothesis** works or fails in terms of explainability metrics – **Concept activation vectors (TCAV)** and **Grad-CAM** based saliency maps. **[Code] [Report]**

Florida Institute for Cybersecurity Research (FICS).....

Graduate Research Assistant

University of Florida

Gainesville, Florida

March 2021 – July 2021

- **Advisor(s):** Dr. Mattia Prosperi, Dr. Kevin Butler
- **Research Area:** Causal Inference, Deep Learning.
- Developed a novel deep learning framework to (1) generate the counterfactual outcomes based on treatment using a Generative Adversarial Network with **information-theoretic** regularization; (2) utilized the counterfactual outcomes to estimate the individual treatment effect (ITE) using **doubly robust optimization** for faster convergence. **Accepted at AMIA Symposium (Oral), 2022.**

Data Intelligence Systems Lab (DISL).....

Graduate Research Assistant

University of Florida

Gainesville, Florida

Jan 2020 – Feb 2021

- **Advisor(s):** Dr. Mattia Prosperi, Dr. Jian Bian
- **Research Area:** Causal Inference, Deep Learning.
- Designed a novel algorithm using a Generative Adversarial Network to generate synthetic treated samples to remove imbalance within an observational dataset for **Propensity score matching**. **Accepted at Computer Methods and Programs in Bio-medicine Update.**
- Developed a **sparse autoencoder** to reduce the dimensionality of the covariates of the patients to calculate the **Propensity score** in an efficient way to estimate the average treatment effect (ATE) of the treatment. **Accepted at JAMIA.**

Industry Experience

Lexmark International India Pvt Ltd.....

Software Engineering Professional II

Kolkata, India

Oct 2016 – July 2019

- Developed the ISP component of the product **Publishing Platform for Retail(PPR)**.

Cognizant Technology Solutions India Pvt Ltd.....

Associate, Projects

Kolkata, India

March 2013 – September 2016

- Developed **WCF** web services in the Contract First Approach using Service Oriented Architecture.

Skills

- **Languages.** Python, C/C++, Java, C#/.Net, Javascript/Typescript, HTML/CSS
- **Machine Learning.** TensorFlow, PyTorch, Scikit-learn
- **Web Development.** Angular, Node.js, WCF

- **Database.** MySQL, Oracle 9i/10g, MS SQL Server, DB2

Graduate Courses

- Fundamentals of Machine Learning
- Machine Learning
- Advanced Machine Learning
- Deep Learning for Computer Graphics
- Causal Inference and Machine Learning
- Visual Learning and Recognition
- Mathematics for Intelligent Systems
- Fundamentals of Probability
- Numerical Optimization
- Analysis of Algorithms
- Advanced Data Structures

Honors & Awards

- Received the **Achievement Award** of 4500 USD during the admission of graduate studies in the University of Florida in Fall 2019.
- Received the **Star Employee** award in Q4, 2013 and Q4, 2015 in Cognizant Technology Solutions.

Academic Service

Journal Review

- Medical Image Analysis (MedIA)
- Journal of Computer Methods and Programs in Biomedicine (CMPB)

Conference Review

- IEEE / CVF Computer Vision and Pattern Recognition Conference (CVPR) - 2024
- Causal Learning and Reasoning (CLear) - 2024
- International Conference on Learning Representations (ICLR) - 2024
- Association for the Advancement of Artificial Intelligence (AAAI) - 2024
- Neural Information Processing Systems (NeurIPS) - 2023
- ACM Conference on Bioinformatics, Computational Biology, and Health Informatics (BCB) - 2022

Workshop Review

- Workshop on Causal Representation Learning workshop (CRL), NeurIPS 2023
- Workshop on Spurious Correlations, Invariance and Stability (SCIS), ICML - 2023
- Workshop on Interpretable Machine Learning in Healthcare (IMLH), ICML - 2023

Teaching Experience

Introduction to Software Engineering (EC 327) - Fall 2023

Talks

- Oral Talk, AMIA 2022 Annual Symposium, Nov 2022
- Fall ISP AI Forum, University of Pittsburgh, Nov 2023