

# Shantanu Ghosh<sup>(he/him)</sup>

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Personal website • 📄 Google scholar • Last updated on October 6, 2023

## Research Interests

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Explainable AI (X-AI); Computer Vision; Medical Imaging; Deep Learning; Causal Inference

## Education

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### Boston University

*Doctor of Philosophy, Electrical Engineering*

Advisor(s): Dr. Kayhan Batmanghelich

**Boston, Massachusetts, USA**

*Jan 2023 – Present*

### 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

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### Conference Proceedings

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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 University

Boston, Massachusetts

Jan 2023 – Present

- o **Advisor(s)**: Dr. Kayhan Batmanghelich
- o **Research Area**: Explainable AI; Computer Vision; Medical Imaging.
- o Currently developing a method to eliminate the problem of shortcut learning using large-scale breast mammograms.
- 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

University of Pittsburgh

Pittsburgh, Pennsylvania

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

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- 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

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- 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

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### Journal Review

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

### Conference Review

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- Causal Learning and Reasoning (CLearR) - 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

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- 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

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Introduction to Software Engineering (EC 327) - Fall 2023

## Talks

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