Shantanu Ghosh(he/him)

✉ shawn24@bu.edu • in shantanuai • ⌂ shantanu-ai

Personal website • ⒼGoogle scholar • Last updated on July 12, 2023

Research Interests

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

Education

Boston University   **Boston, Massachusetts, USA**
Doctor of Philosophy, Electrical Engineering   *Jan 2023 – Present*
Advisor(s): Dr. Kayhan Batmanghelich

University of Pittsburgh *(Transferred to BU)*   **Pittsburgh, Pennsylvania, USA**
Doctor of Philosophy, Intelligent Systems   *Aug 2021 – Dec 2022*
Advisor(s): Dr. Kayhan Batmanghelich

Carnegie Mellon University   **Pittsburgh, Pennsylvania, USA**
PCHE Cross registered student   *Aug 2021 – Dec 2022*
Courses: Foundations of Causation and Machine Learning (PHI 80625) and Visual Learning and Recognition (RI 16824)

University of Florida   **Gainesville, Florida, USA**
*Master of Science, Computer Science, **3.88/4.00***   *Aug 2019 – May 2021*
Advisor: Dr. Mattia Prosperi

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'23), 2023. (**Early accept, top $\sim$ 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'23), 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 Prosperi
   American Medical Informatics Association (AMIA'22) 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'22), 2022. **[Paper] [Code]**

5. ***Causal AI with Real World Data: Do Statins Protect From Alzheimer'sDisease Onset?***
   Mattia Prosperi, **Shantanu Ghosh**, Zhaoyi Chen, Marco Salemi, Tianchen Lyu, Jiang Bian
   International Conference on Medical and Health Informatics (ICMHI'21), 2021. **[Paper]**

Journal Articles

1. ***Propensity Score Synthetic Augmentation Matching using Generative Adversarial Networks (PSSAM-GAN)***
   Shantanu Ghosh, Christina Boucher, Jiang Bian, Mattia Prosperi
   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 Prosperi
   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]**
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]**

Research Experience

Batman Lab

Graduate Research Assistant   **Boston, Massachusetts**
Boston University   *Jan 2023 – Present*
- **Advisor(s):** Dr. Kayhan Batmanghelich
- **Research Area**: Explainable AI; Computer Vision; Medical Imaging.
- Currently developing a method to eliminate the problem of shortcut learning using large-scale breast mammograms.
- 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 pipleline**. **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   **Gainesville, Florida**
University of 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   **Gainesville, Florida**
University of 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.

Review Experience

- Journal of Computer Methods and Programs in Biomedicine - 2023
- Neural Information Processing Systems (NeurIPS) - 2023
- Workshop on Spurious Correlations, Invariance and Stability (SCIS), ICML - 2023
- Workshop on Interpretable Machine Learning in Healthcare (IMLH), ICML - 2023
- ACM Conference on Bioinformatics, Computational Biology, and Health Informatics (BCB) - 2022

Teaching Experience

Introduction to Software Engineering (EC 327) - Fall 2023

Talks

- Oral Talk, AMIA 2022 Annual Symposium, Nov 2022