Shantanu Ghosh

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Shantanu Ghosh • Last updated on May 31, 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

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

West Bengal University of Technology — **Kolkata, India**
Bachelor of Technology, Computer Science, ***8.38/10.00*** — *Aug, 2008 – June, 2012*

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, acceptance rate** $\sim$ **14%**) **[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. **[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. (**Impact Factor: 7.9**)
   [Paper] **[Code]**

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 problem of class imbalance; (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**.
- Developed an attention model to leverage the anatomical landmarks (weak labels) using the **Stanford RadGraph NLP pipleline** to detect Pneumonia and Pneumothorax from **MIMIC-CXR** dataset. Also, designed the baseline using **RetinaNet**. **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)** using **C# .Net 4.5**, **Angular**, **HTML5** and **SQL Server**.

Cognizant Technology Solutions India Pvt Ltd

Associate, Projects — **Kolkata, India**
March 2013 – September 2016

- Developed **WCF** web services in the Contract First Approach to provide a secure communication channel between the different In-house applications using **Service Oriented Architecture (SOA)**, **C# .Net 4.5**, **Oracle Client 11g**.

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.