Shantanu Ghosh

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Shantanu Ghosh • Last updated on October 16, 2022

Research Interests

Explainable AI; Computer Vision; Medical Imaging; Deep Learning; Causal Inference

Education

University of Pittsburgh **Pittsburgh, Pennsylvania, USA**
Doctor of Philosophy, Intelligent Systems *August 2021 – Present*
Advisor(s): Dr. Kayhan Batmanghelich

Carnegie Mellon University **Pittsburgh, Pennsylvania, USA**
PCHE Cross registered student, ***4.11/4.00*** *August 2021 – Jan 2023*
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*** *August 2019 – May 2021*
Advisor: Dr. Mattia Prosperi

Research Experience

Batman Lab

Graduate Student Researcher **Pittsburgh, Pennsylvania**
University of Pittsburgh *May 2021 –Present*

- **Advisor(s):** Dr. Kayhan Batmanghelich
- **Research Area**: Explainable AI; Causal Inference; Computer Vision; Medical Imaging.
- Currently developing novel algorithm to explain the prediction of a black box classifier periodically with the help of network pruning using **lottery ticket hypothesis**. In this project, we want to extract the explainable concepts from a black-box deep learning model iteratively using a neuro-symbolic explainable model. Also, we aim to extract the shortcut (biased) concepts from the black-box through the concepts and iteratively remove them from the features of the black-box.
- Conducted research to leverage the anatomical landmarks (weak labels) from **Stanford RadGraph NLP pipleline** to create an attention driven algorithm to detect Pneumonia and Pneumothorax from **MIMIC-CXR** dataset.

Florida Institute for Cybersecurity Research (FICS)

Graduate Research Assistant **Gainesville, Florida**
University of Florida *Jan 2021 – May 2021*

- **Advisor(s):** Dr. Kevin Butler
- **Research Area**: Causal Inference, Adversarial Machine Learning.
- Designed a robust deep learning model amalgamating the theories of **Causal Graphs** and **Deep Variational Information Bottleneck**.
- Developed robust deep learning models using Causal Inference and performed adversarial attacks on them.
- Replicated the experiments discussed in the papers **"Deep Variational Information Bottleneck"** (Alemi et al.) and **"A Causal View on Robustness of Neural Networks"** (Zhang et al.) in **Pytorch**.

Data Intelligence Systems Lab (DISL)

Research Assistant **Gainesville, Florida**
University of Florida *Feb 2020 – Dec 2020*

- **Advisor(s):** Dr. Mattia Prosperi, Dr. Jian Bian
- **Research Area**: Causal Inference, Deep Learning.
- Performed research on developing models for estimating the Individual Treatment Effect (ITE) using **Doubly Robust estimation** and **Information Theoretic Deep Generative models**.
- Performed research on calculation of Propensity Scores using deep **Sparse Autoencoder** based model.
- Developed a novel algorithm using **Generative Adversarial Networks** to generate synthetic treated samples to remove imbalance within a observational dataset for Propensity score matching.

Multimedia Communications and Networking Laboratory (MCN)

Independent Researcher **Gainesville, Florida**
University of Florida *Feb 2020 – May 2020*

- **Advisor(s):** Dr. Dapeng (Oliver) Wu
- **Research Area**: Computer Vision, Multitask Learning.
- Developed a Deep Convolutional Multitask Neural Network(**MTL-TCNN**) to classify textures under the supervision of Dr Prof Dapeng Oliver Wu of the Department of Electrical & Computer Engineering in the University of Florida. **[Report] [Code]**

Publications

Conference Proceedings

1. ***DR-VIDAL - Doubly Robust Variational Information-theoretic Deep Adversarial Learning for Counterfactual Prediction and Treatment Effect Estimation***
   Shantanu Ghosh, Zheng Feng, Marco Salemi, Tianchen Lyu, Jiang Bian, Kevin Butler, Mattia Prosperi
   American Medical Informatics Association (AMIA), 2022 (**oral, *to appear***).
2. ***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.
3. ***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), 2021.

Journal Articles

1. ***Propensity Score Synthetic Augmentation Matching using Generative Adversarial Networks (PSSAM-GAN)*** **[Code]**
   Shantanu Ghosh, Christina Boucher, Jiang Bian, Mattia Prosperi
   Journal of Computer Methods and Programs in Bio-medicine Update, 2021
2. ***Deep Propensity Network using a Sparse Autoencoder for Estimation of Treatment***

***Effects* [Code]**
Shantanu Ghosh, Jiang Bian, Yi Guo, Mattia Prosperi
Journal of the American Medical Informatics Association, 2021

Industry Experience

Lexmark International India Pvt Ltd

Software Engineering Professional II **Kolkata, India**
Oct 2016 – July 2019

- Worked as a full stack developer to develop the ISP component of the product Publishing Platform for Retail(PPR) using **C# .Net 4.5**, **Angular**, **HTML5** and **SQL Server** with active participation in 2 major releases. Performed unit testing using **Jasmine/Karma Framework**.
- Worked on the Lexmark Digital Media Platform, a multi-tenant enterprise video content management platform hosted in Amazon Web Services.

Cognizant Technology Solutions India Pvt Ltd

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

- Worked as a senior developer to develop 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.
- Trained C# to new recruits in Cognizant Academy.

Course Projects

Dataset augmentation using InfoGAN and CGAN

Deep Learning for Computer Graphics **Gainesville, Florida**
University of Florida *Oct 2020 – Dec 2020*

- Implemented dataset augmentation on MNIST and CIFAR10 using InfoGAN and ConditionalGAN to improve the classification accuracy of an image classifier. **[Report] [Code]**

Deep Colorization with CNN

Deep Learning for Computer Graphics **Gainesville, Florida**
University of Florida *Oct 2020 – Nov 2020*

- Designed a deep CNN which is trained to color grayscale face images with one channel and size 128 x 128 per image to produce a full-colored image with 3 channels. We transformed the RGB image to LAB colorspace (Lightness, A, and B) which was easier to extract the lightness channel from the image that would be then fed into CNN to predict the color values of the image using regression. **[Report] [Code]**

Hashtag Counter

Advanced Data Structures **Gainesville, Florida**
University of Florida *March 2020 – April 2020*

- Implemented a system to find the most popular hashtags that appear on social media using Max Fibonacci Heap data structure and a max priority structure to find out the most popular hashtags. Tested the code with **1M** hashtags. **[Report] [Code]**

Classification of Handwritten Characters

Fundamentals of Machine Learning **Gainesville, Florida**
University of Florida *Oct 2019 – Dec 2019*

- Inspired by the famous architecture **"Lenet-5"**, developed a deep CNN model to classify Handwritten Characters using a custom Handwritten Character Dataset prepared by Prof Alina Zare by utilizing the Adam Optimizer, Batch Normalization and dropout and achieved a classification accuracy of **97.3%** on a customised data set prepared by Prof Zare **[Code]**

Implementation of P2P network

Computer Networks **Gainesville, Florida**

University of Florida *Nov 2019 - Dec 2019*

- Created a peer-to-peer(P2P) network for file downloading. Developed components – peer and file owner. The file owner has a file, and breaks the file into chunks of 100KB. Each peer connects to the file owner to download some chunks with the help of two threads, one acting as a server that uploads the local chunks to another peer (referred to as upload neighbor), and the other acting as a client that downloads chunks from a third peer (referred to as download neighbor). Tested the code with max **5** peers and max file size of **13.3 MB**. **[Code]**

Skills

- **Languages.** Python, C/C++, Java, C#/.Net, Javascript/Typescript, HTML/CSS
- **Machine Learning.** TensorFlow, PyTorch, Scikit-learn
- **Web Development.** Angular, Node.js, WCF
- **Systems.** Linux, Mac
- **Database.** MySQL, Oracle 9i/10g, MS SQL Server, DB2

Graduate Courses

▪ Fundamentals of Machine Learning ▪ Mathematics for Intelligent Systems ▪ Machine Learning ▪ Deep Learning Computer Graphics ▪ Fundamentals of Probability ▪ Advanced Machine Learning ▪ Analysis of Algorithms ▪ Numerical Optimization ▪ Causal Inference and Machine Learning ▪ Visual Learning and Recognition ▪ 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.
- Recipient of the **National Scholarship** Award from **Central Government Human Resource Development Department of Higher Education, India** for excellent result in Higher Secondary Examination in the state of West Bengal, India.
- Topped with **1%** of all candidates appeared in **West Bengal Joint Entrance Examination** in 2008.