Divyat Mahajan

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EDUCATION

Indian Institute of Technology, Kanpur *July 2014-June 2019*
B.S. in Mathematics And Scientific Computing GPA: 8.6/10.0
Double Major in Computer Science And Engineering

PUBLICATIONS

- **A Generative Framework for Zero-Shot Learning with Adversarial Domain Adaptation**
Varun Khare*, Divyat Mahajan*, Homanga Bharadhwaj, Vinay Verma, Piyush Rai
Winter Conference on Applications of Computer Vision (WACV) 2020

- **Preserving Causal Constraints in Counterfactual Explanations for Machine Learning Classifiers**
Divyat Mahajan, Chenhao Tan, Amit Sharma
NeurIPS 2019 Workshop: "Do the right thing": machine learning and causal inference for improved decision making
Selected for Oral Spotlight Presentation

WORK EXPERIENCE

- **Microsoft Research India - Research Fellow** *July 2019-Present*
Advisor: Dr. Amit Sharma

- **Aalto University - Research Intern** *May 2018-July 2018*
Advisor: Prof. Samuel Kaski

- **National University of Singapore - Research Intern** *May 2017-July 2017*
Advisor: Prof. Wynne Hsu and Prof. Lee Mong Li

- **New York Office, IIT Kanpur - Research Track Exploration Intern** *Jun 2016-July 2016*
Advisor: Prof. Vincent Ng

KEY RESEARCH PROJECTS

- **Feasible Counterfactual Explanations for ML Classifiers** *July 2019-Present*
Dr. Amit Sharma, *Microsoft Research India* Arxiv

· Proposed a causal proximity regulariser to improve the feasibility of counterfactual (CF) explanations for Machine Learning classifiers
· Developed a generative framework for efficient CF generation and feasibility preservation under different assumptions of the problem setting
· Experimented on bayesian networks and real world datasets to show how our approach improves feasibiity of CF explanations as compared to the state of art methods
· The work got accepted for **Oral Spotlight Presentation** in the **NeurIPS CausalML Workshop 2019**.

- **Generative Zero Shot Learning with Adversarial Domain Adaptation** *Feb 2018-Nov 2018*
Course Project: Topics in Probabilistic Modelling and Inference, Prof. Piyush Rai, *IIT Kanpur* Arxiv

· Developed a Generative framework for Zero Shot Learning that learns the class data distribution conditioned on attribute vectors by end to end learning of the mapping from class attribute to parameters using supervision provided by seen data class
· Extended the model using Adverserial Domain Adaption for better estimation of unseen class data distributions
· Obtained results better than many state of the art Zero Shot Learning models on various benchmark datasets
· The paper has been accepted in **Winter Conference on Applications of Computer Vision (WACV) 2020)**

- **Visual Program Synthesis** *Jan 2018-Dec 2018*
Undergraduate Project: Prof. Vinay Namboodiri, *IIT Kanpur* Presentation Report

· Proposed a Deep Generative model using Conditional DC GAN and LSTM for program synthesis of Logo language from the given textual specification
· Created datasets comprising of text caption describing geometrical shapes with basic components like circles and polygons alongwith the corresponding image and logo program
· Trained the complete pipeline end to end using TensorFlow and generated syntactically and semantically correct Logo program along with good synthesized images for text captions in dataset

RELEVANT COURSEWORK

Machine Learning	Machine Learning Techniques, Probabilistic Machine Learning, Visual Recognition Topics in Probabilistic Modelling and Inference
Statistics	Probability and Statistics, Applied Stochastic Process, Statistical Inference
Mathematics	Advanced Linear Algebra, Mathematical Logic, Numerical Analysis and Scientific Computing Severable Variable Calculus , Ordinary Differential Equations, Partial Differential Equations Real Analysis, Complex Analysis, Abstract Algebra
Algorithms and Theory	Data Structure and Algorithm, Algorithms II, Theory of Computation, Quantum Computing
Systems	Computer Organization, Compiler Design, Operating Systems Computing Lab 1, Computing Lab2, Principles of Database Systems

OTHER RELEVANT PROJECTS

• **Interpretable Hierarchical Reinforcement Learning** *Jan 2019-May 2019*
Undergraduate Project: Prof. Vinay Namboodiri, *IIT Kanpur* Report

- Worked on designing Interpretable Reinforcement Learning solutions that could generalize to unseen goals
- Used Meta Learning based heirarchical setup to achieve generalizability with ideas from information maximization to learn interpretable action policies
- Experimented with the frozen lake environment and showed our model can generalize over all the goals by training on only 8 goals, while maintaining interpretability in the lower/action policies.

• **Approximate Bayesian Computation for Cancer Simulator** *May 2018-Jul 2018*
Prof. Samuel Kaski, *Aalto University* Presentation

- Worked on the inference of a complex stochastic simulator based model that represents cancer treatment process of a patient
- Did literature survey of Approximate Bayesian Computation methods and used Bayesian Optimisation for Likelihood Free Inference approach
- Work included Exploratory Data Analysis to determine informative statistics for dimensionality reduction and inference of parameters with Bayesian Optimisation framework implemented using Engine for Likelihood Free Inference (ELFI)

• **Probabilistic Approach to Sense Embeddings** *Sep 2017-Nov 2017*
Course Project: Probabilistic Machine Learning, Prof. Piyush Rai, *IIT Kanpur* Report Code

- Worked on extending the paper Multimodal Word Distributions, ACL 2017 by Athiwaratkun and Wilson to learn multiple word embeddings relating to the different senses of a word using Gaussian Mixture Model
- Developed a model with reduced number of parameters as compared to the model suggested in the paper by using a linear combination of global parameters to generate local word specific parameters
- Implemented the model using TensorFlow and showed our model leads to less overfitting on smaller datasets and learning more embeddings per word than the model of Athiwaratkun and Wilson

• **Recommender Systems** *May 2017-Jul 2017*
Prof. Wynne Hsu and Prof. Lee Mong Li, *National University of Singapore* Code

- Worked on building Recommender System that predicts Effectiveness and Side Effects on the usage of a Drug for a Patient
- Created, Preprocessed a dataset and performed Baseline Evaluations using Matrix Factorization algorithms and Regression Models
- Implemented a Deep Learning Model to learn better Latent Features and perform Multi Label Classification of Side Effects

• **Stance Classification of Tweets** *June 2016-July 2016*
Prof. Vincent Ng, *New York Office, IIT Kanpur* Code

- Worked on predicting Stance for Tweets against a Target using machine learning algorithms, a task in International Workshop on Semantic Evaluation 2016
- Read research papers on Sentiment Analysis and Stance Classification and used ideas from them to develop a model for tweets that do not express opinion about the main target

AWARDS AND ACHIEVEMENTS

- Received the **Academic Excellence Award, IIT Kanpur** for the academic session 2017-2018
- Received Certificate of Achievement for Rank 33 in **ACM ICPC 2017** Asia Gwalior Online Programming Round (3000+ teams)
- Obtained 2^{nd} rank in International High Performance Computing 2016 organized by **CDAC India** and Techkriti IIT Kanpur
- Secured All India Rank 1940 in JEE-Advanced 2014 out of 150,000 students with Percentile 98.71
- Obtained Merit with **Rank 13** in Matriculation Examination and **Rank 36** in Senior Secondary Examination
- Secured **Rank 1** in State Mathematics Olympiad organized by Children Science Congress in Himachal Pradesh

MENTORSHIP

- (2018) Project Mentor for the course Machine Learning Techniques (CS771A) offered by Prof. Piyush Rai at IIT Kanpur
- (2018) Mentored 5 freshmen students for a project on Recommender Systems under Association of Computing Activities, IITK

TECHNICAL SKILLS

Programming Languages	C, C++, Python, Bash, Assembly, MongoDB, MySQL, Javascript
Software and Utilities	Git, Docker, Latex, Sklearn, PyTorch, TensorFlow, ELFI, DoWhy, Numpy, Pandas

EXTRA CURRICULAR ACTIVITIES

- (2017) Managed a team of 5 members to publish 2 editions of Newsletter Alpha under Statmatics, mathematics society of IITK
- (2016) Volunteer in Kanpur team of Blood Connect, NGO working to provide a solution for the shortage of blood in India
- (2015) Worked in National Service Scheme at IIT Kanpur to provide better education to underpriviledged children