Divyat Mahajan

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EDUCATION

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

RESEARCH PROJECTS

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

- Developed a Generative framework for Zero Shot Learning that learns the class data distribution conditioned on attribute vectors
- Inferred the class distribution parameters by end to end learning of the mapping from class attribute to parameters using supervision provided by seen data class labels
- 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 under inductive, transductive and generalised setting

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

- Proposed a Deep Generative model for program synthesis of Logo language from the given textual specification
- Used Conditional DC GAN to generate images from input text caption and incorporated LSTM with an attention framework to generate Logo program using information from synthesized images
- 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

RESEARCH INTERNSHIPS

• **Approximate Bayesian Computation for Cancer Simulator** *May 2018-Jul 2018*
Probabilistic Machine Learning Group, Aalto University, Prof. Samuel Kaski 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)

• **Recommender Systems** *May 2017-Jul 2017*
National University of Singapore, Prof. Wynne Hsu and Prof. Lee Mong Li 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
- **Additional Project**:
- Worked on extending the Maroon System: a system that integrates information about entities from various sources to create a entity profile and then updates the profile with time
- Developed Web Crawlers for Facebook and Wikipedia and merged the crawlers with the Maroon System

• **Stance Classification of Tweets** *June 2016-July 2016*
New York Office, IIT Kanpur, Prof. Vincent Ng 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
- Generated feature vectors using Bag of Words approach and used Pointwise Mutual Information to extract useful features
- Used Support Vector Machine for classification of tweets in the model and implemented the model using sklearn

OTHER RELEVANT PROJECTS

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

• **Human Emotion Recognition from Images** *Sep 2016-Nov 2016*
Course Project: Machine Learning Techinques, Prof. Piyush Rai Report Code

- Classified the emotion from facial images of humans using machine learning algorithms into seven categories
- Generated features by using Google Cloud Vision API and using Neural Network in the second approach
- Compared the above approaches by implementing Support Vector Machine and K-Nearest Neighbour for classification

• **DLang Compiler** *Feb 2018-Apr 2018*
Course Project: Compiler Design, Prof. Subhajit Roy Code

- Implemented a DLang to x86 compiler from scratch using python and ply
- Incorporated basic features like type checking, operations, loops, statements, arrays alongwith some advanced features like classes

AWARDS AND ACHIEVEMENTS

- Paper accepted for Oral Presentation in **The Fifth Annual Conference of Cognitive Science in India (ACCS) 2018**
- Selected among the 30 students from 350 applicants for **Aalto Science Institute Internship Program 2018**
- Obtained overall rank **93** and rank **7** among IIT Kanpur teams in **ACM-ICPC 2017** Regionals Online 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

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
Algorithms and Theory	Data Structure and Algorithm, Algorithms II, Theory of Computation, Quantum Computing**
Systems	Computer Organization, Compiler Design, Operating Systems*, Computer Networks** Computing Lab 1, Computing Lab2*, Principles of Database Systems**
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

*: Current Semester, **: Next Semester

TECHNICAL SKILLS

Programming Languages	C, C++, Python, Bash, Assembly, Socket Programming, MongoDB, MySQL, PHP, Javascript
Software and Utilities	Git, Docker, Latex, Sklearn, Keras, TensorFlow, ELFI, Numpy, Pandas, Selenium, BeautifulSoup

MENTORSHIP

- (2019) Project Mentor for the course Topics in Probabilistic Modelling & Inference (CS698X) offered at IIT Kanpur
- (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

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