

Gurpreet Singh

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Education

COLUMBIA UNIVERSITY (CU)

MASTER OF SCIENCE IN COMPUTER SCIENCE (MACHINE LEARNING TRACK) | GPA 4.0 / 4.0

New York, NY
Sep 2019 — Dec 2020

Coursework: Analysis of Algorithms, Optimization Methods, Probabilistic Programming, Introduction to Databases, Machine Learning Theory

- Course Assistant: Optimization Methods in Machine Learning (Fall 2019), and Program Languages and Translators (Fall 2019)
- Research Assistant: Prof. Michael D. Parrott (Spring 2020); Worked on building ONNX models using common ML frameworks

INDIAN INSTITUTE OF TECHNOLOGY KANPUR (IITK)

BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE | GPA 9.3 / 10.0

Kanpur, India
Jul 2015 — May 2019

Coursework: Data Structures and Algorithms, Operating Systems, Computer Organization, Probabilistic Modeling and Inference, Natural Language Processing, Computer Vision

- Tutor: Fundamentals of Computing (Spring 2019), and Course Mentor: Introduction to Machine Learning (Fall 2018)
- Secured an All India Rank (AIR) of 174 among 1.5 million candidates in JEE Advanced, 2015

Technical Skills

Software Engineering Distributed Systems, Computer Organization, Database Systems, C/C++, Python, Lua, Javascript, Git, Linux
Machine Learning PyTorch, Tensorflow, Pyro, Keras, PySpark, Scikit-Learn, NumPy, Classification, Pattern Recognition, Deep Learning

Work Experience

GOOGLE

SOFTWARE ENGINEER 3

Sunnyvale, CA
Jan 2022 — Present

- Working on building express data infrastructure offering with the Napa team for internal Google clients.
- Presently leading the GA launch of date partitioned tables, which involved improving the insert latency by 20x and stabilizing the existing architecture.
- Designed and implemented scalability fixes to improve write latency by eliminating contention in our metadata servers, requiring detailed investigation into underlying dependencies.
- Led a multi-quarter migration effort of inactive tables off a deprecated system by building a shadow infrastructure and seamlessly migrating millions of tables with no external user impact.
- Greatly contributed to production stability, especially by mentoring many folks and onboarding them to standard production principles, effectively reducing the daily toil for the team's oncall rotations.

NUTANIX

MTS II - MACHINE LEARNING ENGINEER

San Jose, CA (Remote)
Mar 2021 — Jan 2022

- Designed and planned AWS infrastructure for distributed processing of events in file servers based on SQS, Batch, and Lambdas
- Laid out the foundation for ML-based service offerings in public cloud and drove the development of models for anomaly detection

MACHINE LEARNING ENGINEERING INTERN

May 2020 — Aug 2020

- The objective was to implement robust Machine Learning models for anomaly detection in operations performed on large file servers
- Built a variant of the Holt-Winters Model for temporal based anomaly detection on per hour operation counts with adaptive thresholding
- Implemented and used Collaborative Filtering for detection by learning user behavior using peer comparison for file access patterns

GOLDMAN SACHS

SUMMER ANALYST

Bangalore, India
May 2018 — Jul 2018

- Built a greedy strategy for customer margin allocation, providing an alternative to the existing logic with 97% runtime improvement
- Introduced changes in existing models for asset-liability (AL) gap management identifying bugs in pre-existing code and augmenting features for proper AL gap management for deposits and clearinghouse initial margin

INMOBI

DATA SCIENCE INTERN

Bangalore, India
May 2017 — Jul 2017

- Extracted image features from Ad creative images using OpenCV (in python) and Google Cloud Vision API to explain ad CTR
- Analyzed correlations, performed regression tests, and used variable selection using Weka to detect explainable features

Projects

PAIRWISE APPROACH TO CAUSAL DISCOVERY

DR. ALP KUCUKELBIR (FERO LABS)

MS Thesis, CU
Aug 2020 — Dec 2020

- Explored the use of Xi correlations for causal discovery which proved to be a fast and effective way to discover structure in causal graphs
- Experimented with a measure of variance for conditional distributions (CDS) to orient causal edges on simulated and real-world data
- Explored strengths and weaknesses of pairwise methods for causal discovery along with presenting intuition behind the workings of CDS

OPTIMAL INTERVENTIONS FOR ACTIVE CAUSAL DISCOVERY

PROF. ELIAS BAREINBOIM (CU)

COMS 4995: Causal Inference, CU
Feb 2020 — Apr 2020

- Studied the common assumptions of Causal Discovery (CD), and surveyed recent advances in CD and Active CD
- Proposed an extension to an existing approach for finding the optimal intervention in Active CD using Bayesian Optimization to map the space of causal graphs

BAYESIAN ML FOR PREDICTING UNDERGROUND WATER LEVELS

DR. ALP KUCUKELBIR (FERO LABS)

COMS 6998: Probabilistic Programming, CU
Sep 2019 — Nov 2019

- Modeled underground water levels in a sub-region in Rajasthan (India) based on readings from sparse observatory wells
- Used a HMM-modulated kernel regression to model temporal and spatial patterns dependent on satellite observations of farmland

IMPLEMENTING ADAPTIVE NEURAL NETWORKS

DR. SATYEN KALE (GOOGLE RESEARCH)

COMS 4995: Optimization Methods, CU
Sep 2019 — Nov 2019

- Implemented AdaNet using PyTorch and analyzed its performance with different settings of hyperparameters
- Improved hyperparameter sensitivity by adaptively changing the subnetwork width without compromising on performance

DISCRETE VARIATIONAL AUTOENCODERS AND STOCHASTIC BLOCK MODELS

PROF. PIYUSH RAI (IITK)

Undergraduate Project, IITK
Aug 2018 — Jan 2019

- Surveyed continuous relaxations to discrete latent variables and implemented GumBolt relaxation for RBM prior using Tensorflow
- Augmented GVAEs with binary latent embeddings to offer interpretable latent representations, imitating mixed membership models
- Employed the resultant model for link prediction on graph datasets (Citeseer and Cora) and achieved superior results to baseline models

MIXTURE OF EXPERTS USING DISCRETE VAE

FALL 2018

Prof. Arnab Bhattacharya
CS685: Data Mining

- Proposed a novel model using the VAE framework for clustering in latent space, extending the ideas of the VaDE model
- Modeled the cluster assignment using a deep neural network, and added regularization using Virtual Adversarial training
- The proposed model worked comparable to VaDE on clustering tasks without the need for careful layer wise pretraining
- Extended the proposed model as a gating function for Mixture of Experts tasks and achieved better performance than naive baseline models

CATTALKS: A CENTRALIZED VIDEO + TEXT CHAT TOOL

FALL 2018

Prof. Dheeraj Sanghi
CS425: Computer Networks

- Developed a web-app for text and video chat using Flask and socket programming on python
- Login credentials, requests and messages were stored using MongoDB

INCREMENTAL NEURAL NETWORKS TRAINING

SPRING 2018

Prof. Purushottam Kar
CS777: Statistical and Algorithmic Learning Theory

- Two layer NNs can be represented as an ensemble of multiple single node hidden layer networks, which can be individually trained using generic boosting methods (gradient boosting), which also afford definite theoretical convergence guarantees
- Applied gradient boosting to train two layer networks incrementally and studied the convergence analysis under various constraints
- Implemented incremental NN training in python using sklearn, and applied for Softmax Regression on the MNIST Dataset
- Applied incremental training as pre-training, along with backpropagation for fine-tuning and observed remarkably better convergence

SURVEY ON METHODS FOR CONVEX OPTIMIZATION

SPRING 2018

Prof. Purushottam Kar
CS777: Statistical and Algorithmic Learning Theory

- Surveyed prominent Gradient Descent based techniques (SGD, AdaGrad, etc.) for optimization and perused the convergence bounds of each
- Reviewed and paraphrased a paper which disproves guaranteed convergence of Adam for even convex objectives using a counterexample
- Identified inconsistencies within the convergence proof for Adam as an attempt to explain its incorrectness

CLUSTERING AND MOE FOR ARBITRARY SHAPED CLUSTERS

SPRING 2018

Prof. Piyush Rai
CS698X: Bayesian Modelling and Inference

- Studied VAEs and surveyed clustering models (iWMM, SVAE, VaDE, etc.) for data existing in non-Gaussian shaped clusters
- Implemented Variational Deep Embeddings (VaDE) in Tensorflow to experiment on MNIST and spiral dataset to learn arbitrary shaped clusters
- Proposed gating functions based on VaDE and Stick Breaking-VAE for mixture of experts models

JAVA TO X86 ASSEMBLY COMPILER

SPRING 2018

Prof. Subhajit Roy
CS335: Compiler Design

- Developed an end-to-end compiler in node.js for a subset of Java language to compile into x86 Assembly using jison (for parsing)
- Implemented advanced features such as classes and type casting, along with support for floats. Adjudged one of the best projects

MACHINE COMPREHENSION USING MATCH-LSTM

SPRING 2018

Prof. Harish Karnick
CS671: Natural Language Processing

- Surveyed various models for Machine Comprehension (FastQA, R-Net, Match-LSTM, etc.) and implemented Match-LSTM using Tensorflow
- Experimented with SQuAD and combated inefficiency of Match-LSTM to apply separate attention mechanisms for different question types
- Additionally, introduced simple changes to loss function to improve the EM score on SQuAD by a total of over 5%

SCALING RECOMMENDATION SYSTEMS USING K-MEANS CLUSTERING

FALL 2017

Prof. Purushottam Kar
CS771: Introduction to Machine Learning

- Used K-Means clustering to divide users into cliques, and applied Collaborative Filtering independently within each clique

- Clustered songs based on MFCC features using K-Means and quantified user features based on song clusters from the user's learning history
- Applied the model on MSD. Also proposed simple exploration strategy based on song clusters to allow variations in suggestions provided

NACHOS OPERATING SYSTEM

FALL 2017

*Prof. Mainak Chaudhuri
CS330: Operating Systems*

- Implemented basic operating system functions (Fork, Join, etc.) on a truncated NachOS code (provided) in C++ programming language
- Implemented and evaluated performance of algorithms for various scheduling processes and various page replacement strategies
- Implemented Shared Memory Allocation, Demand Paging and various Page Replacement Algorithms

SMART IMAGE ADVERTISING

FALL 2016

Google DevFest

- Developed a web-app for smart advertising using image analysis with basic controls
 - Wrote a back-end program to detect objects in an image on upload using an API service from Clarifai
 - Stored objects as tags in database and used these to search through products on different e-commerce websites using their affiliate APIs
- * Code and reports for all projects available at [github://fat-fighter](https://github.com/fat-fighter)*