Utkarsh Singh

Education	
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Bachelor of Technology - Mechanical Engineering (8.184/10.0)Expected: May, 2019Minor Degree - Computer ScienceIndian Institute of Technology, DelhiHigh School Graduate (AISSCE, CBSE) - Science (96.2%)May, 2015

Delhi Public School, R.K. Puram, New Delhi

Relevant Coursework

Computer Science: Machine Learning, Data Structures & Algorithms, Database Management Systems, Operating Systems, Artificial Intelligence, Discrete Mathematical Structures

Mathematics: Calculus, Linear Algebra & Differential Equations, Numerical Methods & Computations, Statistics

Coursera MOOCs: Machine Learning, Deep Learning Specialization

Research Experience

Data Driven Legal Reforms [Report][Presentation] Supervisor: Dr. Nomesh Bolia

- Scraping large data-set of court case summaries from the Indian district courts website. Till now, data from 430+ out of 610 available districts have been downloaded, totalling to 8.3 million summaries.
- Continuing on previous work, extended the analysis of district performance over different metrics to a lower level, based on the nature of the case. Visualizations of the same are available on project website.
- Methods were developed to clean the available raw case acts information. Noisy characters in section numbers were removed using dynamic programming solution based on some assumptions.
- Trained Mixture Density Networks for predicting the probability distribution over the completion time of a case. Hypothesis testing using p-value method was done to judge model performance.
- Future work focused on developing LSTM networks that utilizes more features and sequence nature of case hearings for predicting the next hearing of a case and subsequently, the completion time of it.

Analysis of k-means++ algorithm Supervisor: Dr. Ragesh Jaiswal

- Part-time research problem on analyzing the performance of k-means++ seeding technique over datasets satisfying α -perturbation stability for Euclidean distance measure.
- Studying the hypothesis that obtaining O(1)-approximate clustering using k-means++ for the above separation condition with a reasonable probability is possible.
- Tried methods inspired from previous works on related problems (β -approximation stability, σ -separability) for proving the hypothesis. Current work focused on disproving it using counterexample.

Understanding and modifying gem5 simulator Supervisor: Dr. Preeti Ranjan Panda

- Studied the working of gem5 classical model by performing experiments on various benchmarks, and going through the trace log. Also used GDB to observe handling of requests at each memory level.
- Implemented a private L1 & L2, shared L3 architecture for classical model. Also added a new component which behaves as a hardware accelerator, that could directly communicate with L3 cache.
- Noted the assumptions made in classical model for simulating the communications between different memory levels. Explored gem5 Ruby model as alternative for conducting more accurate experiments.

Scholastic Achievements

- Secured All India Rank 577 in IIT-JEE (Advanced) 2015 among over 150 thousand candidates.
- Received IIT Delhi Semester Merit Award for exceptional academic performance in Spring 2016.
- Received Merit Certificate for scoring among top 0.1% of all CBSE Class XII students in Mathematics.
- Qualified for ACM ICPC Gwalior Regional 2017 by securing Rank 20 out of over 3200 teams.
- Qualified for ACM ICPC Amritapuri Regional 2016 by securing Rank 196 out of over 3000 teams.

May 2018 – Present

August, 2017 – Present

July 2017 – August 2018

Projects

Handwritten Devnagri Character Recognition [Code] Course Project, Machine Learning

- Implemented a Neural Network from first principles and trained it to classify Devnagri Handwritten Characters. The best model achieved an accuracy of 94.82% on unseen data.
- Also implemented a Convolutional Neural Network in Keras using TensorFlow backend for the same problem. Model achieved an accuracy of 99.4% on unseen data.

K-means Clustering for Character Recognition [Code] Course Project, Machine Learning

- Implemented the k-means algorithm (with both random initialization and k-means++) from scratch for solving the problem of Devnagri Character Recognition.
- Designed methods to vectorize the computations, resulting in dramatic reductions in training time.
- The model achieved an accuracy of 77% on unseen data, using K = 2300 on random initialization.

Cooperative User Level Threads in xv6 [Code] Course Project, Operating Systems

- Implemented a library for user level threads supported with context switching and synchronization using busy & non-busy waiting.
- Designed starvation-free, priority based thread scheduling policy with priority donation to solve the problem of priority inversion.

Analysis of performance of k-NN search on k-d Trees [Code]

Course Project, Database Management Systems

- Implemented a fast & efficient version of k-Nearest Neighbour search on k-d tree using Best First Search algorithm and C++ optimization techniques.
- Compared the performance of Best First Search to a normal Sequential Scan algorithm on synthetic data, and using the observations, studied the curse of dimensionality.

Back-end for Placements Application

Course Project, Data Structures & Algorithms

- Implemented Gale Shapley Algorithm to ensure a stable matching between the candidates and recruiters on basis of their preferences.
- Used AVL trees for faster look-ups of candidate and company records which also facilitated efficient servicing of modification queries.

Technical Skills

Languages: C, C++, Python, Java, SQL Frameworks: Selenium, TensorFlow, Keras, scikit-learn

Position of Responsibility

Mentor, Student Mentorship Program

• Mentored 4 freshmen to help them transition into their college life.

Web Development Executive, Board for Recreational and Creative Activities May 2017 – May 2018

May 2017 – April 2018

• Developed and maintained the website of the cultural board of IIT Delhi.

Extra-curricular Activities

Student Volunteer, National Service Scheme

- Helped visually challenged students with their studies and projects at National Association for the Blind, R.K. Puram, New Delhi.
- Taught Mathematics to underprivileged students and helped them prepare for the IIT-JEE examination. Designed study materials and practice tests for the same.

Competitive Programming

• Rated 1951 on CodeChef, 2012 on HackerRank.

Chess

- Selected for the team that represented IIT Delhi at Inter IIT Chess Meet in 2016 and 2017.
- FIDE rated chess player, with a rating of 1528.