Pratyush Pandey

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Academic Details

Year	Degree	Institute	CGPA/Percentage
2017-2021 **(Current)**	B.Tech in Electrical and Electronics Engineering	Indian Institute of Technology (IIT) Delhi	9.013
2017	Class XII, HSC	Ratanbai Walbai Junior College of Science, Mulund	90%
2015	Class X, ICSE	Smt.Sulochanadevi Singhania School, Thane	98.2%

Scholastic Achievements

- **Cargill Global Scholarship 2019: 1 in 10** Indian awardees among 30K applicants from 6 countries for this leadership development cum scholarship program, which connects you to a global network of Cargill scholars.
- **Publication:** Co-authored *MergeConnects: Generalized regularisation of Deep Neural Networks*, under review in IJCAI 2020 (Macao, china)
- **IITD Semester merit Award**: Awarded after securing the **Institute highest 10 CGPA** and finishing in **top 7%** in the fall semester, '17-'18.
- **Teaching Assistant, IITD**: For Database Management Systems Course (for both UG and PG), CSE Department in Spring Semester, 2019 - 2020
- **Change of Department**: **1 in 6** students (among 950) in IITD selected to change their majors to Electrical Engineering based on CGPA and co-curricular criteria.

Major Internships

Microsoft - SDE Intern **Delhi, India**, May 2020 - July 2020

Piloted a feature in Word-Online Codebase to integrate a personalised, Intelligent Ribbon Tab in Word Web (Adaptive Ux)

- Successfully delivered a Pilot for the 'For You' ribbon tab, which is fully user customisable and predicts future commands based on user history. Worked with **TypeScript, React, Redux and C#** for development; and KQL for data analysis.
- Integrated a **Tensorflow, Keras** based ML model in the ribbon for prediction of future commands. Developed a feature to detect Context in the document (text/image/table) for more relevant future command predictions.

Bending Spoons - SDE + Data Science Intern **Milan, Italy**, Nov 2019 - Jan 2020

In my time at Bending Spoons, I tried to understand the behavior and measure the value of millions of users of our apps:

- Worked with internal support tools teams on App Store Optimisation (ASO). Worked with **Google BigQuery and Google Cloud Platform** to prioritise our Apps in locale based search results on the App Store.
- Created a **MongoDB and Flask** based RESTful web application to view and edit App metadata to improve results. Handled asynchronous updates using **Celery**, and integrated the tool with Slack using the Slack API.

Singapore University of Technology and Design (SUTD) - AI Researcher **Singapore**, May - July 2019

Worked as a UG research assistant under the supervision of Dr Ernest Chong (Cornell) in SUTD Deep Learning Research group

- Generalised the Dropout Regularisation method of Deep Neural Networks to a novel two model training approach: "Merge-Connect"; enhanced generalisation over unseen data by 2% over dropouts/connect.
- Outperformed dropout on state of art **ResNet32, wide ResNet & ResNeXT** network architectures using benchmarking datasets SVHN, CIFAR-10 and CIFAR-100.
- Tested method on ResNeXt with skip-connection, data-augmentation & momentum to achieve **96.4% accuracy** on CIFAR-10 dataset, improving error rate over Dropouts by 0.8%.

Siemens AG - Machine Learning Intern **Mumbai, India**, May - July 2018

Worked in Energy Management - Strategy division in under Mr. Ravi Subramanium, for the Siemens "FutureLand" initiative.

- Created ML classification model for predicting time of breakdown of Siemens motors, based on its operational parameters (vibrations, temperature, rotation speed, etc) at the time of production. Detailed Report of the work is present here.
- Used **Naive-Bayes & Random Forest** algorithms for classification to achieve **90.2% accuracy** on the training data, fetched from Mindsphere - Siemens' open course IoT cloud platform, linked to all motors and production systems.
- Held Training sessions on the FutureLand focus topics (link) to sensitize 400 Employees from various departments.

Major Projects

Cannon playing AI Bot Prof. Mausam, IIT Delhi , August 2019 - Nov 2019

Cannon is a two-player abstract strategy game whose rules can be found here. Developed an AI Bot using Reinforcement Learning & search which beat (most) IITians at the game. Implementation: Assigned utility to future moves using a weighted function of 11 in-game features. Performed **IDDFS Search** (upto depth 8) to decide future moves using **Minimax strategy**. Improved search efficiency using **alpha-beta pruning, quiescent search, transposition table and tabu list. TD Learning** was implemented to learn the weights of the features used in the utility function.

PKI using RSA and Vignere Ciphers Prof. AK Bhateja, IIT Delhi , January 2020 - March 2020

Implemented a **Public Key Infrastructure (PKI)** from scratch, using a mixed encryption scheme of **RSA and Vignere Cipher**. Included modules for RSA Key-Pair generation, using only strong primes and digitally signed by certificate authorities (CA). Implemented Chinese Remainder Theorem (CRT) for efficient encryption and decryption while sending and recieving messages. Also included a framework for cryptanalysis of Hill Cipher for added security.

PageRank Algorithm using MapReduce Paradigm Rijurekha Sen, IIT Delhi , Jan 2020 - March 2020

Implemented MapReduce Library from scratch using **Message Passing Interface (MPI)** for parallization across distributed systems. Used the parallel Map-Reduce strategy for speedy computation of PageRanks. Bench-marked performance with Google's original algorithm using **Barabasi and Erdos graph networks** (Report here). Further used **P-threads, MPI and OpenMP** for speedy LU decomposition and Matrix Multiplication.

Graph Subset Mapping using SAT Solvers Prof. Mausam, IIT Delhi , Sept 2019 - Oct 2019

Formulated the NP-Hard **Graph subset mapping problem as a SAT problem** and solved it using **MiniSAT**. Used heuristics to solve the problem efficiently by reduce variables and clauses, causing a **10-fold clause reduction** in a random directed graph. To make encoding generation time competent with sat solving time, several C code optimisations were made - including **Buffered inputs, cache-friendly loops and DP** for conversion of Strings to integers. Other optimisations included removal of isolated nodes using constraints on in and out-degrees of graph nodes to eliminate clauses.

Visualising activations of DNNs & Sparse Autoencoders Prof. Sumeet Agarwal, IIT Delhi , Oct 2019 - Nov 2019

Aim of this project was to visualise the high level (or hidden) representation learnt by Deep Neural Networks (DNNs) when trained on MNIST, and compare it with other data dimensionality reduction techniques (like PCA), to determine what causes DNNs to classify data better. Implemented **FCNNs, CNNs and K-Sparse Auto-encoders** from scratch and also using frameworks (TensorFlow, Keras); trained them seperately (Best accuracy: 99.3% on MNIST) and plotted the activations of various layers to visualise the final learnt representation of MNIST data by various models (Report here).

Muticlass SVM for MNIST classification Prof. Sumeet Agarwal, IIT Delhi , Sept 2019 - Oct 2019

Implement a **one-vs-all SVM classifier** for classification of the full MNIST dataset. Implemented the **KKT conditions** and solved the **primal problem via convex optimisation** using the CVXOPT library. Trained the classifier using batch gradient descent, 10-fold cross validation, and exponential decay learning rate. Tested the architecture using **RBF, polynomial and guassian kernels**. Achieved 85.6% accuracy on the test data. The full report can be found here.

Technical Skills

- **Programming Languages:** C++, Python, Java, C, Javascript, Typescript, Swift, MATLAB, OCaml, C#, R, Ruby
- **Frameworks:** TensorFlow, PyTorch, Keras, React, Redux, Django, Flask, PostgreSQL, MongoDB, Docker, Git
- **Softwares:** Android Studio, Xcode, Wolfram Mathematica, Unity 3D, Arduino, Autodesk, Solidworks, Microsoft Office

Relevant Courses

- **Computer Science:** *(*Courses currently pursuing)*
  Parallel Programming*, Cryptography*, Artificial Intelligence; Machine Learning and Intelligence; Database Management Systems; Analysis and Design of Algorithms; Data Structures and Algorithms; Computer Architecture
- **Electrical:** Physical Electronics; Signals and Systems; Electromagnetism; Circuit Theory; Digital Electronics; Engineering Electromagnetics; Control Engineering; Analog Electronic Circuits, Communications Engineering, Power Electronics
- **Mathematics:** Calculus, Linear Algebra, Differential Equations, Probability and Stochastic Processes
- **Online:** Deep Learning (Fast.ai, Coursera), Intro to CS (CS50, Harvard), Machine Learning (Coursera)