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	8.632
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.
- **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.
- **KVPY Scholar 2017**: Granted the 'Kishore Vaigyanik Protsahan Yojana' award by Dept of Science and Technology, Govt of India.
- **Siemens Scholarship '15**: Awarded for academic excellence and securing a place in **top 10 ICSE scorers** in the country.

Major Internships

Bending Spoons - Data Science and SDE Intern *(Ongoing Internship)* **Milan, Italy**, Nov 2019 - *Present*

- Currently working on internal tools for marketing optimization and providing support to the Marketing Technology team. Working with Python, PostgreSQL, MongoDB, Google BigQuery, Docker, Google Cloud Platform.
- Building software tools to compare costs of acquisition and expected revenues from users, based on a statistical model to predict future purchasing behaviour of user.

Regularisation of Deep Neural Networks, SUTD, Singapore Prof. Ernest Chong (Cornell), May - July 2019
Worked as a research assistant in Singapore University of Technology and Design (SUTD), in the ISTD pillar in Dr Ernest Chong's research group.

- Generalised the Dropout Regularisation method of Deep Neural Networks to a novel two model training approach called "MergeConnect"; 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 Ltd. - "FutureLand" Mr.Ravi Subramanium (IIT-B, IIM-A), May - July 2018
Worked in Energy Management - Strategy division in Siemens, Mumbai. Received a **Letter of Recommendation** from the supervisor and head of division, Mr.Ravi Subramanium.

- 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 Workers and Executives 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. Working in a team of two, we developed a weighted utility function for IDDFS Search (upto depth 8) using 11 game features. Search was done using Minimax strategy, improved efficiency was obtained with the aid of alpha-beta pruning (with moves ordered in decreasing order of likelihood for better pruning), quiescent search, transposition table and tabu list. TD Learning was implemented to learn the weights of the features used in the utility function. These functions were implemented as efficiently as possible as bot was allocated no more than 200 seconds to make all moves and win.

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

Explored the high level or hidden representation learnt by Deep Neural Networks (DNNs) when trained on MNIST dataset, and compared results with other data dimensionality reduction techniques (PCA). Implemented standard backpropogation fully connected net, Convolutional nets and K-Sparse Auto-encoders from scratch, along with dropout regularisation techniques. Plotted the activations of various layers using Matplotlib to visualise the final learnt representation. Went on to implement these networks using Tensorflow and keras, along with the use of Nesterov Momentum, Boosting and Adam Optimiser for training, to achieve highest final accuracy of 99.3%. The full report can be found here.

Muticlass SVM for MNIST classification Prof. Sumeet Agarwal, IIT Delhi , September 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.

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

Formulated the NP-Hard Graph subset mapping problem as a SAT problem and solved it using MiniSAT solver. Used heuristics to solve the problem efficiently by reduce variables and clauses, causing a 10-fold 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.

Blur reduction in imaging fast moving targets Prof. Vikram Gadre, IIT Bombay, July 2018 - May 2019

Currently working in Prof Vikram Gadre's research group in IIT Bombay to improve the image quality obtained from Synthetic Aperture Radars (SARs). Improved the processing of linear, quadratic and cubic chirp signals from SARs using GTFT (Generalised Time fourier transform) to obtain focused SAR image of ground moving targets using AGFS (Adaptive Generalised Frequency Spectrogram) based parameter estimation. The project has funding from DRDO, Bangalore and has applications in the military.

Visualisation of Data Structures Prof. Maya Ramanath, IIT Delhi , May 2018 - July 2018

Built software for generating interactive graphical simulations of the BTree, B*Tree, and B+Tree data structures used in Database Management Systems. The link to the project is here. Used the external JGraphX, library to render graphics and animate the above operations. Experimented with JavaFX to render animations.

Tumour Detection in Brain Using Pre-Processing of MRI images Prof. SD Joshi, IITD, July 2018 - Dec 2018

Performed image enhancement and noise reduction techniques on MRI images, then applied morphological operations to detect the tumor in the image. In the end the tumour was mapped onto the original gray scale image with 255 intensity to make visible the tumour in the image. The algorithm used had two stages, first is pre-processing by converting to gray-scale image then applying high pass and median filters for image enhancement and noise reduction, and after that computing the threshhold and watershed segmentation, and finally performing morphological operations. A detailed project report can be found here.

Technical Skills

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

Relevant Courses

- **Computer Science:** *(*Courses currently pursuing)*
  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)

Extra Curricular Activities

- **Chief Editor**, and **(former) Journalist** at Board of Student Publications, IIT Delhi. (link)
  - Heading the creative segment of BSP; **Leading a team of 30+ Student Journalists**; Responsible for online outreach
  - **Coordinator, Publicity, Literati '19:** IITD's annual Literary fest; Edited and headed Inception and Inquirer: our annual creative and journalistic magazines
- **Representative**: Debating Club - *1st International Debating A-level in IITD*, multiple podium finishes
  - Executed 10+ events with participation of 500+ students from over India; conducted year-round workshops for freshers.
  International level: Breaking Adjudicator, SMU Hammers '19 (Singapore) & Malaysia Pre-Asians '19 (Kuala Lumpur).
  National level: Breaking Adjudicator, IITPD '19 (Delhi); Contingent Best speaker, PEC Trivium'19 (Chandigarh).
- **Social work:** Youngest core-team member, Indian Road Safety Campaign (IRSC); Volunteer for NSS and BloodConnect
  IRSC: Handled social media handles and awareness campaigns which gathered 40k followers; Wrote brochures on road safety distributed in 20+ schools across Delhi NCR; helped conduct first responders workshop in AIIMS Delhi
  - Pitched traffic outflow optimisation strategies to MoRTH after surveying 50+ busy and congested roads in Delhi NCR
  Raymond Rehabilitation Center: Mentored 80+ underprivileged children in class 8 Science, Math & English for 6 months
- **Digital Marketing:** Ideated & led various marketing campaigns for OnePlus, Alibaba, Tryst, Pravega, Literati, IITPD
  OnePlus Student Ambassador '18: **1 in 10 students** selected in a pool of 10K; received **Letter of recommendation**
  - Provided logistic & analytical support during **OnePlus 6T Launch Event** (Delhi) & **6T McLaren Launch** (Mumbai)
- **Cultural Activities:** IITD: Member of Lit Club (1^{st} in 3 Muses, 2^{nd} in Potpourri), Quizzing Club (1^{st} in Freshers quiz)
  Hindustani classical music: 6+ years of training; certified Visharad by Sangeet Kala Kendra(Bengal) and Gandharva(Pune)
  Taekwondo: Brown Belt by World Karate Org.(WFSKO, Korea), recognised by Govt of India and Indian Olympic Assoc.
- **Content Writing:** 5+years of content writing(30+articles) & editing (5+magazines) experience for NGOs and Start-Up
  - Wrote **3 featured articles** for Titanic App; Wrote poetry for BSP's Instagram and magazine; runs a personal blog
  - Scriptwriter for play which finished 2^{nd} **in Mumbai** (Kasber's Live Wire'14); Editor for Hostel and School Magazines
- **Former Executive** at Office of Career Services (Previously Training and Placement Cell), IIT Delhi (link)