

Varun Rawal

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ML Department, Carnegie Mellon University

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ACADEMIC QUALIFICATIONS

- **Carnegie Mellon University** Pittsburgh, PA, USA
Masters in Machine Learning August 2019 – Present
School of Computer Science Batch - Fall 2019
ML Department
- **Indian Institute of Technology Kharagpur** Kharagpur, West Bengal, India
B.Tech. (Hons.) in Computer Science and Engineering July 2013 – April 2017
CGPA: **9.72/10.0**
Department Rank **3** among **90** CS Students
- **Delhi Public School Bhilai** Bhilai, Chhattisgarh, India
Senior Secondary Education June 2011 – March 2013
Percentage Score : **97.3%** CBSE (Central Board of Secondary Education)
Rank **3** in school
- **Delhi Public School Bhilai** Bhilai, Chhattisgarh, India
Secondary Education June 2010 – Mar. 2011
CPI : **10.0 / 10.0** CBSE (Central Board of Secondary Education)

INTERESTS

My broad area of interest lies in the fields of Artificial Intelligence, Machine Learning, Deep Learning and their applications in Computer Vision, Natural Language Processing, Reinforcement Learning and their intersections.

PROFESSIONAL EXPERIENCE

- **Adobe Systems India Pvt. Ltd.** Noida, India
Senior Member of Technical Staff January 2019 – June 2019
 - Worked in product team affiliated to Adobe CC (Adobe Creative Cloud) which is an enterprise level product used for graphic design, video editing, web development, photography
 - Worked on recent (launch targeted 2020) port of Adobe Illustrator to iOS platform for iPad - project Proteus; work intensively focused in C++ and iOS platforms
 - Learned programming in Metal language for handling side-tasks involving graphics-based aspects of Illustrator and development on iOS platforms
- **Adobe Systems India Pvt. Ltd.** Noida, India
Member of Technical Staff (2017 - 2018), Senior Member of Technical Staff June 2017 – December 2018
 - Worked in product team affiliated to AEM (Adobe Experience Manager) Forms evolved from Adobe LiveCycle team and part of Adobe Experience Cloud Solutions. LiveCycle is an enterprise level product used for business process automation services
 - Worked on various aspects of product both at front-end and back-end sides. Contributed to end-to-end development of new interfaces featured for Interactive Communication Applications, Data Integration Services, Document Fragment and Letter-based Services
 - Worked on independent project for Intelligent Chatbot services using NLP for Query-based interaction on personalized customer contexts derived from their respective statement reports.

INTERNSHIP EXPERIENCE

- **Qeexo** Pittsburgh, USA
ML Research Intern (Master's Summer Training) June, 2020 - Aug, 2020
 - **AutoML - App for ML on Sensor-Data:** Worked on off-device and on-device Real-Time Clustering on Sensor data & Visualization
- **Adobe Big Data Experience Lab (BEL), Adobe Research** Bangalore, India
Research Intern (B.Tech. Summer Training) May - July 2016
Guide : Harvineet Singh, MTS, Adobe Research Labs

- Actively participated in and contributed to the fulfilment of the Project based on “*Analytics of Multi-Channel Customer Data*”
- Applied Machine Learning models to predict customer affinity to interact in a given channel with limited information, given this information of interaction across other channels.
- Designed a unique and novel solution approach exploiting CCA (Canonical Correlation Analysis) for suggesting ways for predicting customers’ purchase behavior using a shared feature space which captures cross channel correlations instead of directly merging the input channels’ data or predicting on the basis of single channel.

IBM India Research Laboratory (IRL)

New Delhi, India

● **Research Intern (UG Summer Training)**

May - June 2015

Guide : Dr. Sameep Mehta, Senior Researcher & Manager, IBM

- Actively participated in and contributed to the partial fulfilment of the Project “*Construction of Knowledge Graph and Use of Semantic Knowledge Graph in Supervised Training and Blended Learning*”
- Prepared a model for Knowledge Graph construction by discovering relations and establishing links between graph nodes, and completed implementation in JAVA, collecting 4000 records by crawling a Research Repository as the work dataset.
- Applied a variety of text-mining techniques like Entity-Extraction, Part-of-Speech Tagging and Similarity Detection using Online JAVA Services and JAVA libraries. Finally demonstrated a 3D visualization of the growing Knowledge Graph using visualization Library tools

CAMPUS JOB EXPERIENCE

Carnegie Mellon University (CMU)

Pittsburgh, PA

● **Research Assistant**

Sep - Dec 2020

Supervisor : Dr. Beibei Li, Heinz College

- Responsible for Development, Maintenance and Improvement of iOS/ Android App

TECHNICAL SKILLS

- **Programming Languages:** Python, C/C++, JAVA, R, MATLAB, Scala; **Scripting Languages:** Javascript, jQuery, HTML5, CSS, PHP, JSP, MySQL
- **Domain Technologies:** J2EE, Restful Web Services, Adobe AEM 6.3, Apache Sling, Apache Felix, OSGi Framework; **ML Libraries:** Tensorflow, Numpy, OpenCV, Scikit-learn, Caffe
- **Software Experience:** Eclipse, IDEA IntelliJ, Netbeans, R-Studio, MATLAB, GNU Octave, SolidWorks

ACADEMIC PROJECTS

SOFTWARE DEVELOPMENT PROJECTS

Website for Talpuri International Housing Colony

Talpuri, Bhilai

● **Freelance Project**

Autumn 2017

Guide: Dr. Arpana Rawal, BIT DURG

Website hosted at URL: www.talpuri.com. Designed the skeletal architecture of website and wrote core modules for the same. Code base written in PHP and Javascript, setting up remote database SQL server. Guided and mentored a team of five students for implementation of various features in the requirement.

Course Management System

IIT Kharagpur

● **Databases & Management Systems Term Project**

Spring 2016

Guide: Dr. Pabitra Mitra, CSE, IIT KHARAGPUR

Developed a complete web-based application for online course design, course calendar publishing, student registrations for self-paced learning, content administration, assignments, and assessments. Implemented using PHP, HTML5, CSS3, Bootstrap and MySQL. Features like mail service, file transfer, chat forum, calendar, notifications and quizzes were implemented using MySQL as database.

2D/3D Graph Plotter & 2D Graph Scanner Software

IIT Kharagpur

● **OpenSoft (inter-hostel tech competition)**

Spring 2015, 2016

2D/3D Graph Plotter “Plot-It” developed in 2015 & 2D Graph Scanner “PlotEx” in 2016, *Plot-It*: Implemented in Python, mainly contributed to development of the Front-End part of the Graph Plotter,

using tools like PyQt Designer and Photoshop, *PlotEx*: To Detect Graphs from scanned documents and produce the corresponding data tables for the graphs; used OpenCV, open-source libraries like Tesseract OCR for text detection in images and plotted Data Tables from the information obtained. Involved in guiding and mentoring a team of sophomores for the Inter-Hall Event

TinyC Compiler

IIT Kharagpur

• **Compilers Term Project**

Autumn 2015

Advisor: Dr. Partha Pratim Das, CSE, IIT KHARAGPUR

Designed and implemented a compiler for a C-like language (a subset of C language), as a part of Term Project for the completion of Compilers Course.

Software Component Cataloguing Software

IIT Kharagpur

• **Software Engineering Term Project**

Spring 2015

Guides: Dr. Partha Pratim Das, Dr. Rajib Mall, CSE, IIT KHARAGPUR

A fully functional system, implemented as a JAVA Applet and GUI realized in JAVA Swing. The project involved designing and developing a complete GUI Software which maintains a catalogue of various available Software Components and showcases all the details and information about each component to allow their potential code reuse. Provided full documentation of the software including UML diagrams.

Personal Library - User & Issue Management System

IIT Kharagpur

• **Software Engineering Term Project**

Spring 2015

Guides: Dr. Partha Pratim Das, Dr. Rajib Mall, CSE, IIT KHARAGPUR

Developed a fully functional Personal Library Management System, implemented in JAVA and GUI realized in JAVA Swing. The project involved designing and developing a complete GUI Software for automating all the operations of a Library like handling and keeping records of issue and return of books, reserve books, advanced search for books with filter options, add/delete books, print receipts, compute fine, dispose old books, view statistics, etc.

RESEARCH PROJECTS

Towards Frequency-Based Explanation for Robust CNN Models

Carnegie Mellon University

• **Deep Learning Project** [[Project Code](#), [Project Report](#)]

Spring 2020, Fall 2020

Advisor: Eric P. Xing, ML Department, CMU

Project Titled “*Towards Frequency-Based Explanation for Robust CNN Models*”. In this work, we present an analysis of the connection between the distribution of frequency components in the input dataset and the reasoning process the model learns from the data. We further provide quantification analysis about the contribution of different frequency components toward the model’s prediction.

Music Generation with Generative Adversarial Networks

Carnegie Mellon University

• **Machine Learning Project** [[Project Report](#)]

Fall 2019, Spring 2020

Advisor: Tom Mitchell, ML Department, CMU

Project Titled “*Music Generation with Generative Adversarial Networks*”. Our work primarily delves into ways for music-piece generation through more advanced deep learning techniques like GANs and VAE-GANs, that appear to be still in nascent stages of machine learning research paradigm of content generation of any kind: images, text and music. The primary objective is to be able to provide these models with arbitrary notes and let them begin amending the pieces gradually until one finds them producing good pieces of music.

Citation Analysis using Deep Neural Networks

IIT Kharagpur

• **Bachelor’s Thesis** [[Project Report](#)]

Autumn 2016, Spring 2017

Advisor: Dr. Pabitra Mitra, CSE, IIT KHARAGPUR

Project Titled “*Prediction of Citation Function of a specified ‘Cited’ paper in the given ‘Citing’ paper using Deep Supervised Learning*”. The objective was to label the sentiment an author carried while citing a given paper, something even lacked by Google Scholar, the most established product in this arena. Aimed at achieving better results than conventional approaches by designing a new solution framework based on Deep Neural Networks, which had never been used before for such tasks. Primarily deployed

RNN-based architectures: LSTMs and Text-CNNs, exploiting a citation network made of around 1000 inter-referenced research papers and journals crawled from a famous e-print research archive.

Image Deblurring using Convolutional Neural Networks

IIT Kharagpur

● **Machine Learning Term Project**

Autumn 2016

Guide: Dr. Pabitra Mitra, CSE, IIT KHARAGPUR

Implemented a deep convolutional neural network structure for image deconvolution. A series of convolution steps were used for approximating deconvolution. The system uses two modules corresponding to deconvolution and artifact removal.

Supporting Throughput Fairness in IEEE 802.11ac Dynamic Bandwidth Channel Access

IIT Kharagpur

● **Network Modelling Term Project**

Autumn 2016

Advisor: Dr. Sandip Chakraborty, CSE, IIT KHARAGPUR

IEEE 802.11ac supports Dynamic Bandwidth Channel Access (DBCA), where a wireless station selects channel bandwidth dynamically based on the availability of the secondary channels. But the widely-used contention based medium access mechanism provides an opportunistic access of secondary channels and affects the performance of DBCA. Consequently, unfairness in channel access is increased in DBCA, which further reduces average throughput of stations. In this work, we develop a hybrid adaptive resource reservation mechanism, Hybrid Adaptive DBCA (HA-DBCA), for supporting fair channel access in DBCA. In HA-DBCA, a polling based online learning mechanism is designed to avoid starvation of primary channel users. This work has been accepted for publication in IEEE Conference on Local Computer Networks (LCN) 2017.

Researcher Recommendation System

IIT Kharagpur

● **Information Retrieval Term Project**

Spring 2016

Advisors: Dr. Pawan Goyal and Dr. Animesh Mukherjee, CSE, IIT KHARAGPUR

Developed a search and recommendation engine for Scientific Research Community, as a part of Term Project for the completion of Information Retrieval Course. Used beautiful soup and selenium in python to parse MAS to generate the data set for the project (1 lakh authors and their publications). Used clustering techniques to cluster similar authors based on their co-author graph to recommend new co-authors to an author. Used LDA to model topics from the keyword database of an author and recommended top 100 authors based on their rank (gained a 25% increase in recall). Further developed a full-fledged Scientific Search Engine.

ACADEMIC HONORS AND AWARDS

GORA LAL SYNGAL MEMORIAL SCHOLARSHIP RECIPIENT

2015-16

Granted Scholarship of INR 2500 per month, awarded to the second highest CGPA holder clearing all prescribed requirements of curriculum and having no backlog after 6th semester amongst the 4-year B.Tech. (Hons.) CS / EE / EC Students.

B.P. PODDAR SCHOLARSHIP RECIPIENT

2015-16

Granted Scholarship of INR 1000 per month awarded to the best students of the final year class of B.Tech. (Hons.) securing the highest CGPA at the end of the VI or VIII semesters.

SAIL Proficiency Award

2012-13

Awarded Certificate of Merit-cum-Cash Award by Education Department, Bhilai Steel Plant, Steel Authority of India Limited, for Outstanding Proficiency in All India Entrance Examination for Professional Course in Engineering 2012-13

Prime Minister's Trophy SARVOTTAM Scholarship Award

2013-14

Awarded in 2013 by Bhilai Steel Plant, Steel Authority of India Limited for Outstanding Academic Performance for four Academic Years

Joint Entrance Examination (JEE) Mains

2013

Secured All India Rank 165 within top-200 among 1.3 million candidates in JEE Mains 2013

Joint Entrance Examination (JEE) Advanced

2013

Scored All India Rank 764 within top-1000 among 150,000 candidates in JEE Advanced, 2013

Kishore Vaigyanik Protsahan Yojana (KVPY) Scholar Award

2012

Selected for KVPY scholarship in the year 2012 with an All India Rank 60 (offered to 200 students in the country, from over 25,000 applicants)

National Talent Search Exam (NTSE) Scholar Award

2008-09

Qualified for the Award of Scholarship in NTSE, clearing all 3 rounds of selection in the session 2008 – 2009; recipient of NTSE scholarship since 2009, (1000 students selected Nationwide per year)

WORKSHOPS

Microsoft Code.Fun.Do Coding Hackathon & Workshop 2015

March 2015

Attended the Microsoft Code.Fun.Do Coding Hackathon & Workshop 2015 organized by Microsoft at IIT Kharagpur and developed an app “NextGenToss” for Windows platform, using Construct2 Gaming Engine

PUBLICATIONS

Varun Rawal, Kumar Ayush, Raja Karamakar, Pradyumna K. Bishoyi, Samiran Chattopadhyaya, Sandip Chakraborty. **“Supporting Throughput Fairness in IEEE 802.11ac Dynamic Bandwidth Channel Access: A Hybrid Approach”** Paper accepted at *42nd IEEE Conference on Local Computer Networks (LCN). 2017.* for publication in its proceedings. [Publication URL](#)

Varun Rawal, Zifan Wang, Yilin Yang, Ankit Shrivastava, Zihao Ding. **“Towards Frequency-Based Explanation for Robust CNN”** Paper accepted at *arXivLabs 2020* [Publication URL](#)

ACADEMIC COURSEWORK & CERTIFICATIONS

Probability & Statistics	Matrix Algebra	Information Retrieval
Speech & Natural Language Processing	Algorithms I & II	Discrete Structures
Formal Languages & Automata Theory	Machine Learning	Image Processing
Performance Modeling of Computer Networks	Artificial Intelligence	Theory of Computation
Adv. Image Processing & Comp. Vision	Deep Learning	Principles of Programming Languages

Machine Learning by Stanford University on Coursera. Certificate earned on August 6, 2016. [Certification URL](#)

EXTRACURRICULAR ACTIVITIES

- **November 2013 - February 2017:** Core Member, K.R.A.I.G. (Kharagpur Robotics and Artificial Intelligence Group), Technical Wing of Technology Robotics Society at IIT Kharagpur
- **June - November 2016:** Worked as a team member for AUV (Autonomous Underwater Vehicle) Group, IIT Kharagpur
- **January - April 2017:** Functioned as Team Captain, for OPENSOFT 2017 Team, M.S. Hall at IIT Kharagpur
- **July 2013 - April 2015:** Successfully completed the NCC (National Cadet Corps) training under the unit 4(A) BN NCC: Air Wing
- **July - November 2016:** Appointed as Teaching Assistant and Student Mentor at the CSE Department at IIT Kharagpur