Manan Sharma
Current: Google Research India
Past: Indian Institute of Technology Bombay
Major: Civil Engineering
Minor: 1) Computer Science & Engineering
2) Artificial Intelligence

Bachelor of Technology (B.Tech.)
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Examination	University	Institute	Year	CGPA / %
Graduation	IIT Bombay	IIT Bombay	2021	9.24 (Ranked 4)
Intermediate/+2	CBSE	MDS Senior Secondary School	2017	89.0
Matriculation	CBSE	Step By Step High School	2015	10.00

Industrial Research Experience

Pre-doctoral Researcher | Google Research India *August 2022 - Present*
Earth Observation Sciences Group *Bangalore, India*

- Working on large-scale soil moisture estimation models using computer vision techniques on multi-modal data.
- Built pipelines for large-scale time-series and satellite imagery extraction across the earth for spatiotemporal modelling.

Pre-doctoral Research Fellow | Microsoft Research India *July 2021 - July 2022*
Machine Learning and Applied Sciences Group *Bangalore, India*

- Worked on proposing a novel piecewise-polynomial filtering based model for node classification over graph datasets, conducted theoretical analysis and performed ablative studies. Work accepted at **ECML'22** and **ICLR-GTRL'22**.
- Worked on improving generalization by proposing deep Bayesian Polynomial Filtering approaches for GNNs for semi-supervised node prediction task. Working on uncertainty quantification for heterogeneous graphs

Anomaly Detection System for E-Commerce Pricing | Amazon Development Centre *April - June 2020*
Software Development Engineering Intern, Automated Advertising Team *Bangalore, India*

- Developed scalable, **real-time anomaly detection system**, to tag incoming current product prices with a reliability score, using historic data, for the recommendation engine to output reliable recommendations to the customers
- Surveyed, implemented and tested multiple state-of-art autoregressive, forecasting & intelligent algorithms including **DeepAR**, **Gaussian Process** classifier, **Exponential Smoothing** & formed weighted ensemble to minimize errors
- Designed and hosted the entire end-to-end architecture on **AWS** cloud, hosting the models on **SageMaker**

Research Experience

Zero-shot Cross-task Domain Adaptation with Instructions *Ongoing*
Prof. Nanyun Peng, CSE | Research Intern *University of California LA*

- Improved cross-task adaptation on unseen tasks of large language models by instance filtering to improve predictions
- Strengthened BART based models, filtering using RoBERTa classifier, obtaining performance gains of upto 5
- Working on a novel GAN-based data augmentation technique to enhance performance. **Work under publication.**

Deep Sequential Models and Sensitivity Analysis in Hydrological Modelling *August 2020 - July 2021*
Prof. Riddhi Singh, Civil Engineering Dept | Bachelors' Thesis *IIT Bombay*

- Designed **LSTM** based Bayesian sequential models for rainfall-runoff prediction in ungauged basins, across the USA.
- Implemented **Bayesian Neural Network**, evaluated model sensitivity via **variational inference** over parameters

Deep Bayesian Active Learning on Graph Data *Autumn 2020*
Prof. Abir De, CSE Dept | R&D Project *IIT Bombay*

- Worked on active learning on graph data, obtaining mutual information among **Bayesian Graph Convolution Network**'s parameters & label as acquisition function
- Used **MMSBM** for parametric random graph generation and ran **MCMC inference** for approximating the posterior

Multi-label Image Classification using Graph Neural & Attention Networks *Summer 2019*
Prof. Biplab Banerjee, CSRE Dept | Research Project *IIT Bombay*

- Extracted multiple segment-wise visual descriptors from images **oversegmented** using **SLIC** algorithm and formed **region adjacency feature graphs** from the image dataset using **OpenCV**
- Trained multi-layered **graph convolution network**, by formulating convolution and pooling operations as aggregating feature information from the spatial structure of graph; achieving a state-of-art accuracy of **64%**

Data Engineering Intern | Praktice AI *December 2018*

- Built **near-real-time web-analytics platform**, to analyse user engagement via capturing raw events
- Structured scalable, efficient **NoSQL** format & improvised queries to analyse effectiveness and performance of product

Code for selected projects is available at: https://github.com/manan-s

Selected Projects

Shortest Path in a maze via a Markov Decision Process formulation *Autumn 2020*
Prof. Shivaram Kalyankrishnan, CSE Dept | Course Project *IIT Bombay*

- Modelled 2D maze as **Markov Decision Process** with appropriate states, actions, rewards & transition probabilities
- Found optimal policy, solving MDP using **Howard's Policy Iteration, Value Iteration & Linear Programming**

Blind Super-Resolution Kernel Estimation using Internal-GAN *Spring 2020*
Prof. Suyash Awate, CSE Dept | Course Project *IIT Bombay*

- Implemented a **GAN** variant that predicts the blurring **kernel** of a low-resolution image in a **single-shot setting**
- Trained the generator to downscale images with an **implicit kernel** and discriminator to learn the distribution by formulating **L1-normed loss** & designed a **regularizer** to decrease hypotheses space to subset of plausible kernels

A Generative Adversarial Approach for Zero-shot Learning for Noisy Texts *Autumn 2019*
Prof. Biplab Banerjee, CSRE Dept | Course Project *IIT Bombay*

- Leveraged GANs to imagine unseen categories from text descriptions from Wikipedia by simulating conditional distribution of visual features of corresponding class using generator & leveraging discriminator for supervised classification
- Added **visual pivot regularization** for preserving inter-class discrimination, improving the accuracy by up to **6.5%**

Music Genre Classifier *Spring 2019*
Prof. Biplab Banerjee, CSRE Dept | Course Project *IIT Bombay*

- Formed normalized descriptors by extracting high-level features like **MFCC**, **Chroma frequencies** from audio files
- Trained an ensemble classifier by implementing **k-NN**, **SVM** with kernels, **Decision Tree**, **Naive Bayes**, **softmax** classifiers & a neural network for the task of classifying musical pieces in 10 genres, achieving mean accuracy of **78**%

Automatic Water Supply Network Solver *Spring 2019*
Prof. Riddhi Singh, CE Dept | Course Project *IIT Bombay*

- Automated the process of approximating the discharge in pipe networks by modelling the network structure as a connected graph, simulating the flow as traversal across this directed graph, and performed **BFS** for detecting loops
- Used various analytical methods of **Hardy-Cross** and **Newton-Raphson** for approximating multiple hydrological parameters and optimized the algorithm to produce accurate results in time linear in network's nodes and edges

Killer Sudoku Solver *Spring 2018*
Prof. Krishna S, CSE Dept *IIT Bombay*

- Implemented **backtracking** algorithm under multiple constraints imposed by addition of cages to Sudoku puzzle
- Analysed performance of solving component & determined the **fastest** and most effective order of execution of rules

Scholastic Achievements

- Ranked **4th** in the department, in the batch of 102 students [*2021*]
- Obtained SPI of **perfect 10** with AA in all courses in 6th and 7th semester [*2020*]
- Among top **99.7 percentile** in JEE-Mains 2017 and top **98.9 percentile** in JEE-Advanced 2017 [*2017*]
- Qualified aptitude test for Kishore Vaigyanik Protsahan Yojana (**KVPY**) scholarship [*2015*]
- Achieved National Rank **75** in National Level Science Talent Search Examination (NSTSE) in 2016 [*2016*]

Teaching and Mentoring Experiences

- **Teaching Assistantships** *Autumn 2018 - Present*
  - **MA108, Differential Equations**, Spring 2021 & 2019: Conducted tutorials for batch of 50 freshmen, held tutorial solving and doubt clearing sessions and held special sessions for language challenged students
  - **MA106, Linear Algebra**, Spring 2021: Conducting tutorials for batch of 46 freshmen, additionally holding special sessions for advanced topics in linear algebra for higher level undergraduates
  - **MA111, Vector Calculus**, Autumn 2020: Conducted tutorials for batch of 46 freshmen, providing periodic individual assistance and doubt solving sessions, formulating and grading the quizzes
  - **CS101, Computer Programming and Utilization**, Autumn and Summer 2019: Provided individual assistance to students and helped conducting C++ programming laboratories for 600+ students in a team of 11 undergraduates
  - **BB101, Physical Biology and Biomedical Engineering**, Autumn 2018: Conducted tutorial sessions for class of 50 freshmen & evaluated the answer scripts. Helped students weak in English by conducting separate discussions
- **Mentor | Summer of Science** *Summer 2020*
  - Mentored 3 students on **Data Structures and Algorithms, Cryptography & Neural Networks and Deep Learning** by providing them periodic assistance, occasional discussions and guiding them to relevant resources

Technical Skills

Programming	C/C++, Python, R, Julia, SQL, HTML, XML, CSS
Software/Frameworks	MATLAB, OpenCV, Tensorflow, Keras, Pytorch, LaTeX, Git, AWS, OpenGL

Key Courses Undertaken

Machine Learning	Automatic Speech Recognition, Optimization in Machine Learning, Introduction to Stochastic Control, Foundations of Intelligent & Learning Agents, Theoretical Machine Learning, Advanced Machine Learning (Probabilistic Graphical Models), Machine Learning for Remote Sensing 1 & 2, Medical Image Computing, Reinforcement Learning (edX), Deep Learning Specialization (Coursera)
Computer Science	Data Structures & Algorithms, Computer Networks, Operating Systems, Design & Analysis of Algorithms, Cryptography and Number theory, Computer and Network Security
Maths & Statistics	Calculus, Linear Algebra, Differential Equations I and II, Probability and Statistics
Miscellaneous	Introduction to Electrical & Electronics Circuits, Psychology, Economics, Quantum Physics

Note: Unless stated, all the above courses mentioned were done as coursework requirements in IIT Bombay

Extracurriculars

- Served as a coordinator in **Techfest** and **E-Cell**, helping in planning,organizing and conducting of the events [*2018*]
- Trained in classical **carnatic Violin** under yearly NSO Culturals course for freshmen [*2017-18*]
- Awarded certificate of appreciation from Mahatma Gandhi Hindi Rashtrabhasha Hindi Prachar Sanstha for **first division performance** in its National Bhasharatna Examination in 2014
- Trained in **Abacus** and **Mental arithmetic** for 3 continuous years by UCMAS