Aman Bansal

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Academic Qualifications

Bachelor of Technology (Honours), IIT Bombay, Mumbai 2016 - Ongoing

- Major : *Computer Science and Engineering* Current CPI (after 7 semesters) : ***9.66/10***
- **Advanced Topics** : Virutualization and Cloud Computing, Distributed Systems, Concurrent and Parallel Programming, Advanced Machine Learning, Network Security & Cryptography, Blockchain Technology

Publications

Garbage Collection Using a Finite Liveness Domain International Symposium on Memory Management 2020
Aman Bansal, Saksham Goel*, Preey Shah*, Amitabha Sanyal, Prasanna Kumar*

- Designed a technique for **static context-sensitive** liveness analysis by exploiting recurring liveness patterns
- Improved upon the standard algorithms in garbage reclamation and collection time by an **order of magnitude**
- Extended the algorithm to work for *higher order* functions and obtained huge gains on real-world programs

** Sorted by last name*

Scholastic Achievements And Scholarships

- Achieved **All India Rank 1** in JEE (Advanced) out of 150,000 shortlisted candidates 2016
- Secured **All India Rank 71** in JEE Mains out of 1.2 million candidates 2016
- Awarded Scholarship under the **Charpak Research Internship Program** by the Embassy of France in India to undertake research internship in France (among the 13 students selected nationally) 2018
- Amongst the top 2 in the department to receive the **Institute Academic Award** 2019
- Overall ranked **5th** in the department out of total 120 students 2020
- Received **Gold Medal** and Certificate of Merit for being in the national **top 38** candidates at INChO 2016
- Stood at 17th position among 225 teams in the **ACM-ICPC** Amritapuri regionals 2018
- Recipient of the prestigious **KVPY Fellowship** by Dept. of Science and Technology, Govt. of India 2015

Internships

Haptik Pvt. Ltd. | *Machine Learning Engineering Intern* Nov 2019 - Jan 2020

- Trained an ensemble model in **PyTorch**, by taking state-of-the-art NLP models and applying **transfer learning**, to make the customer-facing *virtual voice assistants* intelligently predict when the user has stopped speaking
- Augmented the training dataset with noise-added data-points to make the model robust to variations in speaking
- Achieved an accuracy of around **85%** on the test data and of over **75%** on real-life chat data

Rubrik Inc. | *Software Development Engineering Intern* May 2019 - Jul 2019

- Developed an **end-to-end** feature, as part of the *Data Life Cycle Team*, for implementing a user-configurable behaviour of on-demand backups for every supported object without compromising efficiency
- Creating optimized **RESTful APIs** for exposing the backend functionality to the UI/UX

INRIA Nancy, France | *Research Intern* | *Guide: Prof. Steve Kremer* May 2018 - July 2018

- Studied about automated, symbolic verification techniques and operational semantics of *applied pi calculus*
- Designed a simulator for interactively displaying attacks on protocols which violate the **behavioural equivalence**

Research Projects

Extending Foundations of Differential Privacy | *Guide: Prof. Manoj Prabhakaran* Jan 2019 - Ongoing
Submitted in Crypto '20

- Proposed two new concepts, **Robust Privacy** and **Flexible Accuracy** along with their composition theorems, for extending the notion of differential privacy to accommodate highly sensitive functions like *maximum*
- Invented new mechanisms with optimal parameters and improved upon the **state-of-the-art** for such functions

Boolean Functional Systhesis | *Guide: Prof. Supratik Chakraborty* Bachelor's Thesis | Ongoing

- Examining the constraints under which factorization can be solved in **P-time** using a *synNNF* multiplication circuit
- Proved that the conjunction of two *synNNF* circuits can lead to *exponential* blowup in time and size complexities
- Studied and relaxed the conditions under which a boolean functional problem synthesis is in **P/Poly** class

Key Projects

Multi-PAXOS Consensus Protocol | *Distributed Systems* Autumn 2019

- Programmed the nodes of a distributed system, who want to *consistently* update a common state, to run *PAXOS consensus protocol* for the election of a *leader node* known to every other node in **Java**
- Handled the unexpected failure of the leader node by a consistent *re-election* via PAXOS to achieve **fault-tolerance**

Distributed Spanning Tree Protocol | *Computer Networks* Spring 2018

- Simulated the topology of network bridges as a *distributed system* of nodes, communicating via messages, in **C++**
- Configured the nodes to run the protocol and agree upon a *loop-less* logical topology to prevent a *broadcast storm*

Secure Online Exam Portal | *Database and Information Systems* Autumn 2018

- Developed a platform for optimizing exam conductance and correction using **JDBC** API with **PostgreSQL**
- Safeguarded the web-pages against database attacks like *SQL Injection* and *Cross-site scripting* (XSS)

Parallelized Fast Fourier Transform | *Parallel Programming* Autumn 2019

- Achieved a speed-up of around **80x** in the execution time of the FFT algorithm on a GPU using **CUDA** in C++
- Optimized the running time by shifting to an *iterative* algorithm which allowed extensive **memory coalescing**

Learning Latent Representation of Sound | *Advanced Machine Learning* Spring 2019

- Used instantaneous frequency spectograms (**ICLR'19**) as audio representations for developing auto-encoders
- Trained **Autoencoders** and **Beta-VAE** on them for modelling latent space of samples in audioset dataset

Autonomous Teaching Assistant | *Institute Technical Summer Project* Summer 2017

- Created a platform to frame questions from text corpus and grade answers using statistical **NLP** and (**NLTK**) library
- Introduced *Named Entity Recognition*, *Pronoun Resolution* and *Synonym/Antonym Detection* for better results

D-RAM Addressing Attack on Intel i7 | *Computer Architecture* Autumn 2018

- Directed a **timing attack** on *Intel 7th gen i7* processor to reverse engineer the confidential DRAM address mappings
- Established illicit inter-process communication through a **covert channel** by utilising the address mappings

EYE, The Interpreter that Visualises | *Software Systems Lab* Autumn 2017

- Developed an interpreter in Python for a subset of C language with **visual execution** as a debugging tool
- Displayed the **memory layout** (stack variables and heap data structures) after every statement execution

Other Projects

- **Virtualization in Linux:** Studied *KVM API* and implemented multiple **hypercalls** in a simple hypervisor
- **Big Data Processing:** Analysed sentiments in a large amount of data using RDD and Dataset in **Spark**
- **Chess Classic:** Designed a chess AI engine using **mini-max** algorithm with **alpha-beta prunning** in *Racket*
- **Decentralized Application:** Built a **blockchain-based** web-application for professional networking with verifiable credentials, using Solidity to create smart contracts, and deployed on Ropsten Ethereum network

Technical Skills

C/C++ (Proficient), Python (Proficient), Scala, Java, JavaScript, Bash, SQL, Databases, Git, CUDA

Positions of Responsibility

Department Academic Mentor Apr 2018 - Apr 2019

- Mentor to 6 sophomores for helping them cope up with the curriculum and solve their general concerns

Teaching Assistant IIT Bombay

- Foundations of Data Structures - MOOC course
- Data Structures and Algorithms (Theory + Lab)
- Design and Analysis of Algorithms (x2)
- Computer Programming and Utilisation - Core TA

Department Sports Secretary Apr 2017 - Mar 2018

- Took initiative to organize and conduct **2 new** department sports events apart from the expected *4 major leagues*

Extracurriculars

- **Wrestle-AI:** Secured *first* place in wrestle-AI competition for engineering an **autonomous wrestling bot** in arduino, with line-following and wall-following capabilities, using *IR* and *ultrasonic* sensors 2017
- Received certificate of merit for swimming for **8 hours straight** covering **12 km** in Swimmathon 2017
- Successfully completed **80 hours** under the National Service Scheme (**NSS**) which involved teaching science at LCCWA (NGO) and powerpoint presentations about basic finance 2016-17