# Shalabh Gupta

Indian Institute of Technology Bombay, Powai, Mumbai-400076

+91-9716708555 shalabh147@gmail.com linkedin.com/in/shalabhgupta github.com/shalabh147

## Education

**Indian Institute of Technology Bombay, Mumbai, India** *July 2018 - May 2022*
BTech. in Computer Science and Engineering with Honors ***CPI - 9.32/10***

## Interests

- System Design, Distributed Systems, Cloud Computing, Deep Learning, Operating Systems, Algorithms, Football

## Academic Achievements

- Secured **All India Rank 19** in JEE Advanced out of **231,000** candidates *(2018)*
- Scored **99.9 percentile** and **All India Rank 74** in JEE Mains out of **11,35,084** candidates *(2018)*
- Cleared **NSEC** and Qualified for **InCHO(Indian National Chemistry olympiad)** *(2018)*
- Secured **All India Rank 128** in the prestigious **Kishore Vaigyanic Protsahan Yojana** Scholarship conducted by IISc (Indian Institute of Science), Bengaluru *(2017)*
- Recipient of the **National Talent Search Examination** scholarship conducted by NCERT *(2015)*

## Internships and Research Projects

**Quant Developer and Researcher Intern** *D.E. Shaw Pvt. Ltd, Hyderabad*
Machine Learning | Data Analysis | Quantitative Research *May 2021 - Jul 2021*

- Analysed the performances of **US bond funds** to find trends or patterns persistent in the returns
- Explored research papers involving **financial factor models** capturing performances and factors impacting returns
- Incorporated these models for performance comparison of the funds against their **self-declared benchmarks**
- Built regression models to estimate the **positioning** of funds against factors duration, inflation and credit spread

**Resume Parser using ML** *FlexiEle Pvt. Ltd., Gurgaon*
Data Science Intern | Machine Learning | NLP *Dec 2019*

- Delivered **improved extraction** and smarter identification of resume data for cloud based HR solutions
- Developed a heuristic based mechanism over **pdfminer tool** to parse resume data into title and its description
- Tuned a classifier using **pre-trained BERT** model to classify statements of resume into content categories
- Explored NLP toolkits like spacy and nltk for **segmentation, entity recognition** and coreference resolution

**Dynamic Offloading of Host Computations onto SmartNICs | BTP** *IIT Bombay*
Prof. Umesh Bellur | Systems | Networks *July 2021 - Present*

- Working on dynamic offloading of components from a **Serverless framework** onto a Netronome Agilio smartNIC
- Working on attempting to speed up **dispatch and orchestration** for serverless workflows with lesser NIC load
- Improved function execution latencies by integrating deployment and execution of micro-c code on smartNICs
- Explored the **P4 programming language** to program the data plane of the existing SmartNIC for components to execute closer to the network to reduce latencies

**Spatial Relationship Learning using Graph Convolutions | RnD Project** *IIT Bombay*
Prof. Amit Sethi, EE Department | Deep Learning | Graph Convolutions *July 2020 - Nov 2020*

- Ideated a **Graph Convolution** based model to code intricate **spatial relationships** between distant objects as graphs in images where CNNs lose resolution due to convolution and pooling
- Designed a residual block based **Visual Attention** model to capture top $k$ attention score points in feature maps from a CNN model having information sufficient for image reconstruction task
- Compared accuracies against resnet50 on classification using **node features of graph** obtained from the model

**Controlled Generation of Retinopathy Images | RnD Project** *IIT Bombay*
Prof. Suyash Awate | Generative Modelling | Medical Imaging *Spring 2021*

- Built models for **automatic generation** of Diabetic Retinopathy images and their vessel filamentary structures
- Used **adversarial training** techniques to generate images that will aid in training models aimed at clinical analysis
- Employed Adversarial Autoencoders and **Conditional GANs** to generate images controlled by disease grade

## Other Key Projects

**Brain Tumor Segmentation & Survival Prediction using Deep Neural Networks** *Course Project*
Prof. Suyash Awate | Deep Learning | Segmentation | Python *Summer '20*

- Implemented and trained **End to End Convolutional neural networks** based deep learning models for automatic segmentation of tumor parts in Brain MRI images and used them for survival prediction
- Developed a new **2D axes integration** based neural network as an extension of a BraTS paper and got **better dice accuracy** of 0.756 than what they had with a similar approach on validation set
- Replicated results close to SOTA for the **patient survival prediction** task using deep neural networks

**Recommender System Web Application** *Course Project*
Prof. Umesh Bellur | PostgreSQL | Node.js *Spring 2021*
- Built a **web application** to serve as a dynamic movies recommender system to users with advanced searching.
- Implemented the web interface using the **MVC architecture in Node.js** and backend on postgreSQL having normalized databases providing recommendations on basis of trending, popular and high rated movies
- Provided **real time recommendations** like cloud based systems along with **features** to add friends and give ratings

**Foreshadow Study and PoC** *Course Project*
Prof. Bernard Menezes | Speculative Execution *Autumn 2020*
- Explored and imitated Foreshadow, a **speculative execution attack** on Intel's SGX processors which allows attackers to steal **sensitive information** from personal computers or third-party clouds
- Studied related attacks like **Meltdown** and **Spectre** which exploit transient out-of-order execution techniques
- Presented a proof-of-concept by simulating SGX's **abort page semantics** to showcase an attack

**Compiler for a language with C like semantics** *Course Project*
Prof. Uday Khedkar | Lexical, Syntax and Semantic Analysis | C++ Lex & Yacc *Spring 2021*
- Implemented Abstract Syntax Tree, TACs & Symbol Table for **effective translation** of C++ code to assembly code
- Provided support for constructs like expressions, nested conditional statements, control structures and scoping

**Blockchain Simulator for Cryptocurrency Network** *Course Project*
Prof. Vinay Ribeiro | Blockchain System | C++ *Autumn '2021*
- Designed an end-to-end Object Oriented discrete event blockchain simulator for a **P2P cryptocurrency** network
- Modeled the blockchain events in an **event-queue** to simulate **Proof-of-work** consensus and mining attacks
- Implemented block creation and validation with longest chain analysis and visualization of trees at each node

## Course Work

**Layer-2 DAPP on top of Ethereum** *Course Assignments*
Prof. Vinay Ribeiro | Introduction to Blockchain and Smart Contracts *Autumn 2021*
- Implemented and deployed a **decentralized application** on top of a peer-to-peer distributed network, Ethereum
- Coded the smart contract in **Solidity** and fired **transactions** to deploy/interact with ETH Node using python **Web3**

**Cloud Management System and Container Design** *Course Assignments*
Prof. Mythili Vutukuru | Virtualisation and Cloud Computing *Spring 2021*
- Built a cloud management system by designing an **autoscaling client server** application with horizontal scaling
- Implemented a **load balancing program** using libvirt API to monitor and distribute load across VM servers
- Designed a container from scratch using **Linux namespaces and cgroups** isolating its network and environment

**Xv6 Kernel Programming** *Course Assignments*
Prof. Mythili Vutukuru | Operating Systems Lab *Autumn 2020*
- Implemented **process spawning** and round robin/priority based process scheduling algorithms for xv6
- Added pthread synchronization and dynamic memory management with **lazy page fault handling** to xv6 code

## Key Courses Undertaken

- **Machine Learning:** Data Analysis and Interpretation, Artificial Intelligence and Machine Learning theory, Medical Image Computing, Foundations of Intelligent and Learning Agents
- **Systems:** Operating Systems Theory + Lab, Computer Architecture Theory + Lab, Virtualisation and Cloud Computing, Software Systems Lab, Computer Networks, Introduction to Blockchains and Smart Contracts
- **Other CS + Maths:** Data Structures and Algorithms, Design and Analysis of Algorithms, Database and Information Systems, Linear Algebra, Calculus, Numerical Analysis

## Technical Proficiency

- **Programming Languages:** C++, Python, Racket, Make, HTML, CSS, Bash, SQL, Javascript, P4, VHDL
- **Data Analysis and ML:** PyTorch, TensorFlow, Keras, NumPy, SciPy, Pandas, Scikit-Learn
- **Softwares/Others:** MATLAB, Octave, Wireshark, AutoCAD, Solidworks, Github, LaTeX

## Teaching Assistant

- CS 744 - Design and Engineering of Computing Systems, IIT Bombay *(July 2021 - Nov 2021)*
- CS 387 - Database and Information Systems Lab, IIT Bombay *(Ongoing)*

## Extracurriculars

- Currently rated 1798 with highest rating of 1913 (4 stars) on **codechef** - a competitive programming platform
- Secured **2nd Position** in **Game of Codes 2019** organised by KJ Somaiya Institute of Science, Mumbai
- Succesfully completed 80 hours of community service under National Service Scheme in 2018-19
- Won **inter-department football** CSE tournament 2018-19 organised within IIT-Bombay
- Participated in the **VFL(Vikings Football League) 2018** - Intra Hostel 6 football League