Shalabh Gupta

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Education

Indian Institute of Technology **July 2018 – May 2022**
Bachelor of Technology with Honors in Computer Science and Engineering *Mumbai, India*

- GPA: **9.35/10**

Research Interests

Deep Learning, Reinforcement Learning, Cloud Computing, Blockchain Systems, Generative Modelling

Research Experience

Dynamic Offloading of Host Computations onto SmartNICs **July 2021 – Nov 2021**
Guide: Prof. Umesh Bellur, Dept. of Computer Science and Engineering *IIT Bombay*

- Worked on speeding 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

Spatial Relationship Learning using Graph Convolutions **July 2020 – November 2020**
Guide: Prof. Amit Sethi, Dept. of Electrical Engineering *IIT Bombay*

- 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

Conditional Diabetic Retinopathy Image Synthesis **Jan 2021 – May 2021**
Guide: Prof. Suyash Awate, Dept. of Computer Science and Engineering *IIT Bombay*

- Optimised the Retinopathy Fundus Image generation using a two stage pipeline by first generating the retinal blood vessel filamentary structure followed by overlaying the skeleton with the fundus data
- Experimented with various adversarial Networks and Variational Autoencoders by varying the latent space dimensionality to improve the filamentary structure generation
- Incorporated a Pix2Pix Network, conditioned over the DR grade to generate controlled abnormality images

Brain Tumor Segmentation & Survival Prediction **April 2020 – June 2020**
Guide: Prof. Suyash Awate, Dept. of Computer Science and Engineering *IIT Bombay*

- 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

Internships

Quant Developer and Researcher Intern **D.E. Shaw Pvt. Ltd., Hyderabad**
Python, Machine Learning, Data Analysis *May 2021 – July 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
- Built regression models to estimate the positioning of funds against factors duration, inflation and credit spread

Software Developer Intern **FlexiEle Pvt. Ltd., Gurgaon**
Resume Parser, Data Science, NLP *Dec 2019 – Jan 2020*

- Delivered improved extraction and smarter identification of resume data for cloud based HR solutions
- 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

Software Developer - ML Intern **Abacus.AI, Mumbai**
ML Dashboard, Startup, Backend + ML *Jan 2022 – May 2022*

- Built connector services & data pipelines to efficiently import data from cloud ODBC databases into the product
- Introduced a new NLP Summarization use case into the main product - involving adding the whole pipeline - building summarization model, training the model, cloud deployment and generating batch predictions
- Developed and integrated new functionalities/services to the ML dashboard for better functioning

Key Technical Projects

Mesh Neural Network for 3D Object Classification | *3D Deep Learning* **Summer 2020**

- Implemented the paper 'MeshNet for 3D shape representation' from scratch for 3D classification in PyTorch
- Constructed neural networks for Face Kernel Correlation, Face Rotate Convolution to learn spatial and structural information from 3D Meshes and integrated both using Mesh Convolutional blocks
- Explored research papers related to 3D shape understanding like PointNet, VoxelNet, Mesh RCNN

Cloud Management System and Container Design | *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

Reinforcement Learning | *CS747: Foundations of Learning Agents* **Autumn 2020**

- Implemented and compared Q-learning, SARSA, Expected SARSA algorithms on the windy gridworld problem
- Computed optimal policies for MDPs using value iteration, Howard's policy iteration and linear programming

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 *(2016)*

Technical Skills

Programming Languages: Python, C, C++, Java, Bash, HTML/CSS, JavaScript, SQL, Make, CMake, VHDL, P4
Libraries: PyTorch, Keras, TensorFlow, OpenCV, NLTK, Scipy, NumPy, Pandas, Matplotlib
Software/Frameworks: Linux, GitHub, Matlab, LATEX, Solidworks, GNUPlot, Docker

Relevant Coursework

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

Teaching Assistant

CS 744: Design and Engineering of Computing Systems **July 2021 – Present**
Prof. Umesh Bellur *IIT Bombay*

- Prepared Programming Assignments for students of the course and graded them
- Helped in formulating examination questions for the course and grading them

Extracurriculars

- Currently rated 1798 with highest rating of 1913 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