Param Rathour

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Education

Indian Institute of Technology Bombay *(Mumbai, India)*
Bachelor of Technology in Electrical Engineering, CPI – 8.46 *(Expected Graduation: July 2023)*
Pursuing Minor in Computer Science & Engineering, and Honours in Electrical Engineering

Scholastic Achievements

- Secured **All India Rank 926** in Joint Entrance Examination (**JEE**) **Advanced** among 161 thousand candidates *(2019)*
- Secured **99.9%** percentile in Joint Entrance Examination (**JEE**) **Main** among 1.1 million candidates *(2019)*
- Scored **418** marks out of 450 in Birla Institute of Science and Technology Admission Test (**BITSAT**) *(2019)*
- Secured **99.92%** percentile in **MHT-CET** among 270 thousand candidates conducted by the Maharashtra Govt. *(2019)*
- Statewise top 1% in the National Standard Examination in Astronomy **(NSEA)** and Chemistry **(NSEC)** *(2019)*

Scholarships and Recognitions

- Recipient of the National Talent Search **(NTS)** Scholarship given by NCERT to 1000 students of country *(2017)*
- Awarded Academic Excellence Scholarship **(AES)** by SOF given to **one student per class per state** *(2017)*
- Recipient of the Maharashtra Talent Search **(MTS)** scholarship with **State Rank 11, 10, 16** respectively *(2015-17)*
- Recipient of State Scholarship by Maharashtra State Council of Examination with **State Rank 5** *(2014)*

Research Projects and Work Experience

IIT Bombay Racing | Electrical Subsystem

Faculty Advisor: Prof. Amber Shrivastava
A cross-functional team of 70+ students which designs, fabricates and assembles an Electric Race Car for Formula Student UK

Junior Design Engineer | LV Safety Subsystem *(Sep 2020 - May 2021)*

- Simulated LV Safety board on **LTSpice** and verified the working of RTDS, Brake Light, Error Blocks of the subsystem
- Explored Electromagnetic Interference (**EMI**) Reductions Techniques to be incorporated into PCB designs
- Mentored 3 trainees in understanding the subsystem through FS rulebook, circuit design tasks and spice simulations

Trainee | Electrical Subsystem *(Jan 2020 - Aug 2020))*

- Investigated the Electronic Control Unit (**ECU**) subsystem, working with **RPM** and **position sensors** and realised working of the steering, acceleration pedal and brake sensors of the car with **Arduino IDE**
- Acquired the knowledge of Controller Area Network (**CAN**) and Data Acquisition (**DAQ**) systems and their implementation, wrote code for wireless communication using **LPC1768 Mbed** microcontroller and **XBee** module

Scenario Approach to Robust Optimization *(May 2021 - Present)*

Summer Undergraduate Research Program (SURP) *(EnPoWER, IIT Bombay)*
Guide: Prof. Debasish Chatterjee

- Working on improving scenario approach to robust optimization problems in the **moderate to high dimensional** regime
- Studied **concentration of measure** phenomenon for the analysis of randomized algorithms and the scenario approach
- Analysed various randomized algorithms like **MCMC, Propp–Wilson, Simulated annealing** using Finite Markov Chains

Coded Computing for Straggler Mitigation, Security and Privacy *(Sep 2021 - Nov 2021)*

Guide: Prof. Nikhil Karamchandani *(Course Project)*

- Investigated the concept of employing coding theory techniques to alleviate major problems in Distributed Computing
- Studied optimal coding methods for **Straggler Mitigation** in Matrix Multiplication and Multivariate Polynomial Evaluations
- Explored **Lagrange Coded Computing**, and its applications in **Secure & Private Multi Party Computing** (MPC)

Key Projects

Temperature Controller Using Heating Element and PWM Control *(Ongoing)*

Guide: Prof. Kushal R. Tuckley *(Course Project)*

- Designing a low-cost, easy-to-maintain and reliable high temperature controller system for glass furnaces with ability to maintain any temperature within the range of **200-1000°C** with 1-2% accuracy and achieve it within 30 minutes
- Ideated a control mechanism accounting for the temperature difference, overheating of furnace and preventing oscillations
- Selected suitable components for the driver circuitry, temperature sensing and interfacing by estimating thermal parameters
- Working on simulation modelling, analysis and testing of the system in Simscape

Tinkering Bootcamp *(Summer 2020)*

Learner's Space (LS) *(Tinkerers' Laboratory, IIT Bombay)*

- Developed a **Self Irrigation System** using Arduino IDE, which toggles according to readings from a **DHT1** humidity sensor and provided manual **control** and **data monitoring** through **Blynk App** by projecting real-time data to Blynk servers
- Made **Human Detection System** using a Passive Infrared **(PIR)** sensor which uses a buzzer module for alarm sound
- **Automated** daily fetching of count of corona cases in India from a website using **ESP32** and **ThingHTTP**
- Simulated a **Invisibility Cloak** by live removal of foreground of range of colours from a webcam using **OpenCV**

Distributed Deep Learning *(Summer 2020)*
Institute Technical Summer Project (ITSP) *(Institute Technical Council, IIT Bombay)*
- Developed a **Hierarchically Distributed Deep CNN** in order to parallelise workload across nodes in the model
- Utilised the model to implement better training on **Super-High-Resolution Datasets** via **spatial segmentation** of each sample and observed increases in **training speed** and decrease in **memory utilisation** per node in the hierarchy network
- Compared the performance of **VGG16, ResNet**, and **AlexNet** when used as the underlying Neural Networks
- Verified the approach by using **Retinal OCT** dataset on Kaggle and analysed loss of information due to spatial-segmentation

Tennis Scoreboard Simulator *(Autumn 2021)*
Guide: Prof. V Raj Babu *(Course Project)*
- Simulated a tennis scoreboard using **Embedded C** in the **best-of-three tiebreak** set format on the **Pt-51** board
- Displayed directions to use and the score, Game Point, Set Point, Match Point for each player using an **LCD Module**
- Used **UART** Module and **RealTerm** software for interfacing between a keyboard and **Atmel AT89C51** micro-controller

Arithmetic Logic Unit *(Autumn 2020)*
Guide: Prof. Virendra Singh *(Course Project)*
- Designed a signed **16-bit ALU** using **Structural VHDL** which computes addition, subtraction, bitwise NAND & XOR
- Performed signed addition using 16-bit **Kogge–Stone fast adder** that returns output in 17-bit 2's complement form
- Simulated the circuit using **Quartus** by handpicking test vectors covering all edge cases for each operation

Other Projects

Keyboard Scanning – Implemented **Key Debouncing** using Finite State Machine (FSM) in 8051 and MIPS Assembly
Music Synthesizer – Designed a FSM to play 7 notes of Indian music in a particular order with **Behavioral Style VHDL**
Moustique Cipher – Generated **Pseudorandom Bit Sequences** with almost perfect **linear complexity profiles** in Sage
MDP Planning – Implemented using Value Iteration, Howard's Policy Iteration and Linear Programming in Python
Mountain Car – Drove up a weak car on mountain using **Sarsa** with **Tile Coding** in **OpenAI Gym** environment

Positions of Responsibility

Teaching Assistant | **Computer Programming and Utilization** *(Spring 2021, Spring 2022)*
Guide: Prof. Bhaskaran Raman, Prof. Parag Chaudhuri *(Computer Science and Engineering IIT Bombay)*
- Academically guided 26 students, clearing their doubts through weekly sessions and personal interaction
- Created a **webpage** containing practice problems and relevant resources to enhance understanding of course

Mentor | **Summer of Science** *(Summer 2021)*
Topic: Linear Algebra and its Applications *(Maths and Physics Club, IIT Bombay)*
- Mentored a student in exploring the subject and guided him through various interesting topics in Linear Algebra
- Checked the student's progress regularly, personally cleared his doubts, reviewed and evaluated his submissions

Editor | **Department Newsletter Team** *(2020)*
Background Hum: Team of 20 enthusiastic students *(Electrical Engineering Student Association, IIT Bombay)*
- Ideated and worked on an overview of **exciting labs** in the department to increase awareness among students
- Prepared content recommendations of scientific and engineering marvels to inspire curiosity among readers

Key Courses Undertaken

Electrical	Processor Design†, Microprocessors, Digital Systems, Information Theory†, Error Correcting Codes Control Systems, Nonlinear Dynamical Systems†, Signal Processing, Communication Systems
Computer Science	Operating Systems†, Data Structures and Algorithms, Design and Analysis of Algorithms, Foundations of Intelligent and Learning Agents, Formal Methods in ML†, Logic for CS
Mathematics	Calculus, Complex Analysis, Differential Equations, Linear Algebra, Matrix Computations, Probability and Random Processes, An Introduction to Number Theory and Cryptography

†*to be completed by May 2022*

Technical Skills

Languages	C++, Python, Julia, LaTeX, MATLAB, Scilab, Assembly, HTML, CSS, SQL
Frameworks & Libraries	Sage, Qiskit, NumPy, SciPy, pandas, scikit-learn, OpenCV, TensorFlow, Keras, PyTorch, Jekyll
Software	Git, Docker, Simulink, EAGLE, SPICE, Quartus, Keil μVision, GNURadio, Adobe Illustrator
Hardware	Embedded C, VHDL, MIPS, 8051, 8086, Arduino, ESP32, Raspberry Pi 4, Tiva-C

Extracurriculars

Technical *(2019-2021)*	• Built a **RC Bot** capable of negotiating obstacles and designed & fabricated a **RC Trainer Plane** • Completed Summer of Science in **Game Theory** and **Nonlinear Dynamics** by Math & Physics Club • Completed **Scientific Computing** & **Data Analytics** Bootcamps and **Quantum Computing** Workshop
NCC *(2019-2020)*	• Completed a year-long **training program** as **NCC Cadet** under 2 MER NCC at IIT Bombay • Attended ten-day-long NCC **Annual Training Camp** (ATC) held during Nov-Dec 2019 • Part of **Republic Day Parade Contingent** held on 26th January 2020 at IIT Bombay Gymkhana
Social Volunteer *(2019-2020)*	• Volunteered for Career Counselling Campaign and A Session on Climate Change for 12,000+ underprivileged students from 8th to 12th conducted by **Abhyuday** in association with **NCC** • **Mentored** students appearing for JEE during **COVID-19** crisis as part of **CovEd Education**
Culturals *(2019-2020)*	• Studied **Beginner Music Theory** as a part of Summer School of Cult conducted by ICC