Ratan Kokal

B.Tech Aerospace Engineering
Indian Institute of Technology Bombay

ratanskokal@gmail.com
+91 70217 22267

Education	University	Institute	Year	CPI/%
Graduation	IIT Bombay	IIT Bombay	2023-27	9.25
Intermediate/+2	HSC	Alpha Junior College	2021-23	86.5
Matriculation	ICSE	St. John's Universal School	2021	98.4

Pursuing **Dual Minor Degree** in **Computer Science** and **Artificial Intelligence**

Scholastic Achievements

- Currently holding **Department Rank 4** among 81 students in the Aerospace batch of 2027 [Present]
- Recipient of **Technical Freshman of the Year Award** for outstanding technical skills [2023-24]
- Attained **99.00 percentile** amongst **180,000+ candidates** appeared for JEE Advanced [2023]
- Obtained **99.88 percentile** amongst **1,100,000+ candidates** appeared for JEE Mains [2023]
- Awarded multiple **Certificates of Merit** and **Scholarship** for meritorious performance in All India Open Maths Scholarship exam conducted by Institute for Promotion of Maths [2016-18]
- Achieved **International Rank 2** in **International Maths Olympiad** conducted by SOF [2015]

Professional Experience

Robotics Intern | **Turangi Tech** [Dec '24 - Jan '25]
Guide. Kunal Tyagi

- Simulated **ROS enabled Gazebo** environment showcasing **3D QR code localization** on movables
- Built **Gazebo plugins** and **service wrappers** for dynamic object control and motion simulation
- Implemented **homography-based QR code detection** for tracking states and relative motion
- Integrated **FastAPI** for QR code **metadata management** and dynamic service-based updates

Technical Team Experience

Autonomous Underwater Vehicle, IIT Bombay [Oct '23 - Present]
Prof. Leena Vachhani, Prof. Shashi Ranjan Kumar

AUV-IITB is an all-student team working on the design of **autonomous vehicle**, **Matsya**, which is capable of navigation, smart decision-making and object detection enabling it to autonomously **perform realistic tasks** in marine conditions for **international competitions** such as **RoboSub**

Achieved **4th place globally** in the finals of **RoboSub 24's Autonomy Challenge** and **1st place** in **Technical Design Report** among **41 teams** from 7 countries in Irvine, California.

- Completed **extensive training** on Bash Scripting, **Robot Operating System** and Version Control
- Researched **Otsu** image processing to separate background and foreground for **object detection**
- Co-authored **Technical Design Report** creating **workflow diagram** for the software subsystem
- Dedicated **100+ hours** in extensive testing of **Python** codebase to ensure **optimum performance**
- Implemented **Action-based Navigator** system to improve **interruptability** and **responsiveness**
- Enabled integration of codebase in **Unity environment** using **C#**, enabling **parallel development**

Projects

Mel frequency vocal classifier | **Course Project** [Oct '24 - Nov '24]
Programming for Data Science | *Prof. Vinay Kulkarni*

- Designed an SVM model for **MFCC-based singer classification**, leveraging **statistical features** of **lower-order MFCCs** to capture distinctive **timbral qualities**, achieving an **88% F-score**
- Utilized **YouTube APIs** for large-scale dataset creation, extracting features such as **peak-to-peak** amplitude, **MAD**, and **spectral centroid** to capture unique vocal characteristics across samples

LLMs and VLMs | **Research Project** [Jan '25 - Present]

- Reproduced *Can Large Language Models Infer Causation from Correlation*, which uses **PC-Clark** for data creation, benchmarks LLMs on **causal discovery** tasks, and surveyed future work
- Exploring better **causal discovery** methods to enhance LLMs' ability to accurately **infer causation**
- Reviewed research papers on **Vision Transformers**, Vision-Language Models like **CLIP**, **StyLIP**

ASC Course Extractor | **Self Project** [Jul '24]

- Built a **web scraper** using **Selenium**, **BeautifulSoup** and **openpyxl** to extract list of courses of each department in upcoming semester from **ASC** Portal along with its restrictions in a spreadsheet
- **Streamlined** the **course selection** process by **saving over 50% of time**, avoiding slot clashes
- **Integrated** a **grade notifier** using **Twilio** to alert users when grades are updated on the portal

Vision-based Sudoku Solver | **Self Project** [May '24 - Jun '24]

- Developed a **CNN-based** image detection model to identify digits, achieving **99.7% accuracy** utilizing **custom dataset** after extensive image pre-processing using **Contour Detection** techniques
- Implemented **Backtracking** for efficient Sudoku solving, ensuring real-time processing of grids
- Enhanced mathematical understanding of **neural networks**, focusing on **optimization techniques**, **activation functions**, and **back propagation** by implementing a CNN Model from scratch

Universal Testing Machine | **Course Project** [Sep '23 - Oct '23]

Makerspace | Prof. Joseph John, Prof. Krishna Jonnalagadda

- Fulfilled task to break the foam sheet and plot a **force-displacement curve** using gear mechanisms
- Performed displacement measurements using a striped disc and an **infrared sensor** with **pulse width modulation** and current measurements using **Arduino Uno**, calibrating force accordingly

XLR8 Bot Making Competition | **Institute Technical Council** [Aug '23 - Sep '23]

Electronics and Robotics Club, IIT Bombay

- Part of a team of 4 students which competed with **200+** teams to successfully **design**, **build** and **manoeuvre** a **gesture controlled bot** to finish a obstacle filled track in the most efficient manner
- Used **ESP32** as the **micro-controller**, **MPU6050** for obtaining the **spatial position** to interpret hand gestures, **L289N** for **differential speed mechanism** enabling turns and low speeds
- Awarded the title of **Champions** for completing the track **quickest** along with **bonus points**

Positions of Responsibility

Core Team Member | **Cyber Security Community, IIT Bombay** [Apr '24 - Present]

- Underwent **training in multiple cybersecurity domains**, leading to upskilling in **cryptography** and **digital forensics** with a focus on exploiting vulnerabilities in **public-key cryptosystems**
- Actively participated in **Capture the Flag (CTF) competitions** as a part of the **IITBreachers** team, currently ranked in the **Top 10** teams of India and **publish writeups** of solved challenges
- Conducted **month-long training** on **Game Hacking** and **Cryptography** under **Learners' Space**
- Organized a 48-hour intra-college **Capture the Flag (CTF)** event, engaging over **250 participants**

Teaching Assistant | **Computer Programming and Utilization** [Jan '25 - Present]

- Conducting **weekly lab sessions** for a batch of **20+** first-year students, assisting with programming
- Involved in **evaluating and developing** course materials and facilitating **doubt-clearing sessions**

Technical Skills

- **Programming:** C++, Python, Java, Flask, ROS, Bash, SQL, GDB, Git, Sage, MATLAB, Azure
- **Python Libraries:** Numpy, Pandas, Matplotlib, PyTorch, TensorFlow, Pycryptodome, Pwntools

Key Courses Undertaken

- **Mathematics** Calculus, Linear Algebra, Differential Equations, Probability & Random Processes
- **Computer Sci.** Data Structures & Algorithms*, Distributed Optimization & Machine Learning*, Programming for Data Science, Statistical Machine Learning & Data Mining, Computer Programming & Utilization, Machine Learning for Remote Sensing*
- **Aerospace** Control Theory, Thermodynamics & Propulsion, Low Speed Aerodynamics, Solid Mechanics, Aerospace Structural Mechanics

*to be completed by Apr '25

Extracurricular Activities

Technical	• Actively involved in **Competitive Programming** contests on CodeForces(**1600+**) • Bagged **2nd** prize amongst freshers in CodeGames v2, a **programming contest** [2024] • Completed **Probability Primer** and **Time Series Analysis** in Summer of Quant [2024] • Concluded course on Excel and **SQL** for **Big Data** Handling under Learners' Space [2024] • Accomplished all **10** levels of **Abacus** over **5** years, winning many competitions [2017]
Others	• Volunteered as a **NSS mentor** teaching physics to students preparing for **JEE** [2024] • Mentored **team of 4** freshers for **XLR8 bot making** competition fostering skills [2024] • Awarded **Black Belt** in **Shotokan Karate** after training for more than **5** years [2021]