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Mechanical Engineering & CMInDS
Bachelors of Technology
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Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2025	8.00
Intermediate	State Board of Maharashtra	Nirala Junior College	2021	96.17%
Matriculation	CBSE	St. Peter's School	2019	96.20%

Pursuing **Minor degree** in **Artificial Intelligence & Machine Learning** (AI-ML) from **CMInDS**, IIT Bombay

Patents & Intellectual Property

Development of AI techniques to predict CTS and STS of silica fume concrete *(2023)*

Patent Application Number: IN 202331052390	**Date of Application:** August 08, 2023

- **Abstract:** Developed a **novel M5P model** to predict compressive and split tensile strengths of silica fume concrete. The model's performance was rigorously compared to existing techniques, demonstrating superior accuracy and efficiency.
- **Applications**: Construction, materials science, civil engineering, material analysis, concrete structures optimisation

Scholastic Achievements

- Ranked among **top 1 percentile** in JEE Advanced amongst **0.15+ million students** across all over India*(2021)*
- Secured All India Rank in top **0.5 percentile** in JEE Mains amongst **0.93 million** candidates across India*(2021)*

Research Experience

Fair medical summarization | *Ulster University, Northern Ireland* | *Guide: Muskaan Singh (May - Dec 2024)*

- Evaluated features like **biases** and **factuality** of summary of medical notes using **LLMs** and **prompt engineering**
- Utilised **gemini-1.5-flash** to evaluate **factual consistency** and **hallucination** on summaries generated by **GPT4**
- Implemented **Machine Unlearning** to remove biases against certain race, ethincity and age in healthcare in LLM models
- Researched on **FairCLIP**: harnessing fairness in Vision Language Learning in healthcare that results in biases in VLs

Team Lead, The Humanoid Project | *Student Tech team, IIT Bombay* *(Feb 2023 - Mar 2025)*

- Developed RL algorithms like **PPO** and **DDPG** for optimizing robot's kinematic chain and improving joint actuation
- Implemented **Whole-Body Control** techniques to handle dynamic balancing and locomotion based on the open-source **Darwin OP** bot, while incorporating vision and sensor fusion for robust interaction in complex environments
- Integrated **ROS2-based motion planning** with **Nav2** for real-time task execution and precise trajectory following
- Leveraged **LM optimization** and **IKine** for efficient movement and adaptability in unstructured environments

LLMs for Vulnerability Detection | *TU Berlin, Germany* | *Guide: Prof. Stefan Schmid (April 2024 - Present)*

- Researched on **seq2seq LLMs** for **reverse engineering** and **vulnerability detection** in software's binaries.
- Worked on SOTA LLMs models like **DeepSeekCoder-v2** and **GPT** for decompilation and detection of vulnerabilities.
- Collected datasets using web scrapping for CWEs from **MITRE** and publicly available open-source software codes.

RL in Designing of Propellant Oxidisers | *Guide: Prof. Neeraj Kumbhakarna* *(Jan - Dec 2024)*

- Created **26+ novel** chemically feasible molecules by training the model on a **ChEMBL dataset** of **1.5M molecules**
- Developed a two-stage **RL Generative** model for generating novel **oxidiser molecules** with desired properties
- Utilized **SMILES** strings formatting for molecular representation previously used in drug discovery researches
- Programmed **oxygen balance calculator** using **rdkit** to bias molecule generation towards **higher oxygen content**

Professional Experience

Cybersecurity Intern | *TrustLab* | *Guide: Prof. Kameshwari Chebrolu, IIT Bombay* *(May 2023 - Jan 2024)*

Project: PULSE - *Practical and Upbeat Labs for Security Education for aspiring security professionals & students*

- Developed **20+** interactive educational **cybersecurity labs** focused on implementing various topics in cybersecurity, such as **network security**, **web exploitation**, **cryptography**, **reverse engineering** and **malware analysis**
- Created **VLab platform: Docker** container to isolate environments providing safe platform to practice the labs
- Programmed an **auto grader** to automate evaluation of students and integrated **gamified** elements like **CTFs**

NLP Engineer Intern | *Aavaaz.ai* | *Healthcare AI Start-up* *(Feb 2024 - Jul 2024)*

- Implemented **LLM translator** from **Helsinki** for **13 languages** for patient doctor conversations with medical context
- Experimented with multilingual **BERT Mask Language Model (MLM)** layer for contextual correction of translations
- Integrated **Post ASR correction** for automatically correcting errors produced by **Azure ASR** by finetuning BERT

Key Projects

DRL for Intrusion Detection Systems | *EE782 Course Project* | *Guide: Amit Sethi* *(June - Nov 2023)*

- Developed **DQN model** and trained in a simulated **virtual environment** to detect malicious activity in a local network
- Utilised **VAE** for **dimensionality reduction** to trained the model on the VAE's latent space of **NSL-KDD** datasets
- Evaluated system performance in virtual environment resulting in **87%** accuracy in **detecting intrusion** on test data

LLMs for chemical regulatory and RnD Datasets | *SURP* | *Guide: Prof. Rahul Nadar* *(Jan 2023)*

- Developed a custom LLM chatbot that can query a set of internal domain PDFs confidential to a chemical company
- Utilised **langchain's Conversational Retrieval Chain** to create a chatbot trained on chemical regulatory datasets
- Hosted a public, user-friendly, free-to-use **web app** interface on **render** hosting platform to interact with the chatbot

Image Compression Using VAE | *Course Project ME781* | *Guide: Prof. Asim Tiwari* *(June - Nov 2023)*

- Implemented a **VAE-generative model** architecture for image compression using **TensorFlow & keras** in Python
- Trained VAE model on **MNIST dataset** of **7000** images with loss function of **reconstruction loss** plus **KL divergence**
- Prepossessed original 28×28 pixels images, pooling, sigmoid stretching for brightening, then trained on **6:1** train test split
- Resulted in **82%** accuarcy upon evaluation on **Intersection over Union** comparing original and compressed images

Synthetic Dataset Generator | *Course Project DS303* | *Guide: Prof. Biplab Banerjee* *(Feb 2023)*

- Implemented **GAN** architecture to generate artificial samples, trained on **TensorFlow's Fashion MNIST** dataset
- Fine-tuned hyperparameters to enhance the performance of the model trained it on **6000 images** for **200 epochs**
- Minimised Binary Crossentropy loss for the model using **TensorFlow** with **Leaky-ReLU** and **tanh activations**

BERT for Security tasks | *Self Project* | *Open Source Project* *(Mar 2024 - Present)*

- Trained **BERT** model on corpus of **APTnotes**, **Stucco-Data** and **SemEval 8** learning cyberSecurity Knowledge
- Improved downstream tasks NER, Text Classification, Semantic Understand, Q&A in Cyber Security Domain
- Released the **pytorch** version for **public use** created using of the trained model the **Hugging Face library**

Web Crawler | *Winter In Data Science* | *ITC, IIT Bombay* *(Dec 2023)*

- Developed a web scraper from scratch to scrape all the items from a e-commerce while maintaining terms of the company
- Utilised **scrapy, requests** and **beautiful soup** Python libraries to crawl on the website and collect information of items
- Automated extraction and cleaning data removing inconsistencies, errors and unwanted web elements for efficient analysis

Topology optimization | *Course Project ME312* | *Guide: Prof. Avinash Bhardwaj* *(Jan-April 2024)*

- Built **free-to-use** model using **FENICS** and local adaptive thresholding with **comparable results** to **ANSYS**
- Implemented **topolgy optimisation** algorithm for rigid solid structures for efficient material planning and strength
- Programmed the calculation of stress, strain and deformation on load with different material like steel and Aluminium

Technical Skills

Programming	Python, C++, C#, MATLAB, RUST, Bash, LaTeX, CNC G-code, HTML, JavaScript
Software	ROS, Gazebo, RViz, ANSYS Fluent, Git, Solidworks, Abacus, VMs, Unity, Arduino IDE
Libraries	Pytorch, Tensorflow, PyAutoGUI, OpenCV, requests, SciPy, Matplotlib, Scikit-learn

Position of Responsibility

InterIIT contingent member | *Inter IIT Tech Meet 12.0* | *IIT Madras* *(Dec 2023)*

*Participated and **won overall 3rd position** for IIT Bombay in InterIIT Tech Meet 12.0 held at IIT Madras campus*

- Part of **5 membered** team for **Certin Cybersecurity Challenge** to optimise the security auditing process
- Contributed in **automatic detection and reporting** network intrusion using RL minimising human intervention
- Utilised **IFTTT** to integrate github to maintain regular reports and used it for notifying concerned authorities

SOC Mentor | *Institute Technical Council* | *IIT Bombay* *(Jun 2023 - April 2024)*

*Mentored for **3 months** of Summer of Code program launched and managed by the Web and Coding Club, IITB*

- Mentored a group of **8 cybersecurity & AI enthusiasts** for summer long course of **RL in cybersecurity**
- Formulated a 3 month long curriculum covering basics to advance topics in computer networks and cybersecurity
- Guided them on developing **Intrusion detection system** with RL and taught tools like **wireshark & nmap**

Extracurricular Activities

Sports	• Successfully completed a year-long training of **NSO Chess** under **IM** Sharad Tilak. ***(2021-22)*** • Rated **1900+** in bullets format on **Lichess** and **1400+** in bullets format on **chess.com**
Workshops	• Completed **Data Science** Bootcamp **WIDS** (Winter In Data Science), by Analytics Club. • Successfully completed the course of **Introduction to Statistics** by Summer School ***(2023)***
Competitions & Hackathons	• Contested in **SciComp Blitz**, a competitive coding in scientific computation GC ***(Nov 2023)*** • Participated in **Codewars**, a hackathon by WnCC and developed a game script in **Python**
Social	• Selected as **one among eight** student researchers from **KCDH** for the NDMC Vaccine Group