PRAKHAR TRIPATHI | 22MI31019

B.Tech.(Hons.) in MINING ENGINEERING and M.Tech. in MINING ENGINEERING

EDUCATION

Year	Degree/Exam	Institute	CGPA/Marks
2027	M.TECH Dual Degree 5Y	IIT Kharagpur	7.91 / 10
2022	CBSE	Central Academy	91.8%
2020	ICSE	Springer Public School	96.0%

INTERNSHIPS

Policy Optimization | Research Intern | University of South Carolina | Prof. Amitava Das **Jun 2024 - Sep 2024**

Identified fundamental shortcomings and catastrophic forgetting (CF) in Policy Gradient Algorithms like PPO and DPO during LLM Alignment

- Analyzed **23 DPO** and **PPO** papers on LLM alignment, studied architectures, fine-tuning methods and experimental protocols across benchmark datasets
- Uncovered **reward-shift** and **OOD** issues in PPO (inconsistent value estimates, exploration) and divergence in DPO, linking both to catastrophic forgetting
- Conducted SQuAD v2 **QA** experiments with **SFT** and **HH-RLHF** alignment, quantified forgetting and observed iterative fine-tuning over DPO mitigating CF

Google Ads Automation and Optimization | Data Science Intern | 4XDigital.ai **May 2024 - Jul 2024**

Developed AdAPT (Ads Automation and Performance Tuning) product on Google Ads for generating suggestions based on demographic data

- Yielded an **18%** uplift in **CTR** across **8** campaigns by deploying **Google Ads** optimization pipelines with A/B testing and Bayesian hyperparameter tuning
- Developed a predictive modeling framework for **Google Ads**, enhancing **ROAS** by **25%** via Scikit-learn and XGBoost integration with SHAP interpretability
- Applied **KMeans** and DBSCAN on **5K** user records, achieving **97.6%** audience segmentation confidence by clustering demographics with **GAQL** and Pandas

COMPETITION/CONFERENCE

Quadrotor with Single Motor Failure | ideaForge | Inter-IIT Tech Meet 13.0, IIT Bombay (Gold) **Oct 2024 - Dec 2024**

Developed a real-time Fault Detection and Isolation (FDI) system for UAVs to autonomously detect and isolate mid-flight single motor failures

- Devised **two** PX4 firmware failure detection and isolation algorithms, reducing IMU noise via **Extended Kalman Filter** and real-time ROS pattern analysis
- Engineered a ROS-integrated PX4 analysis pipeline with **IMU** sensor fusion, achieving **85.7%** failure detection accuracy with a **50-72** ms end-to-end latency
- Validated **100%** fault isolation across **160 Gazebo** simulations including flipping and **336** hardware tests, built an SPDT-based PWM fault injection module

Forecasting Metallic Glass Forming Potential | Excavate | MME, IIT Kharagpur (Gold) **Mar 2024 - Apr 2024**

Predicted critical casting diameter (Dmax) i.e. glass forming ability of Metallic Glass alloys using thermodynamic features and alloy composition

- Structured scikit-learn regression pipelines with **7** thermodynamic features to predict Dmax, processing **441** alloy compositions in Python (Pandas, NumPy)
- Streamlined **15** temperature-dependent and **3** compositional features using RFE and F-score for feature selection lifting Dmax prediction accuracy by **20%**
- Instantiated **Extra Trees** Regression in Python with model performance R^2 score of **0.8667** with **5-fold** CV and outclassing Random Forest baselines by **15%**

IRoC-U | ISRO Robotics Challenge - URSC | IIT Kharagpur | Prof. P.K. Mishra **Jan 2025 - Mar 2025**

Implemented safe landing spot detection for UAVs in a GPS-denied Martian environment by integrating depth sensing and optical flow sensors

- Fused **ToF** depth sensing with **optical-flow** enabling depth-aware velocity control to deliver **±5** cm hover stability and GPS-free localization on Jetson Nano
- Implemented a real-time **CV** pipeline - Gaussian smoothing, Sobel edges, **10** layer hierarchical patching, distance transform classifying safe landing zones
- Configured a low-latency edge-inference pipeline on Jetson Nano, integrating perception and guidance modules to deliver real-time safe-landing decisions

PROJECTS

AI Travel Agent Planner **Jun 2025 - Jul 2025**

Developed a LangGraph powered travel planning agent with a FastAPI backend and Streamlit frontend for generating multiday itineraries

- Architected a modular graph-based reasoning pipeline using **LangGraph**, mapping user intents (itinerary builder, budget estimator, etc) to subtask nodes
- Implemented a **FastAPI** service with a Pydantic endpoint in **LLMOps** that instantiates the graph, invokes the LLM provider, and returns JSON responses
- Built a **Streamlit** UI featuring a centered chat interface, posting user requests to the backend and rendering day-wise activities and budget in markdown

Patent Trend Analysis Platform using RAG Pipeline **Jun 2025 - Jul 2025**

Developed a scalable patent analytics system with SerpAPI ingestion, containerized embeddings, vector search, and multi-agent integration

- Constructed a real-time patent ingestion pipeline with **SerpAPI**, and chunking and custom splitting documents for downstream embedding and retrieval
- Containerized an **Ollama** embedding service in Docker and integrated OpenSearch **Vector DB** with hybrid keyword semantic search and **FAISS** indexing
- Orchestrated a multiagent workflow using **CrewAI** and **LangChain** defining roles via YAML definitions to retrieve, summarize, and forecast patent trends

Road Accident Severity Prediction **Dec 2024 - Jan 2025**

Built an end-to-end ML classification pipeline to predict accident severity using feature engineering, PCA and ensemble models on 300 records

- Derived **8** domain-specific risk metrics and applied **Fisher Score + PCA** (**3** components) to reduce **44** variables to **12** features, improving model efficiency
- Provisioned **10K**-trial Optuna hyperparameter tuning for XGBoost and RF, achieving **86.7%** accuracy, then ensembled **3 MLPs** (6-228-276) to achieve **95%**
- Performed explainable AI analysis with **SHAP** to quantify feature importance (±0.03–0.32), identifying vehicle type (F-Score = **6.16**) as a high-risk indicator

COURSEWORK INFORMATION

University: Advanced Calculus | Linear Algebra Numerical and Complex Analysis | Probability and Statistics I Reliability Engineering | Mineral Economics
MOOCs: Machine Learning Specialization(Coursera) | CS229 | Deep Learning Specialization(Coursera) | Data Structures and Algorithms | Prompt Design

SKILLS AND EXPERTISE

Languages/Libraries: Python | C++ | LaTeX | Arduino | HTML | SQL | Java | C | CSS | Matplotlib | OpenCV | Scikit-Learn | TensorFlow | Keras | PyTorch |
Frameworks/Softwares: GAQL | GitHub | Docker | Power BI | ROS | Gazebo | Photoshop | LangGraph | FastAPI | Streamlit | CrewAI | SerpAPI | PX4 |

POSITIONS OF RESPONSIBILITY

Technology Robotix Society | IIT Kharagpur | Governor **Aug 2024 - Jul 2025**

- Spearheaded execution of **8 events**, led a **52-member** cross-functional team and authorized a budget of **INR 3.19L**; coordinated stakeholder engagement
- Mentored **56** students in CV, AR, and ROS during Winter School of AI and robotics and **four** teams to **gold** medals at an inter-school robotics competition

AWARDS AND ACHIEVEMENTS

- Secured **All India Ranks: 235** (GATE 2024 MN, GATE Score **567), 4797** in KVPY SX 2022, **5549** (JEE Mains 2022, **99.39** percentile), **9404** (JEE Advanced 2022)
- Received **Gold** in **Inter-IIT Tech Meet 13.0**, **Gold** at Excavate, a Data Science competition and **National Finalist** and **Special Mention** in Megalith, IIT KGP
- Headed a team of **4 players** and represented my **district** in **Under-16 Chess** at the State Level Chess competition 2020 and was awarded the **Silver Prize**
- Selected for the **Google Upskilling Launchpad Program** from a competitive applicant pool by clearing two coding rounds and earning program rewards

!Self declared by the student, CDC could not verify the relevant documents