Personal Overview

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I am currently a recent graduate student of the Indian Institute of Technology (IIT) Kharagpur, pursued a dual degree (B.Tech & M.Tech) in Civil Engineering with a specialization in Trans portation Engineering, along with a minor in Computer Science. My early involvement in math ematics competitions, including the Regional Mathematical Olympiad, fostered a deep interest in systematic reasoning and problem-solving. Engaging with diverse algorithmic paradigms in my freshman year further solidified my belief that even the most complex challenges can be approached through structured computational methods.

My initial research efforts centered on predicting landslides using Logistic Regression, Random Forest, AdaBoost, and SVM, where I achieved a prediction accuracy of 97.37%. This work not only improved my understanding of machine learning techniques but also led me to incorporate a factor-of-safety term considering multiple environmental features. Building on this founda tion, I expanded my skillset through parallel programming projects such as ESCOIN (Efficient Sparse Convolutional Neural Network Inference on GPUs). In this project, I implemented an al gorithm from Xuhao Chen's research to optimize computations within neural network pipelines. By leveraging the ESCORT algorithm for sparse CNNs and refining data access patterns, I sig nificantly improved the inference speed of AlexNet by a factor of 1.6x over CUBLAS. Another project demonstrated my capacity for large-scale simulation and high-performance computing, where I employed OpenMP to simulate the trajectories of 1000 particles over 720,000 iterations on the Param Shakti supercomputer, eventually visualizing the results in three dimensions.

My academic journey has allowed me to work under esteemed mentors in diverse research environments. At the Indian Institute of Management Ahmedabad, under the guidance of Prof. Indranil Bose, I carried out sentiment analysis on Google Play Store apps. By employing tools such as Beautiful Soup, Google Playstore API, LDA for topic modeling, and VADER for sentiment analysis, I uncovered nuanced patterns in app descriptions and user reviews. At the Indian School of Business, I collaborated with Prof. Prasanna Tantri to analyze daily returns of Tata Motors from 1996 to 2019, examining the influence of momentum, size, value, and market risk premiums using the CAPM and Fama-French models. Through the application of statistical methods including Breusch-Pagan LM, Breusch-Godfrey, and VIF tests, I validated model assumptions and gained deeper insights into financial modeling.

Under the supervision of Prof. Soumyajit Dey at IIT Kharagpur, I developed a toolflow built on Omnet++ and SUMO to simulate platoons of connected vehicles in the presence of adversarial conditions. This integrated system incorporated a rogue vehicle model that introduced false data into the system states, enabling the testing of control-theoretic attack detection mechanisms.

The use of a Z3 SMT solver allowed the synthesis of successful attack vectors, providing a robust framework for designing and verifying security protocols in connected vehicle setups. My endeavors in this domain culminated in participation at the KPIT Sparkle competition, where I was selected as one of the Top 24 finalists across India.

Expanding on the theme of autonomous vehicle security and reliability, I worked again under Prof. Dey to develop an AI-based anomaly detection system aimed at enhancing the robustness of autonomous driving systems. By integrating multisensory inputs—leveraging CarMaker's Video Interface Box and Hardware-in-the-Loop testing—and designing attack scenarios focused on communication protocols, I successfully developed mitigation strategies that leveraged GPU based perception pipelines. This approach effectively rejected false data injections and improved the system's resilience to adversarial conditions.

My research interests extend beyond engineering and optimization challenges. Inspired by inclusive innovation, I ventured into the realm of AI-driven fashion. Using a diverse technolog ical stack—spanning Beautiful Soup, Keras, NumPy, OpenCV, Pandas, Python, Scikit-learn, SciPy, Selenium, Streamlit, and TensorFlow—I assembled an AI-based fashion generator that accommodates various body types and styles. Curating datasets to avoid biases and fine-tuning complex models proved challenging, yet these efforts underscored the importance of equity and representation in AI systems and reaffirmed my conviction that technology can empower rather than exclude.

My professional experiences also include a research internship at Stanford University under the mentorship of Prof. Pascal Geldsetzer. In this project, I explored automated machine learning for geotagged data to predict Maternal and Child Health (MCH) indicators in low-income countries. Surpassing previous benchmarks by a margin that improved MCRMSE confidence scores by over 50%, I enhanced feature selection through Random Forest Regressor and PCA, and optimized forecasting using MLP with LSTM. This work demonstrated my capacity to handle large-scale datasets, apply sophisticated modeling techniques, and adapt to the nuanced challenges posed by real-world data.

In recognition of my work and commitment, I have been awarded the Chanakya Fellowship 2024 by AI4CPS, acknowledging excellence in artificial intelligence and cyber-physical systems research. This honor motivates me to delve deeper into interdisciplinary research, particularly at the intersection of Control Systems, Autonomous Vehicles, Security, Machine Learning, Deep Learning, and Large Language Models (LLMs).

As I move forward, I remain eager to contribute to cutting-edge research endeavors and col laborate with leading scholars and practitioners. My academic and research experiences have not only honed my technical capabilities but also nurtured a deep understanding of the societal implications and transformative potential of technology. I am ready to embrace new challenges, advance my understanding of emerging methodologies, and engage with innovative projects that shape the future of intelligent, secure, and inclusive systems.