Academic Statement of Purpose

As a young boy in Delhi, I stood mesmerized before my first computer, watching in awe as my father's garment business inventory transformed from handwritten ledgers into digital spreadsheets. That moment of digital alchemy sparked a passion that has shaped my academic and professional journey. Years later, as a computer science student, I channeled this passion into a tangible product by developing an e-commerce clothing store and Content Management System dashboard. This platform streamlined inventory management and order processing while expanding the business's reach to a broader online audience, significantly increasing sales and operational efficiency. Witnessing the positive impact of my work on the family business was a pivotal moment, solidifying my desire to harness technology for real-world applications. This journey from wide-eyed observer to innovative creator epitomizes my passion for computer science and my drive to harness technology for real-world impact, propelling me towards the Master of Science in Computer Science program at Purdue University.

My professional objective is to become a leading developer and innovator in software engineering, with a specific focus on the synergy between software systems and artificial intelligence. I aspire to work as a Machine Learning engineer or software developer on industrial and SaaS-based projects that positively impact our global society. Pursuing a Master's degree at Purdue University will equip me with the advanced knowledge, research skills, and industry connections necessary to achieve these goals. My research interests lie at the intersection of software engineering, artificial intelligence, and system reliability. I am particularly fascinated by software dependability and security, AI-driven software engineering, generative AI and large language models, and computer vision applications. My recent work on "Optimized Adversarial Defense: Combating Adversarial Attack with Denoising Autoencoders and Ensemble Learning," presented at the International Conference on Emerging Applications of Artificial Intelligence, Machine Learning and Cybersecurity (ICAMC-2024), reflects my keen interest in enhancing the security and reliability of AI systems. Additionally, my ongoing research on 'machine unlearning' showcases my commitment to addressing emerging challenges in AI ethics and data privacy.

My academic and professional experiences have provided me with a strong foundation for graduate-level research. Graduating with a cumulative GPA of 9.23/10.0 in Computer Science and Engineering from Guru Gobind Singh Indraprastha University demonstrates my strong academic background and dedication to learning. My rigorous undergraduate coursework included key computer science subjects such as Data Structures, Algorithms Design and Analysis, Compiler Design, Operating Systems, Theory of Computation, and Object-Oriented Programming, which have given me a solid theoretical and practical foundation in the field. This comprehensive curriculum, combined with my research experience, has honed my analytical skills and ability to contribute to academic discourse. My research journey resulted in two published papers: "Dissecting Adversarial Attacks: Comparative Analysis of Adversarial Perturbation Effects on Pre-Trained Deep Learning Models," which explored the critical area of AI security, and "Deep Learning Based Approach for Thyroid Dysfunction Prediction," which demonstrated the potential of AI in healthcare diagnostics. A pivotal experience in shaping my research interests was my summer research internship at IIIT Delhi, where I worked under the supervision of Dr Anubha Gupta in the Signal Processing and Biomedical Imaging (SBI) Lab. During this internship, I contributed to the CytoUI project, developing advanced deep-learning algorithms and interactive web widgets for flow cytometry data analysis. This project, crucial for immunology and cancer research, allows researchers to scrutinize individual cells based on their properties. This experience not only further honed my research skills but also ignited my passion for applying AI to solve real-world problems in critical domains like healthcare, reinforcing my commitment to developing impactful AI solutions.

Industrial Internship experiences have been instrumental in providing me with hands-on experience in developing AI-based web applications, implementing predictive modeling techniques, and working with cutting-edge technologies like LLMs and computer vision. During my Software Engineering Internship at Kubikk Cloud Technologies, I developed a Generative AI-based SaaS application for Kubernetes metrics data summarization and insights, leveraging frameworks like Next.js and FastAPI. This experience aligns closely with Purdue's focus on the practical application of advanced technologies. Working in a startup environment, I collaborated directly with founders and department heads, demonstrating my ability to adapt quickly, take on cross-functional roles, and contribute effectively in a fast-paced,

innovative setting. As a Machine Learning Intern at Vector3 Digital Tech, I applied advanced ML algorithms for computer vision tasks, reducing processing time by 40%, and showcasing my ability to optimize and improve existing systems. These experiences honed my technical skills and also developed my capacity to work seamlessly in diverse teams, tackle multifaceted challenges, and thrive in dynamic, entrepreneurial environments. Leading projects like DebrisDetectAI, where I developed AI solutions for construction and demolition waste debris detection and segmentation using advanced models like YOLO v8, v5, and Segment Anything Model (SAM), showcases my ability to apply cutting-edge AI techniques to real-world problems. As Vice-Chairperson of the GeeksForGeeks student chapter in my college, I've cultivated leadership and team-building abilities crucial for success in graduate-level collaborative research.

Purdue University's Computer Science program stands out for its interdisciplinary approach and focus on emerging technologies. The work of several faculty members aligns closely with my research interests. Professor Lin Tan's research on software-AI synergy and automated vulnerability repair resonates with my work on adversarial defense and my interest in enhancing software dependability. Her recent work on improving the robustness of deep learning models against adversarial attacks particularly excites me, and I believe my background in adversarial defense mechanisms could contribute meaningfully to this research. Professor Yongle Zhang's work on distributed systems and cloud computing aligns with my interest in developing scalable AI solutions. His research on improving the reliability and performance of large-scale systems is particularly relevant to my goals of creating robust AI-driven applications. I'm especially intrigued by his recent publications on optimizing distributed machine learning systems, an area where I hope to contribute and expand my expertise. Professor H.E. Dunsmore's expertise in software engineering and his focus on software metrics and quality assurance would provide valuable insights into developing reliable and efficient software systems. His work on agile methodologies aligns with my experience in fast-paced development environments during my internships, and I'm eager to explore how these methodologies can be adapted for AI-driven software development. Professor Raymond Yeh's contributions to software engineering and his emphasis on integrating AI techniques into software development processes are particularly intriguing. His work could provide a strong foundation for my aspirations to innovate in AI-driven software engineering. I'm particularly interested in contributing to his research on automated code generation and repair using AI techniques. The department's strong emphasis on both theoretical foundations and practical applications in areas like AI, machine learning, and software engineering provides the ideal environment for me to grow as a researcher and innovator.

In conclusion, the MS in Computer Science program at Purdue University represents the perfect next step in my academic and professional journey. I am excited about the prospect of contributing to groundbreaking research, collaborating with esteemed faculty and peers, and further developing my skills in this dynamic field. I am eager to push the boundaries of what's possible in computer science, turning today's challenges into tomorrow's innovations. I am confident that my relevant background positions me to make meaningful contributions to ongoing research projects at Purdue. The university's commitment to innovation and its world-class facilities will provide the perfect environment for me to pursue my research interests and achieve my goal of becoming a leading technology professional.