

# Cover Letter

of Prasanna Paithankar

---

I am Prasanna Paithankar, a pre-final year undergraduate student at the Department of Computer Science and Engineering, **Indian Institute of Technology (IIT) Kharagpur**, India, with a keen interest in solving problems with research acumen. I am actively looking towards opportunities in which I could solve real life problems. The following will describe my research and academic involvement.

I am well-versed in Computer Science fundamentals (theoretical as well as applications), which is reflected in my work and academic CGPA of **9.15/10**, putting me in the top percentile of students in my institute. I have covered core concepts of Operating Systems, Networks, Databases and Compilers along with their rigorous assignments and have taken up multiple elective courses, including a course on **Statistical Learning Theory** which led me to explore machine learning further with a different taste. I started reading more about the theoretical framework of learning and its implications, along with a sub-aspect Causal Inference which I found intriguing. I am currently attending courses on **Graph Machine Learning** and **Convex Optimization** to further my understanding of the field. Another course on Information & Systems Security drew me towards Capture the Flag exercises. I also created a strong base through courses like Algorithms-II which covered various graph algorithms to parameterized ones. While the course Computer Organization and Architecture has made a clear understanding of how each instruction and process runs at a bit level, this was reinforced by creating a 32-bit RISC processor (which runs on MIPS like ISA) on an **FPGA** using Verilog. I also took up an elective to study Photonic Quantum Information Technologies to explore broader domains.

My current Bachelor's Thesis under the supervision of **Prof. Partha P. Chakraborty**. We are broadly solving inverse problems (e.g. getting the photonic component geometry given the desired electromagnetic response as the input). These problems are notoriously difficult but are of high industrial importance. The primary focus is on optimizing the computational time using DL architectures (PINNs and more novel pipelines) and understanding the inferences.

Apart from academics, I am profoundly involved in research trying to use computers to tackle a few problems that physicists face. At **Fiber Optics, Nano & Quantum Photonics Group**, I am currently working on the implementation of innovative **RNGs** and extractors. Furthermore, I have been able to realise functional hardware for generating true random numbers from chaotic and photonic sources. Working here with FONQP, I have developed an extensive theoretical understanding of **randomness extractors** and their characterisation and also DL methods. Through the ongoing work at FONQP, I have been able to produce work that has been presented at international conferences like COPaQ 2022 and FiOLS 2023. Under the group's guidance, I have also contributed to a review article published in IJPAP.

With **the Autonomous Ground Vehicles (AGV.AI)** Research Group at my institute, I have worked on the implementation of navigation stack for Unmanned Ground Vehicles employing vision and **RL-based planning**. Furthermore, I have realised functional hardware for state-of-charge estimation using Adaptive Extended Kalman Filter. Working here at AGV.AI I have developed an extensive understanding of **ROS1/ROS2** and of reinforcement learning techniques and their practical implementation using a variety of frameworks and different autonomous prototype robots. With my work at AGV.AI, as the planning and controls team lead, I was also responsible for working with the trajectory prediction team for the F1 Tenth ICRA 2023.

I was also grateful to represent my institute in the **Inter-IIT Tech 11.0** Event, which led to a solo Gold. We were tasked with super-resolution lunar images from Chandrayaan-2 using DL methods. We accomplished a novel GAN based architecture called Lunar T-GAN with Turing test-based adversaries to ensure accurate reconstruction of craters and hills. Along with creating architecture, I was looking after handling big data (each image was more than 25 GB), building a pipeline for the same and then stitching all the super-resolved images into an atlas.

Much recently, I have been a part of a very small group of students trying to spread awareness and exposure towards **high-performance computing** within the institute and will be conducting workshops and hackathons for the same in the upcoming semesters. Furthermore, I have been dwelling on systems programming in **Rust** for the past few months.

Given my analytical interests and willingness to apply them to real-world problems, I would be excited to explore relevant internship roles. These opportunities would be the best way for me to enrich my knowledge and gain first-hand experience in the industry.

---