Cover Letter

Dear Dr. Punit Rathore,

I am writing to express my keen interest in the Project Associate position under your mentorship at **IISc Bangalore**.

My MSc in Physics from **IIT Madras**, consistently ranked as India's top institution by **NIRF**, provided me with a strong foundation in logical and analytical thinking. Coursework in *Advanced Mathematical Physics* and *Advanced Quantum Computation and Information* equipped me with a deep understanding of mathematical modeling and theoretical physics principles, fostering a rigorous approach to problem-solving.

I developed **PaperMatch**, a sophisticated tool for recommending scientific articles based on semantic similarity. This project involved gathering metadata from arXiv API, generating vector embeddings using pre-trained models on GPU, and utilizing Milvus as a vector database to query abstract embeddings. I used Gradio to build the WebUI and then self-hosted the entire application, ensuring a seamless user experience.

I created **RedactNLP**, a redaction tool using NLP, to ensure data privacy by removing Personally Identifiable Information from PDF sources. The solution uses OCR to extract text from PDFs, applies Token Classification to identify sensitive data, and securely redacts PII. It integrates technologies like EasyOCR, and Hugging Face's NER models, showcasing my ability to create robust solutions for privacy challenges.

In another project, I leveraged my expertise in EEG analysis and Graph Theory to develop novel network construction methods and classification models. This research aimed to differentiate Alzheimer's disease in a cohort of 88 participants. My innovative approach achieved classification accuracies exceeding 84%, surpassing the limitations of dataset-dependent algorithms such as k-means clustering. I open sourced my library at **BrainConnectML**, which extensively uses multiprocessing to cut computation time significantly.

My passion for understanding complex systems led me to investigate brain network synchronization using a modified Kuramoto Model. This project provided insights into brain function and equipped me with advanced modeling techniques applicable across scientific domain. I am writing a manuscript based on these results.

At **IISER Tirupati**, I thrived in an interdisciplinary research group, collaborating with physicists, biologists, geologists, and network scientists. I leveraged my technical skills to assist colleagues with computational challenges and developed the ability to communicate complex concepts effectively to diverse audiences — a skill that was further honed by teaching large groups on **Unacademy**, India's largest online learning app.

Beyond academia, I've gained expertise in Linux, Infrastructure Management, and Open-Source Software. My passion for continuous learning is reflected in pursuits like multilingual proficiency and coffee brewing. I am also vocal about mental health, advocating for its importance alongside my professional and personal growth.

In conclusion, my background in theoretical physics and mathematics, along with my experience in applying machine learning to complex systems, positions me well for your Project Associate position. My passion for inter- disciplinary research and belief in AI's transformative potential makes me a strong candidate. I am eager to contribute to and learn from your expertise to advance my knowledge and research goals.

Thank you for your consideration. I look forward to discussing my application further.

Sincerely,
Mitanshu Sukhwani