Sudhanshu Kumar, Final Year Masters, Earth System Science & Technology, IIT Kharagpur

Statement of purpose

I come from a small farming community in the Jamui district of Bihar, India. Although I was born in a family with limited resources and four siblings, my parents strived to provide me with the best primary and secondary education available. During my teenage years, I left my village to avail my schooling in a nearby city. There, I graduated with my 10th-grade board examinations at the top of my class. With a strong inclination towards science and a desire to pursue engineering, I wanted to prepare for the highly competitive (selection rate: 0.01%) Joint Entrance Examination (JEE) which is the only route to gain admission into the coveted Indian Institutes of Technology (IITs) for undergraduate education.

After two years of preparations in addition to my regular higher secondary (10+2) schooling, I finally got admission into the **Indian Institute of Technology (IIT) BHU Varanasi** in the Department of Mechanical Engineering. My consistent academic performance along with leadership skills gained while serving at the Aeromodelling club helped me in being selected for an internship at the Kota Thermal Super Power Plant. My project involved calculating thermal efficiency, major heat losses, and pollution caused by the plant.

Working there I realized the significance of the big energy dilemma in India. Although coal is abundant in India and offers a cheap and affordable method to generate electricity for the massive Indian population, the environmental impact of burning coal is overwhelming. Back in my village, we are now facing daily smog in winter with high particulate matter concentrations in the air. In summers, extreme temperatures are leading to droughts and destroying crops. I understood that given the ever-growing electricity demand, transition to cleaner energies is going to be a prolonged process in India. In the meantime, for sustainable living, better understanding and managing our planet is the only option to the ever-changing climate. Through this experience, the seeds for a career in the interface of climate change were planted in my mind.

In 2020, I qualified for the national level Graduate Aptitude Test in Engineering and gained admission into the graduate school at the **Centre for Oceans, Rivers, Atmosphere, and Land-sciences** at the **Indian Institute of Technology (IIT) Kharagpur**. Along with excellent academic performance, I also hold the position of departmental Post-Graduate Representative, leading the student community of my department.

Despite pandemic-related restrictions, I have managed to complete a three and half months long internship at the **National Centre for Earth Science Studies (NCESS)** under the Ministry of Earth Sciences, Government of India. It is projected that by 2050 more than half of the global population will live in regions that suffer water scarcity at least once a month each year [1]. This highlights the need for better management of water resources. Recent literature [2] has shown that by combining satellite hydrology with better computing resources and techniques, machine learning can serve as a useful tool in water resources modeling. However, we were not able to find any detailed study in the literature on the performance evaluation of machine learning algorithms for streamflow prediction in southern India. To address this research gap, I worked closely with Dr. Rajat Sharma (Scientist at NCESS) on the research topic '**Streamflow prediction using Machine Learning Models in selected rivers of Southern India**' (to be submitted for peer-review at the Journal of Natural Hazards). We aimed to find a correlation between the rainfall data captured at multiple locations in the watershed and the streamflow output measured at the discharge gauge station using machine learning. We applied three algorithms, **Support Vector Regression, Random Forest, and Long-Short Term Memory** for streamflow modeling at monthly and daily time scales of weather (rainfall, minimum and maximum temperatures) data for three river basins (Suvarna, Aghanashini, and Kuleru). Performance of machine learning models was evaluated using Nash-Sutcliffe Efficiency (NSE), Root Mean Square Error (RMSE), Pearson Correlation Coefficient (R), and Mean Absolute Error (MAE). Our results indicated that all machine learning models had an NSE of greater than 60% for the Suvarna and Aghanashini rivers on a daily time scale and greater than 90% on a monthly time scale. However, these models were unable to capture the trend for the Kuleru river due to the disturbance in data caused by streamflow obstruction created by the large dams.

In summary, I believe the combined experiences of my internships, research works, and job as an Academic Officer have inculcated strong work ethics in me. I have served a variety of roles ranging from organization management to academic research. I am a resourceful person trying to find opportunities to constantly upgrade my skills. Despite pandemic-related restrictions, I have still managed to complete three research projects all of which have led to journal publications. I believe I will be able to contribute to this field with my programming, large data analysis, and machine learning skills gained through my previous projects [3] and can successfully conduct the challenging work of a Ph.D. student.

REFERENCES

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