Statement of Purpose

I am Abdus Salam Azad. My research interests broadly span the field of Machine Learning (ML) with an emphasis on Natural Language Understanding(NLU). I am also interested in Information Retrieval and its intersection with NLU.

I got my first taste of research in my junior year. We analyzed 40 years of historical weather data from different regions of Bangladesh to identify the trends in temperature and rainfall. We used a wide range of data analysis techniques, including clustering such as K-means, non-parametric trend tests such as Mann-Kendall and Sen's slope estimator, etc. We found a number of interesting insights, such as, over the years the maximum temperature of our country has significantly increased during June to November. In contrast, there have been no significant changes in rainfall. The results also indicate that the eastern part of the country has faced more changes in temperature than its western part. The findings of the study were published as a book chapter by Springer.

For my undergraduate thesis, I worked on Genetic Algorithms(GA) to solve MDPVRP— a lesser studied variant of the well-known Vehicle Routing Problem (VRP), which extends VRP with multiple depots and periods. I was supervised by Prof. Md. Monirul Islam, who has been working on GAs for the past 20 years. Maintaining the population diversity is crucial for the performance of GAs. For this purpose, the existing GA approaches for VRPs incorporate a diversity measure with the solutions' fitness, which can be computationally expensive. Our proposed method aimed at maintaining the population diversity solely by the use of selection operators. We also proposed a crossover operator by generalizing the Edge Recombination Operator—a widely used crossover operator for the Travelling Salesman Problem. Finally, we proposed a new formulation for MDPVRP which allows interdependent operations among depots to provide cheaper solutions at the cost of a bigger search space. Our work was acknowledged as the winner in the yearly thesis poster competition organized by CSE, BUET (1st out of 57 submissions).

In my Master's thesis, I continued my work with Prof. Islam on our proposed MDPVRP formulation. This time, we developed a Memetic Algorithm (MA)—a hybrid GA with a local improvement component. The existing MA methods focus extensively on greediness, which typically leads them to a premature convergence and require additional techniques such as population restart for further progress. Our proposed method introduces a stochastic local improvement component to address this problem. The component focuses simultaneously on both greediness and randomness to maintain the balance between exploration and exploitation, which consequently helps to avoid a premature convergence. We also proposed a heuristic, partly greedy and partly stochastic, to construct the initial solutions. Extensive experiments on the benchmark problems revealed significant improvements over the state-of-the-art methods. This work has been accepted in the IEEE Transactions on Cybernetics.

I have taken a number of courses related to ML during my undergrad and masters, including Artificial Intelligence, Machine Learning, Pattern Recognition, Advanced Image Processing, and Data Mining. I have also participated in MOOCs on Machine Learning (Coursera) and Deep Learning (Udacity). As a lecturer in CSE, BUET, I have conducted

Artificial Intelligence and Machine Learning lab courses. Besides, I am also instructing an applied machine learning course. The course has around 20 graduates from five institutions. Such experiences have allowed me to study machine learning techniques in depth.

My current research projects involve citation recommendation and machine/reading comprehension. In citation recommendation, the task is to recommend the most relevant works from the literature given a research idea or, abstract as a query. A paper may cite another paper for a number of different reasons, such as having similarity in the applied methodology, problem definition, and/or datasets used for evaluation. To incorporate such multidimensional similarity we are developing a multi-objective optimization based Learning to Rank algorithm. This research is jointly collaborated by BUET and the University of Illinois Urbana-Champaign. In my other project, we have modeled the machine comprehension problem (answering questions based on passages) as a path-finding game in a passage graph, where an agent traverses the graph to locate the answer upon given a question. The graph is constructed from the passage utilizing word embeddings, parse trees, and coreference resolution. We are working on a reinforcement learning method to train the agent.

I consider the Department of Computer Science at the University of California, Los Angeles (UCLA) a suitable place to pursue my Ph.D., as there are a number of active research projects where I believe I will be able to contribute. I am particularly motivated by Prof. Kai-Wei Chang's current research directions, such as extracting knowledge from large unstructured text for solving problems including question answering or, learning and inference with complex structures. My current projects (i.e., machine comprehension and citation recommendation) align with these directions. These projects also align with Prof. Junghoo Cho's research theme—discovering interesting patterns from real-world data for different application domains. The citation recommendation project also matches with Prof. Yizhou Sun's research interests. As part of her research on recommendation via the Information Networks, she also worked on citation recommendation (CIKM '14). Her approach retrieves relevant papers based on a number of meta-paths involving combinations of keywords, authors, citations, and venues. We measure the relevances from a different point of view, such as relevance in terms of problem nature, solution approach, datasets, etc. I am also interested in Prof. Sun's current research on mining data from heterogeneous domains with social factors. Finally, I believe an opportunity to pursue my Ph.D. in the prestigious department of Computer Science at UCLA will enable me to conduct impactful research and help me to advance towards a research-oriented career in academia.