Research Proposal

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Introduction

To predict the future for the field of technology is merely an impossible task. What will happen a hundred years from now will be a quixotic task to imagine. But from the prospect of present technological dynamics, I can assume that the next decades will be the time of advancing Machine Learning in the field of Computer Science and as well as Genetic Engineering in Biology. I am a Computer Science graduate willing to pursue a Ph.D. in Computer Science or related fields, fascinated with the upcoming advancements in this field of technology. It will be an adventure to be a part of this revolution in the field of Computer Science and learn its theoretical and practical aspects alongside. I believe, pursuing a Ph.D. is the best option to be a part of this revolution directly.

Education

In the four years of my undergrad education, I have completed three notable projects. The first project was Applet Scientific Calculator using Java programming language. It has all the computing abilities to calculate several scientific operations like Big Multiplications, Big Modular Operations, and Big Factorials, etc. Also, it can plot any quadratic equations in 2D coordinates. It was based on various number theory algorithms that I have learned throughout the first year of my programming courses and the Discrete Mathematics course.

My second project was based on Online Automatic Question Answering using Semantic Parsing and Lambda Calculus. It was my first project based on some reading of research papers on Natural Language Processing. This project would take any questions and parse them semantically, then answer the question based on learning experience as well as knowledge base database implemented in the Python programming language.

My third project was on Anomaly Detection of an Algorithm's output result using unsupervised machine learning approaches. It was also implemented via Python. It could predict which steps of an algorithm have an anomaly from the code itself.

In the early years of my undergraduate studies, I mainly focused on building a strong foundation on basic Data Structures and Algorithms. I solved various Competitive Programming problems on various online-judge sites such as LightOJ, UVa Online Judge, and later on CodeForces. I took part in several National Collegiate Programming Contests for the first three consecutive years of my undergrad education. In the final year though, I concentrated solely on my undergrad research. The research is based on the performance analysis of various supervised machine learning algorithms for the text classification process in Natural Language Processing. This research later got accepted in the 19th International Conference on Computer, Information, and Technology, 2016, and got 23 citations so far according to google scholar.

Research Experience

My research interest is related to Machine Learning and its theoretical and mathematical model as well as the advancement to its practical applications. To be specific, I mainly focus on Computer Vision and Generative Adversarial Networks. I am interested to take part in research that involves building any sophisticated Machine Learning model and associated applications with the understanding of its theoretical background. In this aspect, I have four publications in various International Conference Proceedings so far. These papers are published in the IEEE Xplore digital library, Springer, and also indexed by Scopus.

To build a strong foundation on Machine Learning, I completed some MOOCs (Massive Open Online Courses) entitled "Machine Learning" by Dr. Andrew Ng and the specialization of "Deep Learning" in Coursera. These courses helped me a lot to gain some strong background concepts of Deep Learning and led to other sources for a better and solid understanding of the field. I found some good practical resources to learn deeper into the topics and some state-of-the-art deep learning classification algorithms implementation like InceptionV3 model, Xception model, Vision Transformer, U-net, V-net, etc.

Currently, I'm working on several other interesting projects based on this practical knowledge such as detecting Complex Bengali and Chinese Handwriting Recognition using the Deep Learning classification technique, Creating Abstract Art using Generative Adversarial Networks, and Generating Music Tune using Recurrent Neural Networks. These are quite interesting to me as I am learning and creating new things from my acquired knowledge. Some of my other collaborative works are image embedding using Generative Adversarial Networks with the help of an external classifier. This is also a part of my ongoing Master's thesis at Bangladesh University of Engineering and Technology (BUET), under the supervision of Dr. Muhammad Abdullah Adnan.

Teaching Experience

I have the experience of conducting some undergrad courses in the Computer Science and Engineering department at the University of Asia Pacific (which will be the host university of the International Collegiate Programming Contest World Final, 2022). I believe, this experience of teaching would help me to become a good researcher in the future. As learning and teaching are complementary to each other. To be in the teaching profession, I had to be always innovative in making new problem sets, evaluating students, and giving guidance and motivations according to their potentials. I enjoyed the challenges of this profession because, in this profession of teaching, I had to be always in a process of updating myself. I had to be always slightly better today than yesterday.

In the teaching profession, I conducted the courses and labs like Pattern Recognition, Machine Learning, Mathematics for Computer Science, and Computer Graphics, etc. These courses are very much research-oriented and I enjoyed the teaching of these courses very much. I updated these course contents according to the recent advancement of these fields consulting with the senior faculty members of this university. I have learned some new interesting stuff by teaching these course as well, e.g. Generative Adversarial Networks for Data Augmentation, Lagrange Multiplier method for Constrained Optimization, and, Principle Component Analysis for Dimension Reduction, etc.

Academic and Research plan

My first and foremost plan regarding academia and research is to complete my Ph.D. degree from any North American (either USA or Canada) universities, which are enlisted by CS-ranking website, which is I believe, the most reliable ranking system for postgraduate Computer Science programs since this ranking is generated by the real-time data collected from the DBLP (Auto-generated Computer Science Bibliography).

My research interest covers the broad area of Machine Learning. But my focus would be on Computer Vision, more specifically Generative Adversarial Networks - GANs. I am especially interested in GANs because I come across the practical implementation of several GANs models and this experience of working with the generative models fascinates me. Some of my projects are to create Abstract Art using DC-GAN, Data Augmentation for the low-sampled semi-supervised environment, High Cursive Complex Character generation using GANs, Embedding images with GANs, etc. But apart from that, I am hopefully capable, as well as interested in any area that covers Deep Learning techniques and their theoretical background and practical applications.

Concluding Remarks

After completing my Ph.D., my target is to ensure a position either in academia or industry that has the prospect of research and development based on my area of expertise in Computer Science arena.

So, I believe, I have the confidence, capabilities, and enthusiasm to admit into the Ph.D. program. I would like to produce some impactful research, that would make me compatible with this degree.