

With the rapid advancement in technology, there are a lot of industries that have benefited from the applications of artificial intelligence, machine learning, and data science. In particular, machine learning is employed on a large scale in every sector to solve the most complex and intricate problems. I first understood the potential of this field when I started using machine learning techniques such as random forest and stochastic calculus in my workplace. However, I realized that although I may have a good grasp of the mathematical principles behind the algorithms, I need to improve my skills in implementation. I can do this by learning advanced courses in operating systems, database management and software engineering. Hence, in order to build a career in the field of machine learning, I wish to pursue a postgraduate degree in Computer Science with specialization in Machine Learning.

Since childhood, I have been fascinated by electrical signals and have tried to understand their design, operation, and functionalities. In order to acquire more knowledge in this area, I decided to pursue my undergraduate degree in Electronics and Communication Engineering, with Computer Science and Engineering as my minor subject. During this period, I particularly enjoyed learning mathematics-oriented topics such as probability and random processes, linear algebra, real analysis, complex analysis, partial differential equations, discrete mathematics, and Automata theory. My professors guided me to understand the practical applications of concepts such as back propagation and chain rule. I also understood implementation of complex algorithms through my courses on operating systems, data structures, and algorithms. In order to go beyond my coursework and acquire more knowledge in the field, I did several online courses on deep learning and algorithms specialization. All this helped me build a strong foundation in the field of machine learning.

I was quite eager to explore the domains of machine learning and deep learning further, and so I decided to take up a project on early detection of diabetic retinopathy. The objective here was to segment very fine blood vessels in retinal images, which is very crucial for early detection and treatment of the disease. For this, I used a combined approach of Otsu's segmentation and convolutional neural networks (CNN). I also used Python for writing the code and integrated deep learning libraries such as Numpy, Scipy, and Theano.

After this, I took up another project as part of my Digital Signal Processing course, where I replaced a gradient descent with stochastic search to optimize the loss function for classification. The goal here was to distinguish Brodatz pattern with stochastically optimized Gabor filter bank. For this, I designed the loss function to minimize the area of mean-variance scatter plot and maximize the distance between clusters for a pair of images. I also used stochastic search over the parameter space to optimize the loss function. Through this project, I was able to work with gradient descents and gained familiarity with MATLAB.

Following this, I wanted to work on more electronics-focused projects, and so I decided to use the 8085 microprocessor to develop a cash register. I used a simple user interface which stored the shopping costs of the user using memory calling and interruption, and input-output interfacing. I also developed a laugh detector as I wanted to gain hands-on experience in the hardware implementation of

deep neural networks. For this, I built a prototype of a laugh detecting device using electronic circuitry. The module was built using five sub-modules of amplifier, envelope detector, bandpass filter chain, thresholding, and exponential averaging. The entire device was built using low-level electronic components such as resistors, capacitors, and op-amps. Both these projects helped me understand the software and hardware components of electronics and how to build functional electric circuits using these components.

Once I acquired sufficient knowledge through my coursework and these projects, I got the opportunity to work on a machine learning-based project on Image Segmentation and Face Detection. Here, I used the Gaussian Mixture Model (GMM)-based clustering for the segmentation and classification of an image among 40 classes. I implemented face recognition in the project by using Principal Component Analysis (PCA) along with a few image processing techniques. This project helped me become familiar with machine learning, image processing, and face detection techniques.

By this time, I was ready to undertake a complex project for my undergraduate thesis, and so I worked on the generation of a semantic graph from unstructured text data. I first identified the different entities in a text and then classified the relation between the entities. I used distant supervision for relation extraction, and the database Freebase for providing labels for relations. The clustering of vector representations was done using the algorithm FastText and noise labels in the dataset were reduced using multi-instance multi-label learning. Through this project, I had the chance to work on sequential data and deep learning techniques such as bi-directional LSTM. I also acquired hands-on experience in different kinds of word-to-vector encodings.

During the course of my undergraduate studies, I was excited about the field of deep learning and CNNs, and so I undertook an internship at the Image Analysis lab in Tohoku University, Japan. Here, I worked on the inversion and visualization of deep convolutional neural networks using different regularization techniques. I optimized an energy-based loss function and regularized it with sparse coding using back propagation. This experience helped me learn about inversion techniques, statistical analysis techniques, and the different layers of CNNs. Following this, I attended another internship at the Computer Vision and Systems lab at University Laval, Canada, where I worked on real-time 3D object detection and tracking using deep learning. Here, I developed an end-to-end model for detecting and estimating 6 degrees of freedom of objects in RGB-D video sequence. I also implemented the R-CNN model for object detection and increased the robustness of the tracker to handle noisy initialization. Both these internships taught me a lot about advanced deep learning techniques and their implementation in real world projects. I also understood the work culture and scope of research projects in different parts of the world.

After completing my undergraduate course along with my projects and internships, I was eager to implement my skills and knowledge practically. So, I started working at JP Morgan as a Quant in the Quantitative Research part of the Investment Banking division. Here, I was a part of the modeling team of the Wholesale Credit Rating Group and my duties involved rating middle market clients who applied to banks for loans. I was asked to increase the model accuracy of the Obligor Grade rating framework,

where I used a combination of differential equations, mathematical models, and machine learning algorithms to achieve this objective. Other technologies I have used include Black-Scholes model for option pricing, graph algorithms, and depth-first search. Based on project requirements, I have extensively used Python, R, and CPP for writing codes. My work period has given me in-depth hands-on experience in machine learning and statistical models such as random forest, neural networks, LSTM, and HMM.

Throughout my undergraduate and professional periods, I have worked extensively with doctoral and postdoctoral students, and I have learnt how to approach problems and devise solutions. I have also realized that knowledge of advanced computer science techniques is paramount to being a technology expert. Hence, I wish to bridge the gap between my current knowledge and the level of knowledge that is required to carry out fruitful research by pursuing a postgraduate program in this field. After completing my higher education, I would like to take up a research-oriented position where I can approach problems logically and attempt to solve them. If given the opportunity, I am also interested in pursuing a PhD in the field of Machine Learning. Eventually, I would like to immerse myself in artificial intelligence research involving human-computer interactions.

In order to kickstart my career where I can use technology to contribute to the benefit of the society, I would like to pursue a postgraduate education in the field of Computer Science with specialization in Machine Learning at your esteemed University. I believe that I have considerable research experience to be able to conceptualize and execute research projects in the field of machine learning. I look forward to working at your state-of-the-art research facilities where I can enhance my skills and deepen my knowledge. My international work experiences will make me a good fit for your student community and my discussions with accomplished faculty at your premises will help me acquire a better understanding of the field.

Given my intense passion for the field and relevant work experiences, I wish to make the maximum use of your program to advance my knowledge and skills in the fields of deep learning and machine learning.