

Motivation Letter

Solving real-world problems technically has always been my passion. There have been few things that persuaded me to continue to graduate studies: my previous work experiences and real-life situations. My undergraduate courses and my professional work in the field of artificial intelligence have opened my eyes to a wide range of research areas. My personal experience in analyzing the cause for a disease called **Myasthenia Gravis** which has many reasons for its occurrences has motivated me to go through various cancer diagnosis research works. My intention for pursuing a master's has become strong as I realized the need for a fact, context and logic-based research in the area of health care and bioinformatics based Machine Learning applications. Therefore, I would like to pursue my higher studies in the field of Computing Science with a specialization in Machine Learning and Artificial Intelligence.

During my time as an undergraduate student at Amrita University, my interest in mathematics from my childhood made me start solving trivial mathematical problems. I consequently, developed a hobby of solving programming questions over multiple programming platforms through which I developed a strong foundation in **Data Structures and Algorithms** and extending my interest through participating in the ACM ICPC programming contests. I was part of the FOSS club where students get to know about their interests and contribute themselves in their areas of interest after college hours. I was introduced to open source contributions by my seniors' who were already part of organizations like Wiki-media, Firefox, KDE, etc, which was quite interesting as our work is going to reflect in the code without actually being an employee of the organization. As a first step, I have decided to go with **Linux Kernel** upon my senior's recommendation. I worked on it for a while understanding the architecture, code, filing bugs, interacting with the community and also have sent few coding style error patches to the community head.

My introduction to Machine Learning happened in the Business Intelligence class during the discussion about reducing the problems of unstructured data. I was excited about the concept of reducing stochasticity and eliminating the concept of 'randomness' through defined attributes. My enthusiasm towards the subject has further increased after knowing the fact that most of the real world ML problems are solved mathematically(which is my primary interest since childhood that actually reflected in my grades). This actually motivated me in opting for a Data Mining elective, where I acquired an in-depth understanding of various supervised and unsupervised learning algorithms (Regression, Classification, Decision Tree) and anatomy of learning algorithms. I tried my hands in building regression models from scratch for multi-variate problems. The final year project I did with my project mate while continuing my internship at **Robert Bosch (on General Motors telltales project)**, was about classifying basic human activities using an SVM kernel-based algorithm while developing a monitoring device through an Android application, especially for aged people. My contribution to the project was on collecting the training data with relevant features, applying the Machine Learning model which best suits our data.

I have had an opportunity to work on my area of interest as a **Graduate Trainee Engineer in Synopsys** for a year where my perspective towards approaching ML problems has completely changed. I was privileged to work on a yet to be patented research project which involved building a data analytics tool for reducing chip design time which is usually huge (due to re-checks). My work partly involved in developing dynamic design layout plot modules (using PyQt5 and Matplotlib) and to **cythonize** the developed application. A Major part of my work involved finding solutions for some machine learning problems. One such problem I worked on is unsupervised anomaly detection on various design data of Intel and Samsung. My challenge here was to define what an anomaly is for the

data and to identify the right features for building a model that fits the data. My research on it started by applying standard density(DBSCAN) and clustering based algorithms which couldn't yield better results. After this, I was suggested to pose the same problem as probabilistic inference question and try a Bayesian approach which actually involves uncertainties related to model and parameter values through prior information. My beginnings with bayesian modelling were challenging as it involved me going through a lot of research on **terminology, numerical methods like Variational Inference and Markov chain Monte Carlo, Dirichlet process based Gaussian Mixture Models and probability distributions**. My work for six months involved in educating myself through research journals, day to day discussions with my colleague and applying them using Probabilistic Programming package **PyMc3**. This experience was vital in making up a decision to continue for **research-based graduate studies**.

My intention towards working on realistic data and challenges which are impactful to society has led me to choose person health-related problems on the application side due to some personal health issues I have observed in our family. After independently working on health care projects and reading **Professor Judea Pearl's works on Causal and Counterfactual Reasoning**, I zeroed in on a couple of research problems. The most common problem we have with the current diagnosis or modelling systems is the lack of properly defined cause and effect relationships. Knowing the causal structure of a problem gives us to look at the advanced reasoning of its behaviour and overcoming the random situation which is not possible through correlation, that purely depends on other levels in predicting a level. Another parallel problem that intrigued me was in presenting ML technologies contributing to patient-specific treatment for myriad diseases. I intend to do research on this by developing an in-depth understanding of Machine Learning especially computational causality framework, Bayesian Inference and Probabilistic Modelling for health care and Bio-Informatics applications.

For these reasons, the **Master's program in Computing Science at University of Alberta** is especially attractive to me. I am fascinated by several research projects carried on by the faculty and the research groups. In particular, research conducted by **Dr. Russell Greiner** aligns with my research interests. My interest in working with him doubled after reading through his works on cancer diagnosis and his ongoing research on survival prediction. I aspire to extend my learning to doctoral studies and thereby continuing a career in research. I strongly believe that my serious intention of pursuing higher studies, my previous academic record and, my work experiences makes me the right person for the program. Moreover, the conducive research environment provided by your university will help me achieve my goal which is to make some socially impactful contributions. I, therefore, request you to grant a merited consideration to my application and give me an opportunity to pursue a **Masters in Computing Science** from your esteemed University.