Application for Graduate Studies
Computational Finance
Carnegie Mellon University

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Statement of Purpose

For as long as I can remember, I have always been an intellectually inquisitive person. Questions fascinate me the most. Questions that arose out of curiosity have culminated in momentous events that history is rife with. Why did the apple fall from the tree? Can we fly like birds? Can we reuse rockets? Fascinating questions like these have been driving our evolution as a race. The answers are out there and the right questions can make a lot of difference in finding them. These questions arise from human behavior, which is the vanguard of all major advancements in the world. Financial markets pose an intellectual puzzle to solve - one that keeps changing everyday, one that necessitates having an intimate understanding of human behavior, and entails asking the right questions everyday. It is this sheer ever-evolving nature that drew me into finance. Mavericks of the markets like Ed Thorp, Jim Simons, Ken Griffin, etc., have all established that the markets are inefficient, cracking the puzzle in their own way. It is my intent to investigate these inefficiencies with the skills I have been acquiring in Mathematics, Finance, Computing, and Data Science.

My first foray into the world of Finance was through an Economics course during my undergraduate study. While researching for the course project, I came across a financial economics paper that caught my fancy. The study titled "On the impossibility of informationally inefficient markets" by Stiglitz and Grossman, opened me up to the different approaches to obtain informational advantage and the multitude of possibilities that come with it, to leverage the inefficiencies in the global financial markets. Exploring further and learning about the progress achieved in the field of quantitative finance captivated me! I could cognize that the future of finance was being carved with technology at the forefront, combining the power of data, mathematics, and computing.

I further investigated the financial markets in my senior-year project, "*Forecasting future exchange rates in currency markets using Machine Learning & Artificial Neural Networks*". This was a highly cerebral project and having no experience with Machine Learning or Neural Networks made it all the more challenging. Never one to shy away from a challenge, I equipped myself by auditing Stanford's Machine Learning and IIT's Neural-Networks courses. I tackled the challenges along the way by iteratively learning and refining the research process I approached it with. After a lot of experimentation training the neural network, I was able to arrive at a sweet spot at which I could combine macroeconomic and fundamental data with historical time series data and predict closing exchange rates for 120 days with the highest order of accuracy.

I was bestowed with an academic excellence merit scholarship for 4 out of 5 years in college, for consistently being in the top 2% of the batch. I graduated with an internship-cum-employment offer from PayPal. At PayPal, I developed a proficient command of Python & C++ as part of my quantitative toolkit. During my internship, I developed a semi-automated statistical reporting system for the APAC technical management team, using Python. The system provided an interactive platform for the managers to create customized reports, and achieved an 85% reduction in the man-hours spent on the reporting process. Currently all the technical account managers at PayPal are using this tool.

Post internship, I joined PayPal's Risk Product team as a Software Developer. I built products using C++ & Java to mitigate risks and handle buyer/seller frauds, leveraging big-data analytics. I saved over $5mn per annum for PayPal in seller-risk losses by implementing seller-fraud prevention features. I was eventually promoted to the Software Developer-II position in which I worked with cross vertical domains in the development and integration of risk APIs. At PayPal, I acquired a holistic perspective in building scalable systems and managing heterogeneous infrastructure.

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All the while I was working at PayPal, the obsession to develop substantial knowledge in Quantitative Finance kept consuming me. I left PayPal in July 2017 to dedicate a year to study finance and to assess how I can leverage my skills in exploiting the inefficiencies in the Indian stock market. I started by analyzing the markets everyday to get a sense for how the prices moved. The observations I made led me to develop a systematic approach to capture inefficiencies, and eliminate speculation from the trading activity. I created a securities master database using historical data of listed Indian equities from Quandl and programmed the system to automatically update the database everyday as NSE releases the EOD data. I integrated this into an infrastructure I built to facilitate backtesting of different strategies. Using price-volume data, I built strategies incorporating statistical analysis with datasets that utilized news, social media, fundamental actuals, and analyst forecasts in order to capture trading opportunities. With this system, I was able to test certain trend following and mean reversion strategies in real time.

Trading with these strategies in real time made me aware of the skills I should acquire before I can successfully take a concept from research to active trading. So, I signed up for WorldQuant's Financial Engineering courses to fill these gaps. Alongside, I audited the *Stats in R specialization offered by Duke University* to strengthen my skills in Statistics, and *Columbia's 2-part Financial Engineering & Risk Management* courses on Coursera to get an in-depth primer on Derivative Securities and structured products. I have done course-projects on option pricing models, statistical portfolio analysis, optimal tracking and replication of the S&P 500 Index, and forecasting stock prices, using Excel, R, and Python. Currently, I am working on an empirical study on the performance of ETFs in India and am also investigating a strategy based on the historical performance of IPOs in India, using Python and Excel.

I have also been active in other academic & extracurricular endeavors. While at university, I taught "Programming in C" and "Data Structures and Algorithms", to a batch of 25 students as a teaching assistant. I mentored pre-final year students in their preparation for career placements. I organized and participated in the PayPal intern show-up and my team won the *"Best Pitch"* and *"Best Product"* awards. I was part of a winning team in PayPal's global risk-hackathon for which we developed a real-time platform for tracking and progress of priority level bugs. I worked with the organizing team in hosting PayPal's Product Fair and annual day events. I have a strong flair for strategizing and solving challenging problems. In the last two years, I also co-founded an artisanal food products manufacturing company, guided a team of 4, developed data driven product strategies, and expanded our B2B presence to over 5 cities. We increased sales by 7x and profits by 3x, taking the valuation from INR 100,000 to INR 4 Million.