SENIOR THESIS

GPU Optimized Machine Learning Algorithms for Low-Volatility Stock Portfolio Options

Julian Gilyard

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THANKS

Keeping with the ever present traditional of the senior honors these, I would like to take this time to thank some of the people that have been individually responsible for my success throughout my undergraduate career. These individuals have played a significant role in providing me with clarity, opportunities and understanding. Without there support, I would not have been able to thrive during my time at Wake Forest University. As much as this thesis is for me, it is for all of the individuals that have helped me along the way.

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the greatest person that I have had the pleasure of interacting with in my life. Outside of being able to research with Dr. Cho, I have had the pleasure of calling him my friend. Whenever, I have needed to talk with someone about life, research, understanding or context, he has been available. Dr. Cho can tell you able times that I have cried in his office, rambled for hours about unique concepts that he already was an expert in, and about my many mistakes. In the fact the the majority of my work has dealt with research Dr. Cho taught me how to expand my horizons and to truly pursue ideas that I thought were worthy. He gave me the courage to take nontraditional approaches to numerous ideas while expanding my mind. In the time that I have known Dr. Cho, he has not once inhibited my ability to learn or experiment. In fact, he has been always willing to give me a shot to go after the most obscure topics with significant importance. In the amount that Dr. Cho has given me, I doubt that I will be able to ever repay him. I suspect that he is rarest form of person that exist, one that challenges the ideas of the status quo while appreciating the current reality and encouraging others to do the same. Sam, I am sure that forever we will be friends; you will always be my mentor; and, I will never forget you.

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1 Introduction

This project is a hybrid construction between economics, finance and computer science. We seek to identify characteristics of low volatility equities while attempt to forecast if the equities stay within the realm of profit for specific options strategies. While volatility and value and positively correlated, given the black scholaes formula, we seek to look only for low volatility strategies as this gives us a cheaper and more reliable approach for looking at applications to finance as a whole.

After we identify these low volatility equities in one of five time horizons (3 months, 6 months, 1 year, 2 year and 5 year) we look at numerous machine learning algorithms and see which ones are most adept at identifying the desired outcome for low volatility. We will be using a combination of algorithms then present the most compelling algorithms comparing the results to one another. This will allow us to gauge performance from a run time perspective and an accuracy perspective. Traditional metrics for machine learning such as confusion matrices will serve as a litmus test to determine how our algorithms will perform in real world scenarios.

In order to prepare for this project, we enlisted the help of Coursera's machine learning class taught in R. This provided us with industry experience and a wide variety of additional techniques that have been used to perform machine learning algorithms. This class is cross taught at the University of Pennsylvania and is provided for free online. The class covered R's implementation of the Caret package for machine learning, current testing methods, forecasting ideologies, co-variance matrices, data mining techniques and a complete understanding of data cleaning.

Our goal is to see how well these algorithms perform, select the best algorithm that performs the most accurate under our testing set then to see how we can increase the performance of our algorithms by porting them to GPUs. We will use a combination of leverageable packages through R and CUDA. In the end we seek to find performance gains and accurate predictors for a equities while displaying useful real world performance. Future implications for this work can be to limit negative market exposure or to dynamically craft baskets for clients that want particular exposure to companies in a specific sector but at a quantifiable risk profile. In order to provide validity to our testing methods we divide our data into two separate categories.

2 Methodology and Approach

In order to have a starting point [1]

3 Literature Review

4 GPU Rationale

5 Keywords

6 Additional

7 results

References

[1] D. J. Leek, D. R. Peng, and D. B. Caffo, “Practical machine learning,” 2016.