Crypto Price Simulation Strategies

ISYE 6644 Simulation

Progress Report

Group 21

Team Members:

Chin-Hsien Tsai, Yanhui Li, Xiaofan Jiao, Yuhan Qian

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Professor: Dr. David Goldsman

I. INTRODUCTION

Recently, cryptocurrencies have become incredibly popular, grabbing everyone's attention with their extreme price swings and potential for big profits. To really understand this fascinating and fast-changing industry, we took on a project to create and test our own cryptocurrency trading strategy. Using Jupyter Notebook, we could easily and clearly see how our plan performed through charts and data. Our objective was to develop a system that could successfully negotiate the erratic cryptocurrency markets and maybe yield substantial profits.

II. DATA COLLECTION AND PREPROCESSING

The historical price data of the six cryptocurrencies we used are: Bitcoin (BTC), Ethereum (ETH), Dogecoin (DOGE), Pepe (PEPE), Shiba Inu (SHIB), and Dogwifhat (WIF). The historic price data was downloaded from Yahoo Finance (Yahoo Finance, n.d.). A preprocessing function was defined to clean and prepare the data. This involved converting the 'Date' column to datetime format, sorting the data chronologically, and removing any rows with missing values. To guarantee correctness and consistency, this function was then applied to each cryptocurrency dataframe.

II. IMPLEMENTATION OF MOVING AVERAGE CROSSOVER STRATEGY

Our project began by implementing a moving average crossover strategy. We defined a function that calculates both short-term (20-day) and long-term (50-day) moving averages using the closing prices of each cryptocurrency. Trading signals were generated based on the crossover of these moving averages. When the short-term average crossed above the long-term average, it triggered a buying signal (1). Conversely, when the short-term everage crossed below the long-term average, it triggered a selling signal (-1). This function was applied to each of the six cryptocurrencies, resulting in dataframes containing moving averages and corresponding trading signals.

III. TRADING SIMULATION AND VISUALIZATION

We will then simulate trading based on these signals. Starting with a portfolio capital of $100,000, we calculated daily returns for each cryptocurrency. We then tracked the portfolio value over time by executing trades according to the generated signals. We visualized the performance of our strategy by plotting the portfolio value over time, along with the moving averages and trading signals on the price charts. This shows us feedback of how our strategy responded to different market conditions and how the trading signals influenced the overall portfolio value.

IV. CONTINUOUS PROGRESS
Incorporation of News Events

To enhance the realism of our simulation, we will integrate major news events that could impact the prices of our selected cryptocurrencies. We will collect historical news data from sources such as Google News or CryptoPanic, focusing on key events like regulatory announcements, technological developments, and analyze how these events historically impacted the prices. We can adjust our trading signals to better reflect realistic market reactions.

Integration of Hidden Markov Models (HMM)

To simulate the fundamental market conditions, including bull, bear, and stagnant markets, we will incorporate Hidden Markov Models (HMM). We will start by defining the market states and initializing the HMM with appropriate parameters. Then, we will train the model using historical price data to capture transitions between different market states. Once trained, we will use the HMM to predict the current market state based on observed price data. Based on these predictions, we will adjust our trading strategy, potentially increasing or decreasing position sizes according to the market state.

Monte Carlo Integration for Risk and Return Estimation

We will also use Monte Carlo integration to simulate a large number of possible future price paths for our selected cryptocurrencies based on historical volatility and return distributions. This involves generating random variables to create numerous simulated price paths, iterating through these paths by applying daily returns to the current price, and calculating the expected return and risk of the trading strategy by averaging the results from these simulations. This includes estimating the mean return and the standard deviation of the returns to assess the strategy's risk.

Visualization and Performance Analysis

Finally, we will visualize our results through graphical representations, including the historical price data, moving averages, trading signals, and changes in portfolio value over time. We will also conduct a profitability analysis to determine the final portfolio value and overall growth percentage. These graphics will give us a summary of our findings and assessment of the effectiveness of our trading strategy. We will then be able to evaluate the moving average crossover technique's effectiveness in relation to a variety of cryptocurrencies, providing valuable information about its potential as a trading strategy and for additional research and optimization in the field of cryptocurrency trading.

V. CONCLUSION

In conclusion, by combining cutting edge modeling techniques with practical considerations, this project seeks to thoroughly assess the performance of a moving average crossover approach across a variety of cryptocurrencies. We aim to provide an extensive study of the potential profitability of our trading approach by utilizing Monte Carlo simulations to evaluate risk and return, leveraging Hidden Markov Models to comprehend market states, and including noteworthy news events to reflect market reality. The project's insights will not only support the moving average crossover approach but also point out areas that require additional research and enhancement in the field of bitcoin trading strategies. This comprehensive method will improve financial trading decision-making and lead to a deeper comprehension of market dynamics.

REFERENCES

[1] Yahoo Finance. (n.d.). Cryptocurrency prices, charts and market capitalizations. Yahoo Finance. Retrieved June 25, 2024, from https://finance.yahoo.com/crypto/?offset=25&count=25