FINANCIAL MARKET DERIVATIVE ESTIMATION PROJECT PROPOSAL

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1 PROBLEM STATEMENT

Ever since the creation of the stock market in 1611, financial instruments have been a vessel to hold wealth. More people than ever have access to forex, option and margin trading through mobile application brokers, making financial markets even more speculative. This has caused numerous studies to be done with various machine learning algorithms for financial market prediction. We will be developing a financial market pricing estimation system utilizing deep learning algorithms.

2 TASK DEFINITION

For the inputs, we will utilize the average of the high, low, open and close data for multiple time frames, e.g. 30m, 1h, 4h, 1d, 1w. We will also use the regression values from a window of time to help identify the market trend. The window size n is still undetermined. The output will be the slope of the selected time frame. The time frame used in the prediction output is still undetermined.

3 CHALLENGE OF PROBLEM

The biggest challenge we will face is to find appropriate data that represents a market trend. Another challenge will be to process the data and to calculate the regression values for each window of size n. Our third challenge will be to optimize our model to minimize the loss between the predicted slope and actual slope.

4 PRELIMINARY DATASET

For our preliminary dataset we will use `https://polygon.io/` which has time-series data for a wide range of financial instruments. We will take the candlestick values, high, low, open, close, and perform our own processing to calculate the regression values based on the window size n. We will take a range of values $2n$ in length, before and after each candlestick to effectively calculate the slope using a linear regression model. These slopes will be added as features into our preliminary dataset to aid our model in making better predictions and identifying trends.

5 RELATED WORKS

Projects relating to stock market prediction are not uncommon and there are plenty of projects that are available on the internet to take reference from. Some of the works we have referenced: Machine learning techniques applied to financial marketing predictions,Stock Market Prediction Using Machine Learning Techniques: A Decade Survey on Methodologies, Recent Developments, and Future Directions

6 BASELINE AND ORACLE

For our problem we will be using the slope from the linear regression model of the candlestick $n+1$ out of the window size n as the baseline for our system. Our oracle will be determined from

comparing the results from using a recurrent neural network (RNN) and LSTM. The algorithm that performs the best will be our oracle.

7 METHODOLOGY

Our method of using linear regression works well with our hypothesis that markets trend in a certain direction. Some of the challenges will be finding good data to represent our hypothesis. We want financial instruments to have a long history of operation and performance to better understand what trends occur within the data.

We plan on either using a Recurrent Neural Network (RNN) or an RNN variation of the LSTM. These algorithms are widely used in time-series forecasting, especially in the context of financial market prediction and analysis. The challenges we will face in the construction of our system is determining the window size n and the algorithm used. The main reason for choosing a RNN or an LSTM is their ability to provide context from past data.

For example, we will choose a window size n and retrieve a sequence of time-series data of length n. We will have already calculated the slope of each element from the time-series window using a linear regression model. The linear regression will take $2n$ data points surrounding each element from the time-series window. The slope of each element will be used as additional features for our model.

REFERENCES

URL: `https://github.com/scorpionhiccup/StockPricePrediction`

URL: `https://github.com/NourozR/Stock-Price-Prediction-LSTM`

"Stock Market Prediction: Machine Learning for Stock Market Prediction." Analytics Vidhya, 13 Oct. 2021, https://www.analyticsvidhya.com/blog/2021/10/machine-learning-for-stock-market-prediction-with-step-by-step-implementation/.

Rouf, Nusrat, et al. "Stock Market Prediction Using Machine Learning Techniques: A Decade Survey on Methodologies, Recent Developments, and Future Directions." Electronics, vol. 10, no. 21, 2021, p. 2717., https://doi.org/10.3390/electronics10212717.