

Empirical Review of Models used for Predicting Financial Market Crashes Using Market Data

COMP 451 Final Project: Final Report

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Introduction Inigo

****thesis statement****

Litterature Review Adrien

We are not the first to attempt to compare ML models performance on their prediction of market crashes using SP500 historical data. Multiple approaches have been tried and tested. Time series analysis has used ARIMA and RNN based models, with the more recent addition of Transformers boosting and improving their performance [1]–[3]. Reviews of these models have been done before, but the comparison of these three models on short-term prediction using very recent market data is lacking in litterature.

One article compared Linear Regression and ARIMA to predict the volatility and trend of SP500. [4]. Key-findings show that ARIMA struggled on short term predictions, particularly during the 1930s and 2020 volatile markets.

Market Crashes do not hold a single definition. While historical data tags specific periods as depressions and bubbles, there are no specific metrics that are universally defined [5], [6].

RNNs are cool

Time series in the stock market are non-stationary. Their statistical properties thus change over time. ARIMA models can be adapted to capture the behavior of non-stationary time-series [7].

Transformers are cool

Drastic market crashes are rare [cite]. Models can achieve extremely high accuracy by simply predicting no market crash for every datapoint. Other methods are thus needed to evaluate the models. Others in litterature have used many methods, such as evaluating true positives and true negatives [cite]. Other have used mean absolute error (MAE) to assess prediction accuracy [8]. Finally, some have used runtime and resource usage for practical feasibility to assess their performance [9].

Methodology Adrien for market crash and Experiment choice Everyone for their assigned model

RNN Implementation

ARIMA Implementation

Transformers Implementation

1. Adrien - 30 days sliding window, 14 days shift days
2. Oscar - 14 days sliding window, 7 days shift days
3. Inigo - 7 days sliding window, 3 days shift days

Empirical Evaluation **Oscar**

Discussion **2 Experiments each**

Conclusion **Everyone does the conclusion for their own experiments**

Future Directions **Inigo**

Self-Assessment **Oscar**

Contributions **Everyone writes their own contribution**

Appendix

References

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