FFT, TimesNet, and Random Forest in Real Estate Stock Market Analysis

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ABSTRACT Placeholder line

INDEX TERMS Placeholder

I. INTRODUCTION

Time-series forecasting plays a crucial role in decision-making across various domains. Its significance lies in its ability to provide valuable insights into future trends and patterns in time-dependent data. For instance, accurate predictions of stock prices, interest rates, and foreign exchange rates are essential for informed investment decisions in finance. Similarly, healthcare organizations rely on forecasting patient demand and resource utilization to allocate resources effectively and improve patient care. Energy management companies use time series forecasting to optimize energy production, distribution, and consumption. The accuracy and efficiency of time-series forecasting models significantly impact organizational performance and decision-making processes.

In this paper, we explore an innovative approach to enhance time-series forecasting using the Fast Fourier Transform (FFT). The FFT algorithm extracts frequency-domain features from time series data, offering a promising avenue for improving forecast accuracy and computational efficiency. Our investigation involves a comparative analysis of models trained with FFT-based features against traditional time domain features. We apply this approach to predict stock prices of real estate companies, leveraging not only FFT but also other techniques such as TimesNet and Random Forest. Through our study, we shed light on the interpretability of frequency domain features and their relationship with underlying time series patterns, emphasizing the potential of FFT-based feature engineering in enhancing forecasting models.

II. RELATED WORKS

In recent years, many stock prediction models have been researched and many articles have been published, such as:

Hind Daori, Alanoud Alanazi, Manar Alharthi, Ghaida Alzahrani (2022) [1] used Artificial Neural Network (ANN), Random Forest Classifier, Logistic Regression,and then analyze and predict the patterns of previous stock prices and the results showed that the models were efficient and produced better results.

Hugo Souto(2023) [2] has researched about TimesNet for Realized Volatility Prediction. Finally, they concluded that TimesNet stands out as a reliable and effective benchmark model for researching realized volatility. Although it may not always surpass NBEATSx and NHITS in every metric, its strong performance and consistency make it a valuable option, especially when compared to TFT. Overall, TimesNet presents a balanced and dependable choice that combines reliability with effectiveness, making it a suitable neural network model for researchers and practitioners in the field of realized volatility.

In another article by Bohumil Stádník, Jurgita Raudeliuniene, Vida Davidavičienė [3], they pointed out that the Fourier analysis may not be advantageous for investors forecasting stock market prices as it fails to detect existing predominant cycles. An attempt to identify significant periods in the US stock market data using FFT, a method of Fourier analysis, proved to be unacceptable. Similar failures can be expected with other liquid investment instruments or financial data series. Despite this, Fourier analysis is still used for forecasting in finance and its benefits are a topic of discussion among financial market practitioners and academicians.

III. MATERIALS

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A. DATASET

The historical stock price of Quoc Cuong Gia Lai Joint Stock Company (QCG), Dat Xanh Group Joint Stock Company (DXG) and Vinhomes Joint Stock Company (VHM) from 01/03/2019 to 01/03/2024 will be applied. The data contains column such as Date, Price, Open, High, Low, Vol., Change. As the goal is to forecast close prices, only data relating to column “Close" (VND) will be processed.

B. DESCRIPTIVE STATISTICS

TABLE 1. QCG, VHM, DXG's Descriptive Statistics

	DXG	VHM	QCG
Count	0	0	0
Mean	0	0	0
Std	0	0	0
Min	0	0	0
25%	0	0	0
50%	0	0	0
75%	0	0	0
Max	0	0	0

IV. METHODOLOGY

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A. LINEAR REGRESSION

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$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \varepsilon$$

Where:

- Y is the dependent variable (Target Variable).
- $X_1, X_2, \ldots, X_k$ are the independent (explanatory) variables.
- β_0 is the intercept term.
- $\beta_1, \ldots, \beta_k$ are the regression coefficients for the independent variables.
- ε is the error term.

V. RESULT

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A. EVALUATION METHODS

Mean Percentage Absolute Error (MAPE): is the average percentage error in a set of predicted values.

$$MAPE = \frac{100\%}{n} \sum_{i=1}^{n} |y_i - \hat{y}_i| = 1$$

Root Mean Squared Error (RMSE): is the square root of average value of squared error in a set of predicted values.

$$RMSE = \sqrt{\sum_{i=1}^{n} \frac{(\hat{y}_i - y_i)^2}{n}}$$

Mean Absolute Error (MSLE):is the relative difference between the log-transformed actual and predicted values.

$$MSLE = \frac{1}{n} \sum_{i=1}^{n} (log(1 + \hat{y}_i) - log(log(1 + y_i))^2$$

Where:

- n is the number of observations in the dataset.
- y_i is the true value.
- $\hat{y}_i$ is the predicted value.

B. DXG DATASET

TABLE 2. DXG Dataset's Evaluation

C. VHM DATASET

D. QCG DATASET

VI. CONCLUSION

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A. SUMMARY

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B. FUTURE CONSIDERATIONS

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ACKNOWLEDGMENT

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