F-019

Multi-Model and Multi-Feature Fusion Approach for Financial Trend Prediction

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1. Research Background

In recent years, stock price prediction has gained increasing importance in enhancing investment decision-making and risk management. Deep learning-based time series forecasting models have attracted attention due to their ability to capture complex, nonlinear patterns that traditional statistical methods struggle to model. Moreover, stock prices are influenced not only by economic indicators and company performance, but also by external factors such as investor sentiment and news events. Therefore, a multimodal approach that integrates such information is required for more realistic prediction.

2. Research Objective

This study aims to improve the accuracy of closing price prediction by integrating sentiment information extracted from news articles with stock price time series data. Specifically, we compare the performance of a CNN-BiLSTM-ECA model enhanced with sentiment features and a structurally sophisticated time series model, N-BEATS. We evaluate how the presence or absence of sentiment information affects prediction accuracy and verify the effectiveness of multimodal approaches in financial forecasting.

3. Experimental Methodology

3.1 Dataset

The dataset used in this study consists of Apple Inc. stock data and corresponding news articles obtained from Kaggle. The stock data spans 2,518 trading days from December 2006 to November 2016. Sentiment scores were extracted from daily news articles using a BERT-based model.

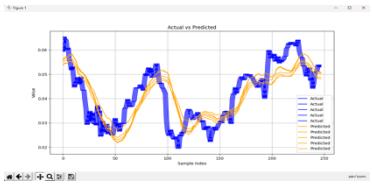
3.2 Model Architecture

CNN-BiLSTM-ECA Model:

The model integrates sentiment scores extracted by BERT with stock price data. CNN is used to extract local features, BiLSTM captures temporal dependencies, and ECA introduces channel-wise attention for improved feature selection.

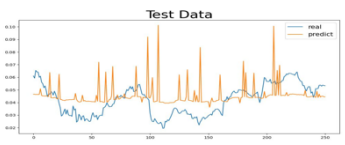
N-BEATS Model: A fully connected, deep residual time series model that predicts the next five days' closing prices based on the past 30 days. The architecture consists of multiple stacks and blocks, with backcast and forecast outputs used to refine predictions via residual learning.

4. Experimental Results



N-beats

CNN-BiLSTM-ECA(WithSentiment)



CNN-BiLSTM-ECA(without Sentiment)

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We compared the mean squared error (MSE) of the three models. The CNN-BiLSTM-ECA model with sentiment information achieved an MSE of 0.000105 and successfully captured upward and downward trends. Without sentiment input, the MSE increased to 0.000148, indicating reduced accuracy. The N-BEATS model, while purely time series-based, achieved the best MSE of 0.000058 under certain conditions, demonstrating the effectiveness of its residual architecture.

5.Reference

1. **N-HiTS: Neural Hierarchical Interpolation for Time Series Forecasting**
Cristian Challu, Kin G. Olivares, Boris N. Oreshkin, Federico Garza, Max Mergenthaler-Canseco, Artur Dubrawski

2.**N-BEATS: Neural basis expansion analysis for interpretable time series forecasting**
Boris N. Oreshkin, Dmitri Carpov, Nicolas Chapados, Yoshua Bengio

3.**Yu Chen, Ruixin Fang, Ting Liang, Zongyu Sha, Shicheng Li, Yugen Yi, Wei Zhou, and Huilin Song:**
Stock Price Forecast Based on CNN-BiLSTM-ECA Model, Hindawi Scientific Programming, Volume 2021, Article ID 2446543

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