Optimizing Model Performance for Financial News Sentiment Analysis

Track1: Financial News Sentiment Analysis

OpenAI Group2: Sesame Backstreet Team

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Introduction

This research explores methods to enhance the prediction accuracy of financial news sentiment analysis models. We investigate four main strategies: addressing uneven data distribution by expanding datasets, comparing the performance of various models, testing model validity with interference data, and employing data augmentation techniques. Our review of existing literature highlights the significant impact of news sentiment on stock market volatility and the potential of advanced modeling techniques to improve prediction outcomes. By integrating these strategies, we aim to develop a robust and accurate model for predicting stock market trends based on financial news sentiment.

Background & Literature Rewiew

Background

Previous research underscores the impact of news sentiment on stock market predictions, emphasizing the importance of accurate sentiment measurement and data processing. Effective models that incorporate sentiment analysis can significantly improve prediction accuracy. Key strategies for enhancement include addressing uneven data distribution, comparing model performances, testing with interference data, and employing data augmentation.Our research aims to develop a more accurate financial news sentiment analysis model by implementing these strategies, ultimately enhancing the model's practical application and performance.

Literature Rewiew

- **Uneven Data Distribution: Addressing Uneven Data Distribution**

Shi and Ho (2021) found that macroeconomic and firm-specific news significantly impact volatility states. Negative news increases the likelihood of higher volatility, while positive news decreases it. This suggests that addressing uneven data distribution improves model prediction accuracy.

- **Model Performance Comparison: Comparing the Performance of Different Models**

Predicting Stock Price Trends (2021) compared various models and found that incorporating sentiment analysis improves prediction accuracy. This study provides important insights for identifying the most effective models

- **Interference Data Testing: Testing Model Validity with Interference Data**

Company Event Popularity (2017) shows that event popularity, measured by news sentiment, has predictive power over stock price movements. Interference data tests the robustness and validity of models.

Key Reserch Question

How to improve the prediction accuracy of the model?

Our research question, “How to improve the prediction accuracy of the model?” is crucial for several reasons:

Experiment 1

Addressing Uneven Data Distribution

Many studies indicate that financial data distribution is often uneven, leading to biased models. Expanding the dataset to include more diverse news sources and events can mitigate this issue, improving model robustness.

Experiment 2

Comparing Model Performances

Comparing the performances of different models, as seen in the studies by Shi and Ho (2021) and Predicting Stock Price Trends (2021), provides insights into which models are most effective in utilizing sentiment analysis for stock prediction. This comparison is vital for selecting the best model for our analysis.

Experiment 3

Testing Model Validity with Interference Data

Introducing interference data, such as noise or contradictory news, tests the validity and resilience of models. This approach ensures that the models can handle real-world complexities and maintain accuracy.

Methodology

Model selection

XGBoost

- High efficiency and speed
- Strong ability to handle nonlinear relationships
- Strong robustness
- Provides feature importance scores

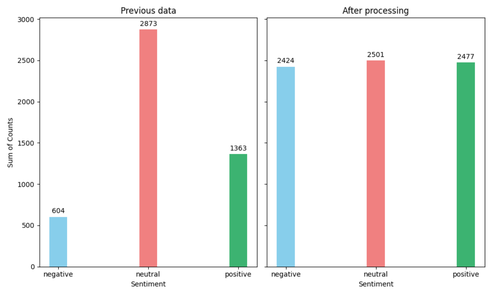
FastText

- Fast training and prediction
- Simplicity
- Efficient word embedding
- Multi-language support

Llama3

- Strong language comprehension
- Context processing
- Adaptability
- Text generation capabilities

Experiment 1



Experiment 2

XGBoost

Read data → Tag encoding → TF-IDF Vectorizer → Define parameter network → Grid search → Train and test → Output accuracy

FastText

Input text → Text processing → Word Embeddings (Input layer): (n-gram features & embedding vector) → Sum of Embeddings (Hidden layer) → Classification(Output layer)(softmax)

Llama3 Fine-tuning illustration

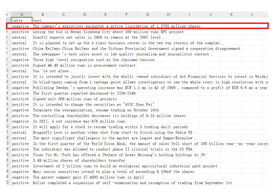
Input text → Embedding Layer (Frozen) → Repeated N Times for Each Transformer Block

Self-Attention: (Frozen) Query — LoRA trainable low-rank matrices

Output — LoRA trainable low-rank matrices

→ Feed-Forward(Frozen) → Output Layer (Frozen)

Experiment 3



Example

Text: The company's executives encounter a active liquidation of 1.5795 million shares

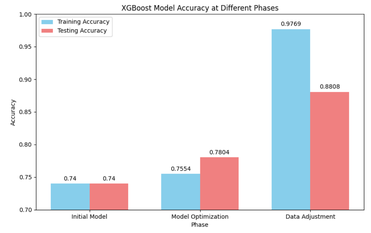
Lable: Negative

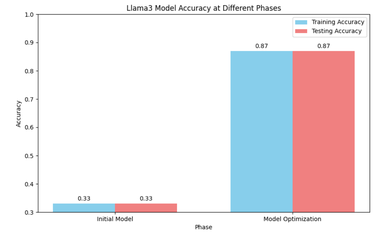
↓

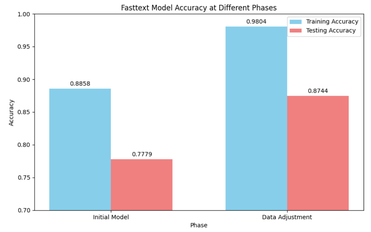
Text: The company's executives encounter a active liquidation of 1.5795 million shares

Lable: Positive

Results



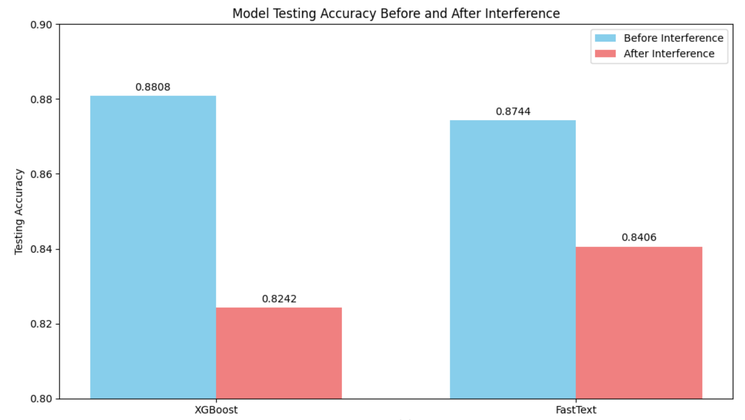




The accuracy of the optimized Xgboost model is improved by 4%.

The accuracy of the optimized llama3 model was significantly improved by 54%.

Training the even dataset has a nearly 10% improvement in accuracy for each model.



Conclusion

- **Summary**
  - Important for decision-making
  - The result of the experiments
- **Limitatons**
  - Inherent constraint
  - =>Invest time and use carefully

Reference

1. Shi, Y., & Ho, K. Y. (2021). News sentiment and states of stock return volatility: Evidence from long memory and discrete choice models. *Finance Research Letters*, 38, 101446. https://doi.org/10.1016/j.frl.2020.101446.
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3. Company Event Popularity for Financial Markets Using Sentiment Analysis and Machine Learning (2017). *Expert Systems with Applications*, 68, 1-17. https://doi.org/10.1016/j.eswa.2017.01.011.