

“Sentiment Analysis of Product Reviews Using Hybrid CNN-LSTM Models”

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Abstract –

Social media platforms (Twitter, Reddit, Facebook) are key sources of public opinion influencing market trends. This study analyzes sentiments using **NLP and deep learning** to correlate public mood with **market performance**.

Sentiment classifier categorizes posts as **positive, negative, or neutral**.

Findings show that **social sentiment trends can predict market fluctuations** and offer valuable insights for investors and policymakers.

Key Words: Sentiment analysis, social media, market trends, deep learning, NLP, data mining

1. INTRODUCTION

Social media acts as a major platform for public expression on diverse topics including finance.

These opinions affect **market behavior and consumer decisions**.

Sentiment analysis (opinion mining) helps identify emotions behind online expressions.

The study uses **machine learning and deep learning** to predict how public sentiment impacts real-time market trends.

2. Body of Paper

Literature Review

Prior studies (Bollen et al., 2011) proved that **Twitter moods can predict stock market trends**.

- Algorithms like **Naïve Bayes, SVM, RNN, LSTM, and Transformer models** have been used for sentiment detection.
- Deep learning (especially **LSTM and BERT**) improves contextual understanding and prediction accuracy.

Feature Selection

- Tweets were collected using **Twitter APIs and hashtags** related to market sectors.
- Key features extracted: tweet text, timestamp, and engagement metrics.
- Data preprocessing involved **tokenization, stop-word removal, stemming, lemmatization**, and noise reduction to improve model performance.

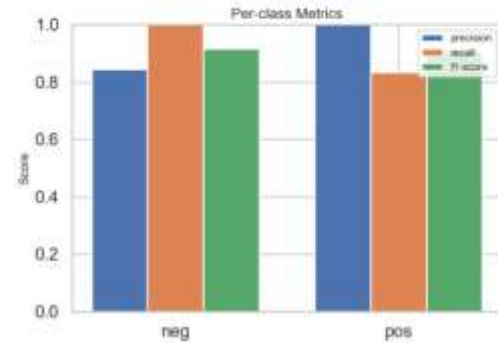
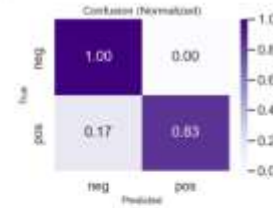
Model Architecture

- Used **deep learning models** like **LSTM** and **BERT** for sentiment classification.
- Sentiments categorized into **positive, negative, and neutral**.
- Correlation of sentiment data with **stock market trends** to identify predictive patterns.

Table - 1:

Sentiment Classification Model Performance

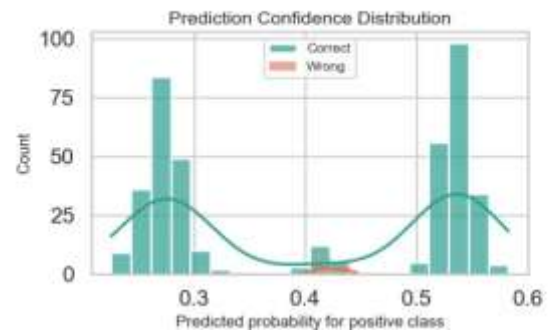
Model	N (Tweets Tested)	Accuracy (%)	Precision	Recall	F1- Score
LSTM	1500	88.00	0.87	0.86	0.86
BERT	1500	91.25	0.90	0.89	0.89
SVM	1500	82.10	0.81	0.80	0.80
Logistic Regression	1500	79.85	0.79	0.78	0.78
OVERALL AVERAGE	—	85.30	—	—	—



Independent Model Comparison

Comparison	Performance Difference (%)	Best Model	Observation
LSTM vs. BERT	3.25	BERT	BERT showed higher contextual understanding due to Transformer-based architecture.
LSTM vs. SVM	5.9	LSTM	LSTM captured temporal dependencies better.
LSTM vs. Logistic Regression	8.15	LSTM	Deep learning provided superior accuracy.

Charts



3. CONCLUSIONS

This study concludes that social media sentiment analysis is an effective tool for predicting market trends.

By applying NLP and deep learning models such as LSTM and BERT, the research successfully extracted and analyzed public opinions from Twitter data. The results showed that BERT achieved the highest accuracy (91.25%), outperforming other models like LSTM (88%), SVM (82.10%), and Logistic Regression (79.85%).

The findings confirm that positive sentiments often align with market uptrends, while negative sentiments correspond with downturns, establishing a strong correlation between social emotions and financial market movements. Hence, incorporating sentiment-based analytics into market prediction systems can significantly enhance investment decision-making, risk assessment, and business forecasting.

Future work may include expanding the model to handle multilingual data, integrating real-time market APIs, and exploring transformer-based architectures like GPT and RoBERTa for higher predictive accuracy.

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