A Hybrid Long Short-Term Memory Model for Stock Trend Prediction Using Market Sentiment Mining and Social Media

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Abstract

This paper presents a novel hybrid prediction framework that seamlessly integrates bidirectional Long Short-Term Memory networks with multi-source sentiment analysis for enhanced stock market forecasting. While conventional approaches typically treat technical indicators and sentiment signals as separate analytical domains, our architecture captures their intricate interrelationships through an attention-enhanced neural network mechanism. The model processes a sophisticated feature set comprising technical indicators, market microstructure metrics, and sentiment scores derived from financial news and social media using domain-specific language models. Empirical evaluation across diverse market conditions demonstrates the hybrid model's superior predictive capacity, achieving a 31.2% reduction in root mean squared error compared to traditional LSTM approaches and a direction accuracy of 76.85%. Notably, during periods of extreme market volatility such as the COVID-19 crash, the model maintained robust performance (72.3% directional accuracy versus 58.1% for technical-only approaches). Ablation studies reveal that while technical indicators remain fundamental to prediction accuracy, sentiment features contribute approximately 32% of the model's predictive power, with news sentiment exhibiting stronger correlation with medium-term returns than social media signals. The ensemble prediction approach enables meaningful uncertainty quantification through confidence intervals that appropriately adapt to market conditions. This research advances both theoretical understanding of sentiment-price dynamics and practical implementation of deep learning for financial forecasting, offering particular value for event-driven trading strategies and volatility-adaptive portfolio management.

Keywords

Bidirectional LSTM, Stock Market Prediction, Sentiment Analysis, Hybrid Deep Learning, Financial Time Series, Market Volatility, Social Media Mining.