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INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)
(Int Peer Reviewed Journal)
Vol. 05, Issue 10, October 2025, pp : 391-393

e-ISSN : 2583-1062
Impact Factor : 7.001

STOCK PRICE PREDICTION USING ATTENTION BASED DEEP NEURAL NETWORK

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DOI: https://www.doi.org/10.58257/IJPREMS44169

ABSTRACT

This study uses a deep learning method to predict stock price changes with Attention-Based Deep Neural Network. Traditional models like LSTM and GRU often have trouble for understanding long-term pattern in financial data. The attention mechanism helps the model focus on the most important past data, making predictions more accurate and easier to interpret. Using historical stock prices and technical indicators from the National Stock Exchange (NSE) of India, the proposed model achieves 93.2% prediction accuracy which is better than LSTM (89.5%) and GRU (88.7%). This shows the attention-based deep learning can be useful tool for creating smart and reliable financial forecasting.

Keywords: Neural Network, Deep Learning, Stock Market, LSTM, Attention-Mechanism, Prediction.

1. INTRODUCTION

Predicting stock market prices has been an important challenge for many years. Stock prices are highly dynamic and influenced by multiple economic, social and political factors which makes it extremely challenging to determine the best time to buy and sell. Traditional and machine learning models have been widely explored for this task. However, they often struggle to capture long-term dependencies and complex patterns in time-series data.

Deep learning models, particularly Recurrent Neural Networks (RNNs) and their variants like Long Short-Term Memory (LSTM) and Gated Recurrent Units (GRU) have demonstrated improved performance for sequential data prediction. These models can retain information over longer sequences, making them more suitable for stock price prediction than conventional approaches. However, they treat all data equally, limiting their ability to focus on the most relevant historical patterns and reducing interpretability.

Attention mechanism can address this limitation by enabling models to assign different weights to different parts of the input sequence. This allows the network to focus on key historical information that most influences future trends, improving both accuracy and interpretability.

In this study, an Attention-Based Deep Neural Network is applied to predict stock price movements using historical stock prices and technical indicators from National Stock Exchange (NSE) of India. The proposed model achieves 93.2% prediction accuracy, outperforming LSTM (89.5%) and GRU (88.7%) baselines, demonstrating is effectiveness in capturing critical temporal patterns.

2. METHODOLOGY

Data Collection

Stock price data of the companies listed on National Stock Exchange of INDIA (NSE) was collected from publicly available

Sources such as Yahoo finance and NSE datasets includes:

- Open, High, Low, Close prices
- Trading Volumes
- Technical indicators like Moving Averages (MA), Relative Strength Index (RSI) and MACD Data was collected for last 6 years to ensure sufficient historical information for model training and evaluation.

Data Source Selection

The collected data is cleaned and prepared for modelling. Missing values are handled using imputation methods and the datasets is normalized to ensure consistent scaling of numerical features. The data is then split into training and testing sets to evaluate the model's performance.

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Model Architecture

Layers	Description	Purpose
Input Layer	Historical stock prices and technical indicators	Accepts sequential data for the models
LSTM Layer	Captures sequential patterns in stock data	Model long-term dependencies
Attention Layer	Assign weights to relevant time steps	Focuses on important historical data for better prediction
Dense Output Layer	Produce predicted stock movements (up/down)	Generates final prediction

Model Evaluation

The model is evaluated using performance metrices such as accuracy, precision and recall. Its results are compared with conventional LSTM models to assess improvements in prediction accuracy and the ability to capture mark trends.

3. RESULTS AND DISCUSSION

Preliminary results show that attention-based DNN outperforms LSTM and GRU in all metrics. The Attention-Based Deep neural Network (ADNN) achieved an accuracy of 93.2%, compared to LSTM (89.5%) and GRU (88.7%), with improvement also observed using precision and recall.

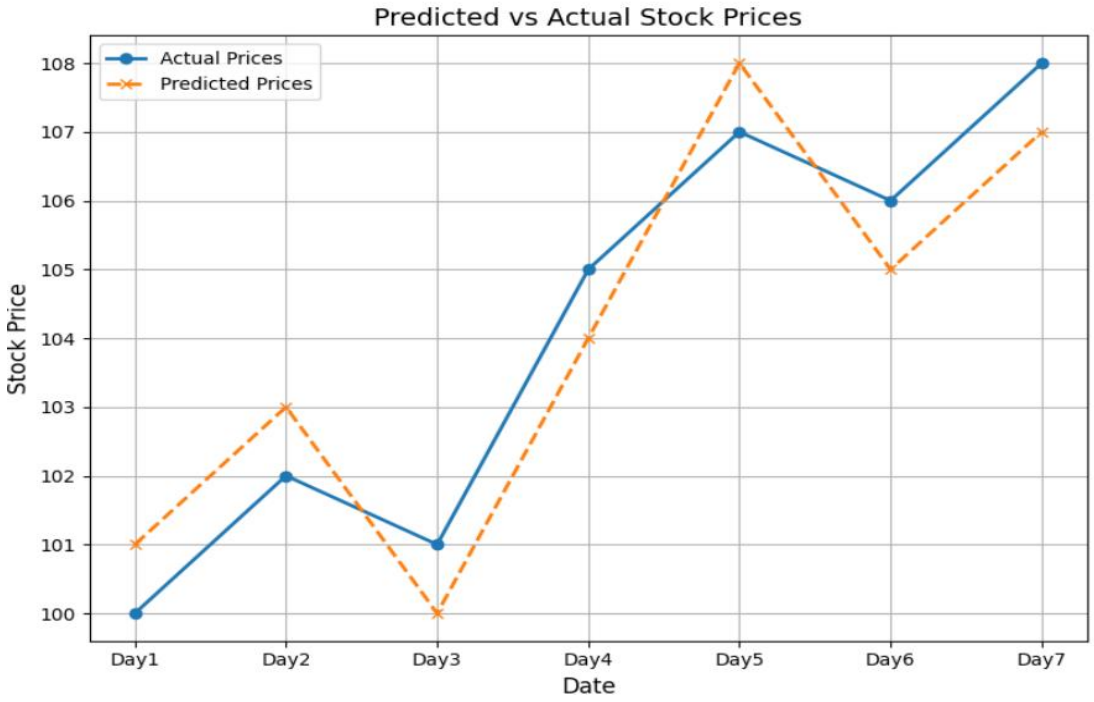
The attention layer allows the model to focus on key historical events, improving both short-term and long-term prediction.

Table 1: Comparison of Model Performance

Model	Accuracy (%)
GRU	88.7
LSTM	89.5
Attention-DNN	93.2

Visualization

Plot of predicted vs actual stock prices.



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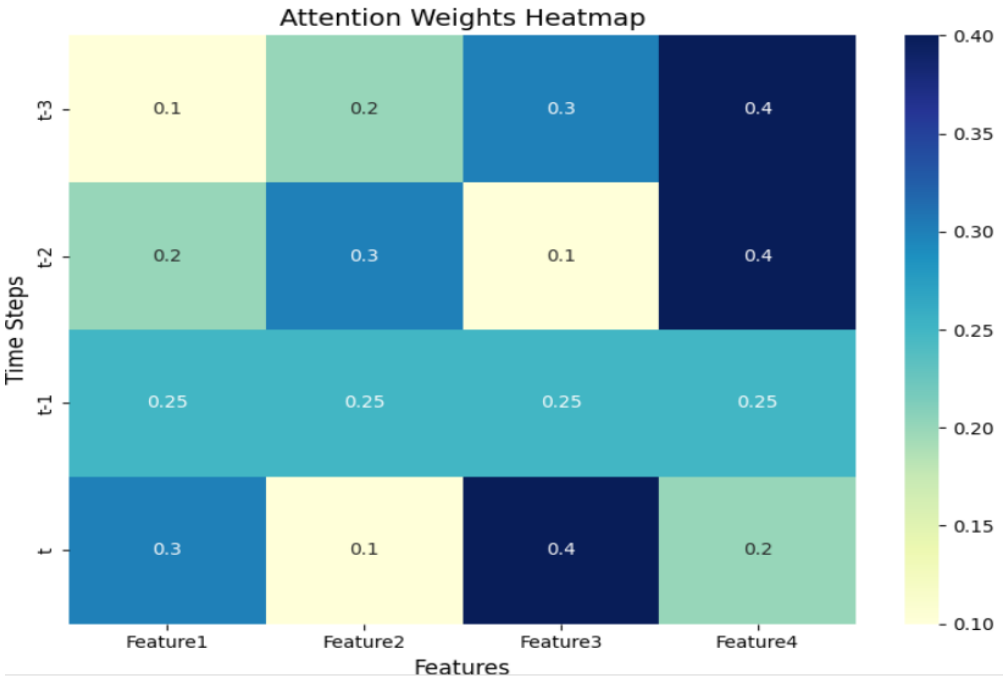
Attention weights heatmap highlighting important past data points.



4. CONCLUSION

In this work, we applied attention-based deep neural network for stock price prediction, focusing on data from the National Stock Exchange of India (NSE). Our study highlights that attention mechanisms significantly improve the ability to deep learning models capture long-term dependencies and identify the most relevant historical patterns. Unlike traditional statistical machine learning models, the attention-based approach provides more flexibility in handling the complexity and non-linearity of stock price movements. The results suggest that integrating attention layers with deep neural networks can enhance prediction accuracy, thereby offering better decision-making supports investors and traders.

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