Stock Price Prediction Using L.S.T.M. Neural Network

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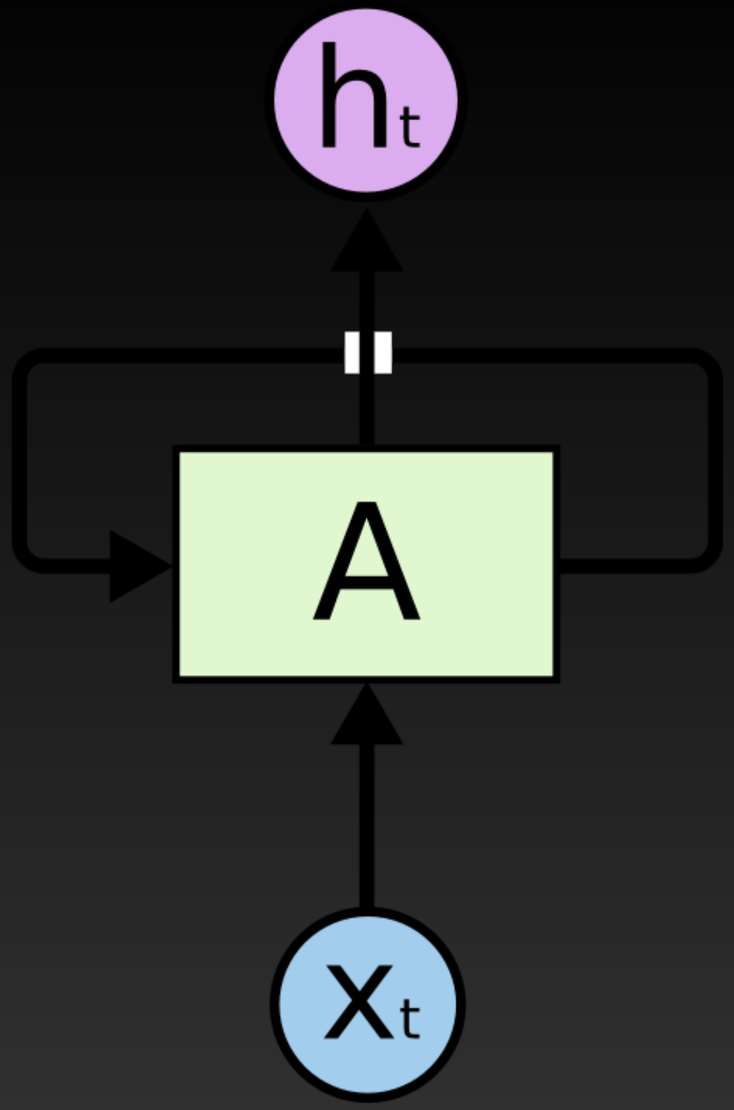
Introduction

In today's rapidly evolving financial landscape, accurate stock price prediction is a vital component of effective investment and trading strategies. Welcome to our presentation on "Stock Price Prediction Using LSTM Neural Networks."

We'll explore how LSTM neural networks, a type of recurrent neural network (RNN), have revolutionized the field of time series analysis. These networks possess memory, enabling them to capture intricate patterns and dependencies in historical stock price data. As we dive into LSTM's capabilities, you'll gain an appreciation for its unique ability to discern trends and make predictions in dynamic financial markets.



Recurrent Neural Network

Understanding Stock Data

High: The highest price a stock reached during a specific trading period, typically a day. On a candlestick chart, it is represented by the upper shadow or wick . (In the above figure refer to “high(2)”)

Low: The lowest price a stock traded at during the same period. It's shown on a candlestick chart as the lower shadow or wick . (In the above figure refer to “low(3)”)

Open: The price at which a stock started trading at the beginning of the period, often the trading day. On a candlestick chart, it's depicted as the thin horizontal line to the left of the candle body.

Close: The final price at which a stock ended the trading period. It is shown as the thin horizontal line to the right of the candle body on a candlestick chart . (In the above figure refer to “close(4) ”)

Technical Indicator's

Technical indicators are heuristic or pattern-based signals produced by the price, volume, and/or open interest of a security. Technical indicators can be used to predict future price movements of a security and identify possible trends. These indicators can broadly be categorised into two types:

Lagging Indicators

These indicators provide delayed feedback i.e they give a signal once the price movement has already passed or is in progress. Lagging indicators can be used to confirm a price trend which has already initiated.

Leading Indicators

These indicators are used to predict the future direction of a price movement. Leading indicators are used to identify potential trends in the future and enter the market accordingly.

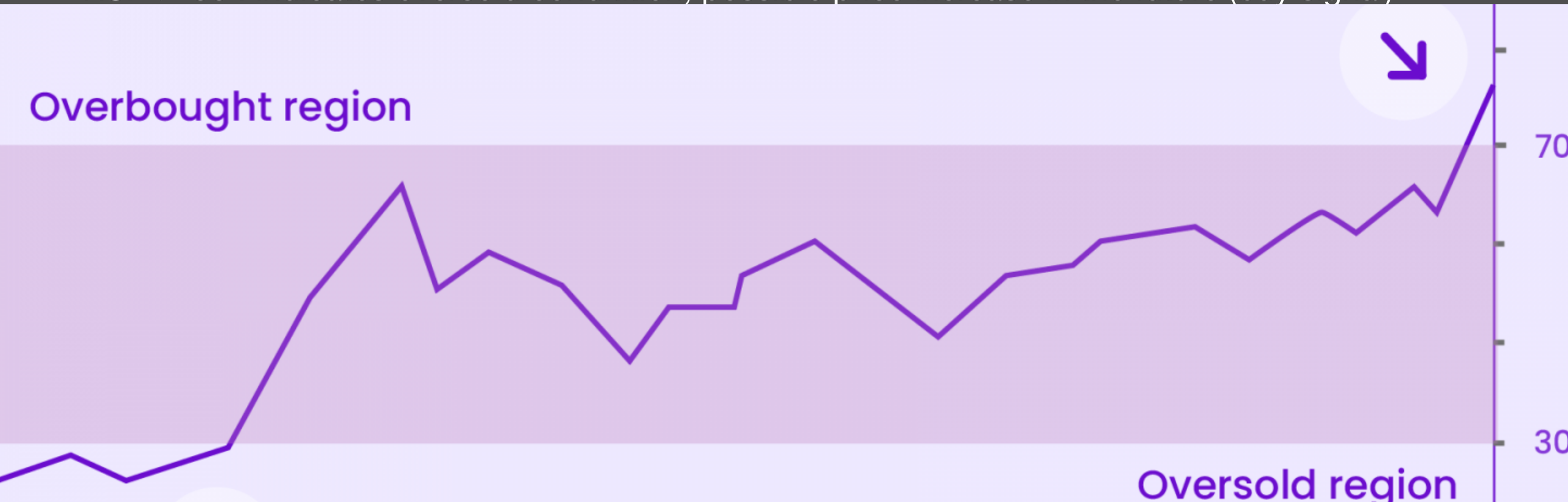
For the purpose of this model, a combination of both leading as well as lagging technical indicators will be fed into the network in order to follow price trends once they are in place as well as predict future trends and forecast the price accurately.

Relative Strength Index (RSI)

RSI is a momentum indicator which measures the speed and magnitude of a security's recent price changes. It is used to evaluate overpriced or underpriced conditions of a stock price and can predict possible trend reversals in the future. It is an oscillator which ranges between 0 and 100.

Traditionally,

- RSI >= 70 : indicates overbought condition, possible price drop in the future (sell signal)
- RSI <= 30 : indicates oversold condititon, possible price increase in the future (buy signal)



Williams %R (WPR)

WPR is also a momentum indicator which is used to measure overbought and oversold levels of a stock price. It takes a different approach than the RSI and compares a stock's closing price to the high-low range over a specified lookback period. This is also an oscillator, and values range between -100 and 0.

Traditionally,

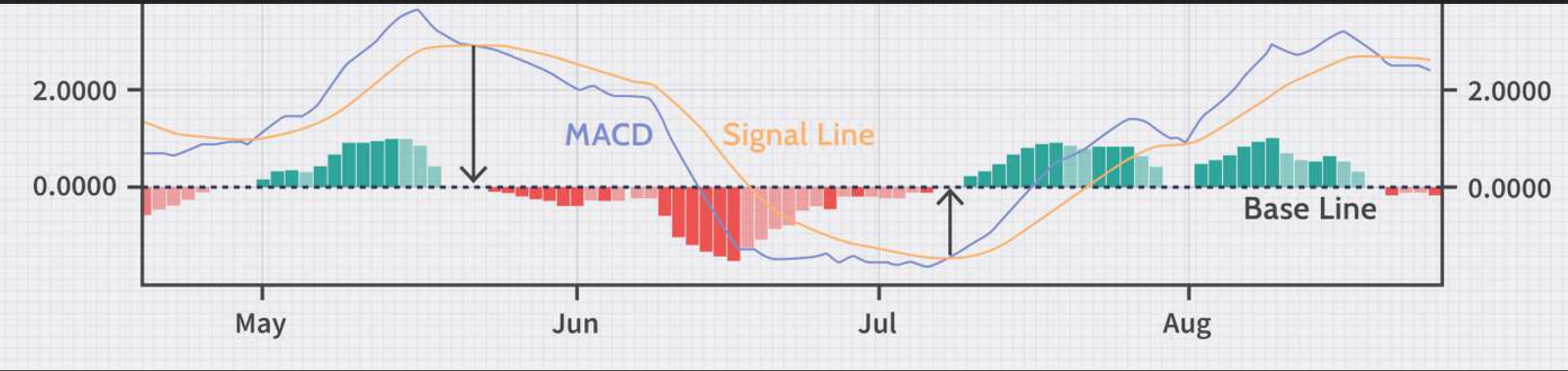
- WPR >= -20 : indicates overbought condition, possible price drop in the future (sell signal)
- WPR <= -80 : indicates oversold condititon, possible price increase in the future (buy signal)

Volume Weighted Average Price (VWAP)

VWAP is a type of moving-average indicator which incorporates both stock price as well as volume data. It can be used to observe the trend which the stock price might be currently following. VWAP can prove to be a better alternative to typical moving averages as it gives more significance to the price levels at which there is greater volume of trade.

Moving Average Convergence-Divergence (MACD)

MACD is a trend-following momentum indicator which shows the relationship between two exponential moving averages (EMAs) of a stock's price. It is typically calculated by subtracting the 26-period EMA from the 12-period EMA. Positive/negative values of the MACD are used to identify uptrends/downtrends. When there is a rapid rise/fall in the MACD level, it usually indicates overbought/oversold levels and can result in possible price corrections.



Working of L.S.T.M.

Recurrent Neural Networks

Input Layer:

The input layer, denoted as **lstm_input**, serves as the neural network's entry point for historical stock price information. It accepts input data in the form of a time series, where the shape is determined by the number of historical data points considered (**backcandles**) and the number of features used for prediction (**features**). This layer acts as the starting point for processing sequential data and sets the stage for subsequent transformations.

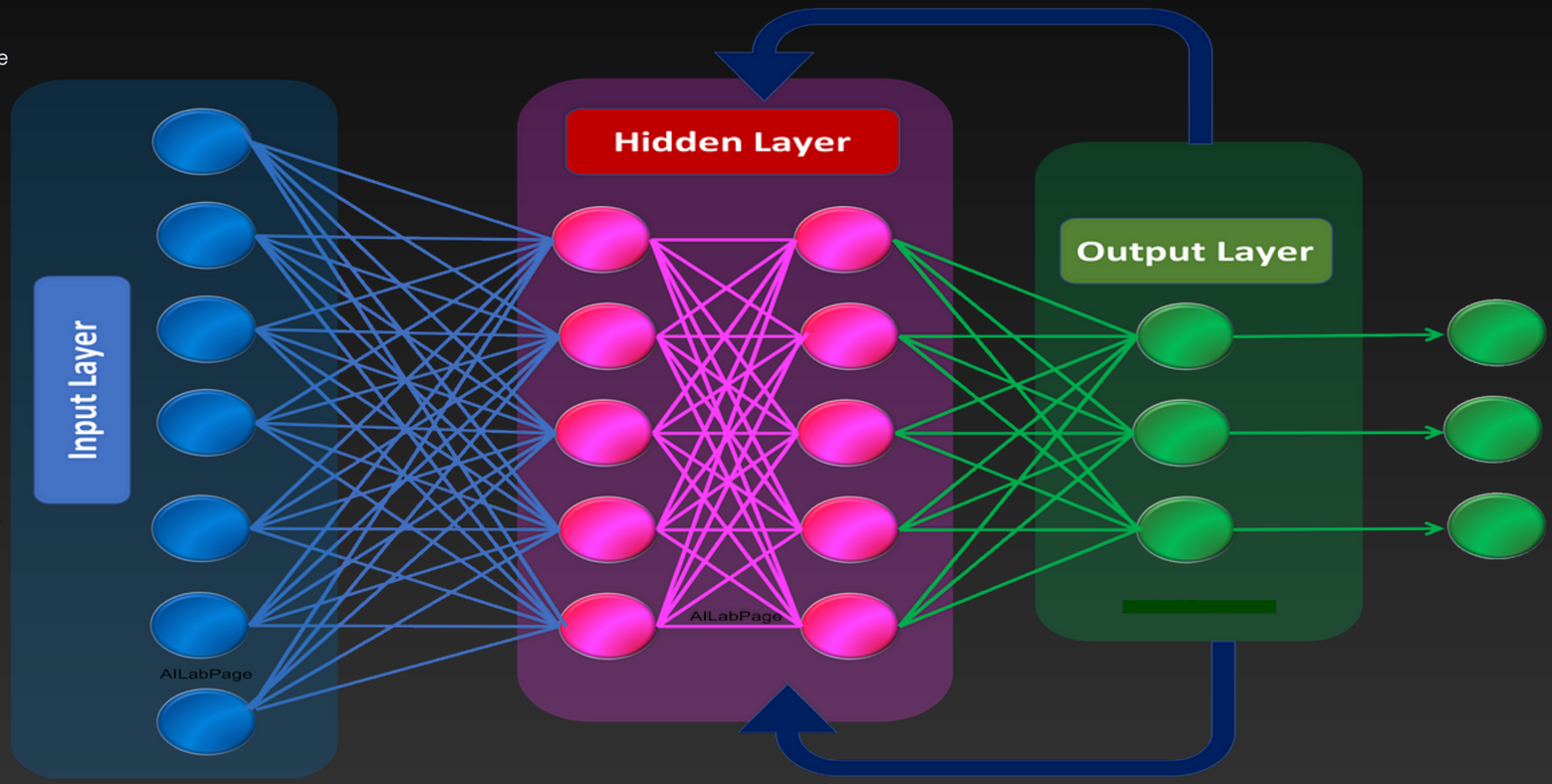
Hidden Layers:

In this model, two Long Short-Term Memory (LSTM) layers, named **firstLSTM_layer** and **secondLSTM_layer**, function as hidden layers. LSTMs are well-suited for processing sequential data, making them a suitable choice for stock price prediction. A dense layer with 64 units and a Rectified Linear Unit (ReLU) activation follows the LSTM layers, enhancing the information learned from the sequential data. To mitigate overfitting, a dropout layer with a 20% dropout rate is inserted after each LSTM layer (**dropout1** and **dropout2**). These hidden layers collectively transform the input data into a more informative representation for accurate stock price predictions.

Output Layer:

The output layer consists of a single neuron, reflecting the nature of predicting a single value—the future stock price. Employing a 'linear' activation function in this layer ensures that the output provides continuous predictions without undergoing any non-linear transformations. The output layer is where the final prediction is generated, signifying the forecasted future stock price.

Compilation and Training:
The model is compiled using the Adam optimizer, setting up the neural network for training. The mean squared error (MSE) is chosen as the loss function to measure the model's prediction accuracy. The training process, executed with the **fit** method, utilizes historical data (**X_train** and **Y_train**) with a batch size of 15 and runs for 20 epochs. The shuffle parameter is set to True, ensuring the model encounters data in varied orders during each epoch, enhancing learning robustness.



Prediction by our model

Model Performance Evaluation:

1.)Root Mean Square Error (RMSE):
RMSE is a crucial metric for assessing the predictive performance of our LSTM model. It measures the accuracy of our stock price predictions by calculating the square root of the mean of the squared percentage differences between predicted and actual stock prices.
A low RMSE value indicates that the model's predictions are close to actual values. Our RMSE is approximately 5.2%, which is indicative of high predictive accuracy.
2.)Correlation:
Correlation measures the linear relationship between actual and predicted stock prices. In our case, the correlation between actual and predicted values is approximately 0.96, indicating a strong positive correlation.

Conclusion:
The impressive model performance metrics, including a low RMSE and a high correlation coefficient, highlight the accuracy and effectiveness of our LSTM-based stock price prediction model. The cointegration analysis further substantiates that the model is proficient in capturing long-term relationships within stock price data. This combination of predictive accuracy and cointegration strengthens the model's reliability for real-world applications, making it a valuable tool for investors, traders, and financial analysts.

THANK YOU