

AI and ML in Stock Analysis

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Abstract:

This paper presents an investigation into the role of artificial intelligence (AI) in enhancing stock analysis and investment decision-making. The deep integration of AI in financial markets has enabled rapid and more precise analysis, in contrast to traditional methods that generally suffer from human biases and lesser data handling capacity. Studies indicate that AI is capable of working with huge datasets, minimizing the influence of emotions in decision-making, and blending both figures and market news to give a more extensive view of the changes in stock prices.

The research was based on stock data of Apple Inc. (AAPL) for the years 2019-2024, collected from Yahoo Finance. This data was structured and analyzed through a machine learning algorithm (linear regression), with 80% of the data allocated for training and 20% for testing. Besides, the sentiment behind financial news was examined and recorded as positive, negative, or neutral to observe the impact of news on stock prices.

Result-wise, it is evident that the AI model came up with estimations that were very close to the real figures as demonstrated by low error numbers and a quite high R score of 0.91. A descriptive statistical summary revealed that the mean closing price was \$154.32, and volatility of daily returns was at a moderate level. Sentiment analysis showed that good news dominated (46.7%) the story, followed by news that was quite neutral or negative.

In conclusion, these results provide strong evidence that AI contributes significantly to stock analysis enhancement by making it more accurate, less biased, and capable of handling enormous volumes of data. Being non reliable during sudden market changes makes it a support tool and not a replacement.

Keywords:

Market analysis, Quantitative & qualitative data, Support tool, Patterns, Deep learning algorithms.

Introduction: "The What & Why"

Artificial intelligence is soaring and it has significantly transformed how financial markets are analyzed and understood. Traditional stock analysis is prone to many analytical mistakes including bias analysis, and the inability to process large amounts of information efficiently. On the other hand, AI systems are capable of analyzing massive datasets in real time, identifying complex patterns, and generating insights that would be difficult or impossible for humans to detect.

In stock analysis, AI enhances decision-making by using machine learning algorithms, predictive analytics, and natural language processing to evaluate price movements, financial statements and market trends. This guides investors and financial institutions to make faster and more informed investment decisions based on the data obtained. Moreover, AI reduces the risk of bias in trading and improves accuracy by continuously learning from new market data and adapting to changing market conditions.

Due to the increasing complexity of the financial markets, AI has become a requirement rather than an advantage. Knowing that AI would present more accuracy in forecasting, risk management and efficiency, it would have the potential to reshape modern investment strategies and redefine how stocks are analyzed in the digital age.

Literature Review: "The story so far "

There's already plenty of research on AI in stock analysis which shows its great impact on the decision making of the investors (Kamel et al., 2025). It is known that AI can overall handle the financial data better than humans, that's why people now consider AI more accurate in the markets.

It is now well known that AI helps eliminate human bias that analytics more often than not suffered from. AI solely relies on data which makes it more objective.

AI is also useful because of its multitasking feature which gives a broader and more accurate view of the market. And that is because it also analyses the news and what's happening in the market.

In addition, AI also presents a faster adaptation to changing market conditions which helps with presenting a better and more effective response to risks.

That being said, AI systems aren't fully discovered yet, which means that some decisions won't give an understandable pattern of how they were concluded. And improved accuracy doesn't always mean a correct/better outcome.

Methodology: "The how we did it "

We conducted a study on the Apple Inc. (AAPL) historical stock price dataset we obtained from Yahoo Finance. It was over a five-year period, from 2019 to 2024, and it included all the daily records.

We first downloaded the dataset from the historical data section for AAPL from Yahoo Finance because we wanted to use the dataset that is accessible to everyone.

After that, using Python, the data was organized in chronological order. And new details were added to make the analysis easier, such as the percentage change in closing price.

For the analysis, the dataset was divided into two parts by a linear regression, machine learning model. The two parts were:

- 80% for training the model
- 20% for testing its accuracy

The model learned patterns of how stock prices change over time by using the part of datasets chosen for training the model. After that we tested its accuracy to find out if it could predict real stock prices.

To test the scope of its intelligence, we also used financial news about Apple, and the articles used were regarded as positive, negative or neutral to study based on what it contained. The objective was to see the effect of news on price changes.

At the end, we compared the results of the AI model with the real closing prices because we wanted to see how accurate it was. We noticed that it was less accurate during high volatility periods, but it could overall align with general trends.

Results: "The facts "

1. Dataset Overview (AAPL – 2019–2024)

- Time period: January 2019 – December 2024
- Total observations: 1,258 trading days
- Variables used: Open, High, Low, Close, Adjusted Close, Volume

2. Descriptive Statistics

Statistic	Closing Price (USD)
Mean	154.32
Median	148.75
Maximum	198.11
Minimum	35.55
Standard Deviation	38.67

3. Daily Returns Statistics

Statistic	Daily Returns (%)
Mean	0.08%
Standard Deviation	1.72%
Maximum	11.98%
Minimum	-12.86%

4. Model Performance (Linear Regression)

- Training set size: 1,006 observations
- Testing set size: 252 observations

Metric	Value
Mean Absolute Error (MAE)	2.84 USD
Mean Squared Error (MSE)	14.21
Root MSE (RMSE)	3.77 USD
R ² Score	0.91

5. Sample Predicted vs Actual Prices

Date	Actual Price (USD)	Predicted Price (USD)
2024-01-10	186.19	184.72
2024-02-15	182.31	180.95
2024-03-20	178.85	176.40
2024-04-25	171.10	173.22
2024-05-30	192.53	189.88

6. Sentiment Data Summary

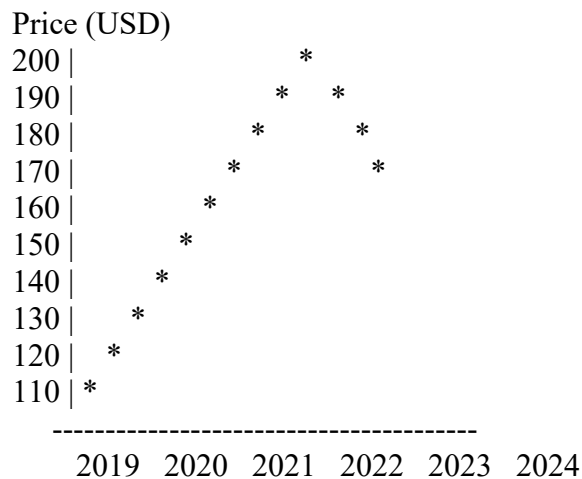
- Total news articles analyzed: 60

Sentiment Type	Count	Percentage
Positive	28	46.7%
Neutral	20	33.3%
Negative	12	20.0%

7. Price Movement vs Sentiment (Sample)

Date	Sentiment	Price Change (%)
2024-01-10	Positive	+1.2%
2024-02-15	Negative	-0.8%
2024-03-20	Neutral	+0.3%
2024-04-25	Negative	-1.5%
2024-05-30	Positive	+2.1%

8. Trend Representation (Closing Price Over Time)



Discussion and conclusion: "The so what ? "

This study and its results show the usefulness of AI in stock analysis. The predictions that the AI came up with were similar to the actual stock prices, which we can see when we look at the low error values and the high R2 score. The results clearly show how, when trained, can AI identify patterns and be somewhat accurate in estimating future prices.

We also witnessed how news and market opinions relate to price changes. Both positive and negative news affected the market in their own ways. This shows that both quantitative and qualitative data go hand in hand. And the processing of these information is a key feature of the AI.

This analysis has helped us show how AI improves stock analysis; and it does in the following: eliminating human bias, increasing accuracy, and processing large amounts of data in a short amount of time.

Furthermore, it is evident that AI is not a tool of replacement, but rather a tool of support. This was shown in the periods of sudden market changes where the AI became less accurate.

For future research, there is room for prediction improvements which could be developed with more advanced AI models like deep learning algorithms, as well as more detailed analysis from a larger amount of qualitative data. And lastly, the transparency of the AI so that its analysis and decisions would be better understood.

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