



# The Role of AI and Machine Learning in Modern Trading

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## Abstract

*"If you dream it," states Walt Disney "you can make it."*

*Many great people dreamed of making the world better and easier for humans. We are in an era where we can sit in a place and do many things (like shop, order food, work, play, entertain ourselves, etc.). All these things were not that easy a few decades ago until technology was invented in our lives.*

*Talking in particular about the finance sector, many advancements have been made. These advancements can be credited to the integration of Artificial Intelligence (AI) and machine learning (ML) with the finance sector.*

*Artificial intelligence is a contemporary concept that is widely talked about. It's a term that is heard quite often in our day-to-day lives.*

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Jeff Bezos pointed out that we're at the beginning of a golden age of AI and are solving problems that were once in the realm of science fiction.

But AI and ML: What are they?

Artificial intelligence is the science and engineering of intelligent machines. Machines can calculate, reason, adapt to different situations, and solve complex problems. Machine learning is a part of AI that allows systems to improve without being explicitly programmed.

## How are AI and ML used in trading?

Artificial intelligence and machine learning have revolutionized the finance sector, particularly in modern trading. AI algorithms are capable of analyzing vast amounts of data and making complex predictions, allowing traders to make more informed decisions. ML algorithms, on the other hand, can learn from historical data and adapt their strategies accordingly, increasing the accuracy of trading models. These technologies have greatly improved efficiency and profitability in the finance industry, making it easier for individuals to engage in trading activities and navigate the complex market landscape.

## Market analysis

Market analysis is an important process that provides businesses, traders, and policymakers with critical insights into the dynamics of a particular market. It involves a comprehensive examination of factors that affect supply and demand, pricing, and various market trends. Its primary goal is to gather relevant data and transform it into actionable intelligence, guiding stakeholders in making the right decisions. As technology continues to evolve, AI and ML play an important role in market research.

## Predictive Analysis

AI and ML can analyze historical data to identify patterns and trends, enabling traders to make predictions about future price fluctuations. Predictive models like time-series analysis, help in forecasting market movements and optimizing trading strategies.

We will prepare a predictive model using Python and historical data of an Indian retail corporation that operates a chain of supermarkets in India.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Date	Open	High	Low	Close	Adj Close	Volume							
2	01-04-2017	640.05	806.8	628.05	736.5	736.5	13425819							
3	01-05-2017	736.9	825.1	692.5	743	743	5774202							
4	01-06-2017	745	839	745	814.6	814.6	3726833							
5	01-07-2017	810.1	964.25	809	917.9	917.9	4771989							
6	01-08-2017	919	1068	861	1039.6	1039.6	3197368							
7	01-09-2017	1045	1217	983.1	1077.6	1077.6	4198409							
8	01-10-2017	1091	1289	1072	1138.2	1138.2	4245466							
9	01-11-2017	1140.15	1178.95	1085.5	1116.7	1116.7	1609372							
10	01-12-2017	1120.5	1193.9	1085.75	1180	1180	4089261							
11	01-01-2018	1190	1283.15	1127.1	1179.65	1179.65	2366121							
12	01-02-2018	1185.1	1387	1083.15	1347.45	1347.45	1949114							
13	01-03-2018	1348	1385	1272	1327	1327	1778114							
14	01-04-2018	1327	1534	1327	1493.15	1493.15	1860455							
15	01-05-2018	1500	1606	1337.05	1565.5	1565.5	8896716							
16	01-06-2018	1535	1622.05	1420	1482.1	1482.1	1958520							
17	01-07-2018	1485.5	1663.8	1485.5	1652.75	1652.75	1444823							
18	01-08-2018	1660	1682	1548.2	1605.65	1605.65	1009862							
19	01-09-2018	1607	1617.1	1350	1394.9	1394.9	976965							
20	01-10-2018	1401.9	1422.05	1126.95	1338.65	1338.65	1779489							
21	01-11-2018	1353.9	1496.9	1344.55	1488.3	1488.3	955520							
22	01-12-2018	1499	1696.15	1473	1607.7	1607.7	1093331							
23	01-01-2019	1611	1621.15	1346.5	1372.45	1372.45	1604472							

Figure 1. Historical Dataset (taken monthly since 2017)

### Dataset Information

The used dataset has been taken from Yahoo finance, a data repository. It contains historical stock price data. The data has been collected on a monthly basis since the year 2017. It contains date of stock data entry (Date), opening and closing price of the stock (Open, Close respectively), highest and lowest prices reached on the given date (High, Low respectively), adjusted closing price (Adj Close) and the number of shares traded on the given date (Volume).

We plan to employ linear regression as a method to forecast the upcoming volume.

Linear Regression is one of the most fundamental statistical regression methods stating a linear function must be incorporated to understand or predict the relationship between an independent variable (say  $y$ ) on one or more dependent variables (say  $x$ ).

Simple linear regression is used when there is only one independent variable, and we believe that the relationship between this independent variable and the dependent variable is approximately linear.

```
File Edit Format Run Options Window Help
# Import necessary libraries
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
import numpy as np

# Load the dataset
data = pd.read_csv(r'C:\Users\DELL\Downloads\sales_data.csv')

# Convert Date column to datetime
data['Date'] = pd.to_datetime(data['Date'], format='%Y-%m-%d')

# Optional: Sort by Date
data.sort_values(by='Date', inplace=True)

# Explore the data
print(data.head()) # Check the first few rows to understand the structure of the data

# Select relevant columns
X = data[['Open']].values # Independent variable (Open prices)
y = data[['Close']].values # Dependent variable (Close prices)

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=0)
```

```

# Create and train the Linear Regression model
model = LinearRegression()
model.fit(X_train, y_train)

# Make predictions on the testing set
y_pred = model.predict(X_test)

# Evaluate the model
print("Mean Squared Error:", mean_squared_error(y_test, y_pred))
print("R2 Score:", r2_score(y_test, y_pred))

# Visualize the results
plt.scatter(X_test, y_test, color='orange', label='Actual')
plt.plot(X_test, y_pred, color='purple', linewidth=2, label='Predicted')
plt.title('Open vs Close Prices')
plt.xlabel('Open Price')
plt.ylabel('Close Price')
plt.legend()
plt.show()

# Predict future prices
future_open_prices = np.array([[1700], [1750], [1800], [1850], [1900], [1950], [2000]]) # replace with actual future open prices
future_close_predictions = model.predict(future_open_prices)

print("Future Open Prices:", future_open_prices.flatten())
print("Predicted Future Close Prices:", future_close_predictions)

```

Figure 2. Python Code

Here's a breakdown of what the script does:

1. Loads the data from the CSV file into a pandas Data Frame.
2. Explores and visualizes the data using matplotlib.
3. Splits the data into training and testing sets.
4. Initializes a Linear Regression model, trains it on the training data, and makes predictions on the testing data.
5. Evaluates the model's performance using mean squared error.
6. Visualizes the regression line along with the data points.

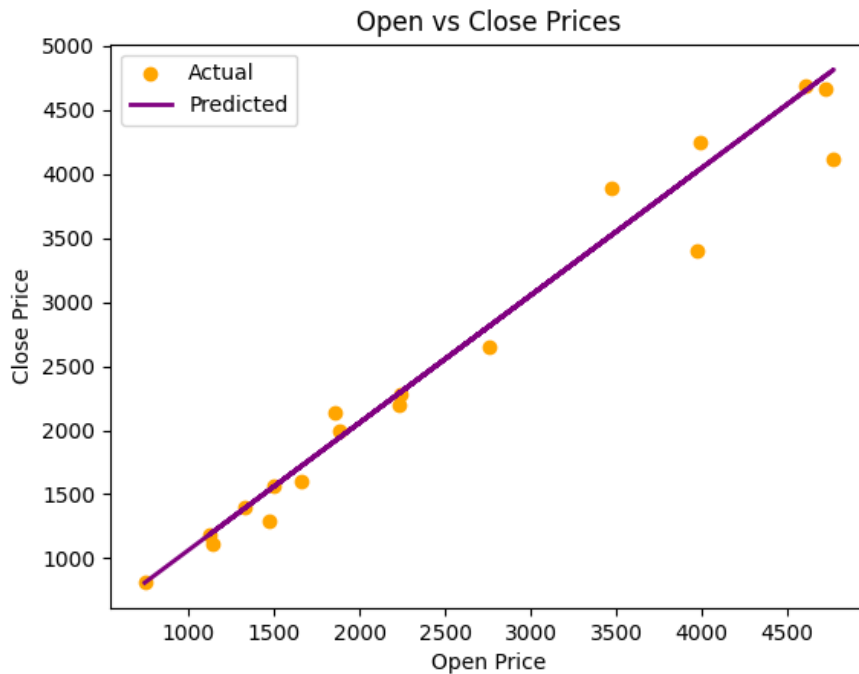


Figure 3. Scatter plot graph - Open vs Close Prices

7. Predicts the future open and close prices.

```

Mean Squared Error: 68270.1896188484
R2 Score: 0.9579955726032054
Future Open Prices: [1700 1750 1800 1850 1900 1950 2000]
Predicted Future Close Prices: [1760.06399571 1809.81070687 1859.55741803 1909.30412919 1959.05084035
 2008.79755151 2058.54426267]

```

Figure 4. Predicted Future Open and Close prices

- Mean Squared Error (MSE): It shows the closeness of predicted value from actual number. It is usually considered that if the MSE value is lower, the model is better.
- R<sup>2</sup> Score: One important observation is on R<sup>2</sup> Score which indicates proportion of the variance in dependent variable that is predictable from independent variable where a score near to 1 represents a good fit.
- A scatter plot to visually assess the model accuracy (actual vs predicted close price).
- Future Predictions: This section predicts future close prices based on new open prices using the trained model.

Customer journey analysis	Consumer Segmentation	Image and video analysis
AI and ML algorithms can analyse multiple touchpoints and interactions throughout the customer journey to identify critical moments, pain points, and areas of opportunity. By understanding the customer journey in detail, market researchers can optimize marketing strategies and drive customer loyalty.	AI-driven market research clustering algorithms group consumers into different segments based on similarities in their demographics, behaviours, and preferences. Market researchers then tailor marketing strategies and messages to each segment, improving campaign effectiveness and enhancing customer targeting efforts.	With the rise of visual content on social media and other platforms, AI and ML-powered image and video analysis tools have become invaluable for market researchers. These tools can automatically analyse and categorize visual content, detect brand logos, and recognize objects, scenes, and emotions depicted in images or videos, providing deeper insights into how customers interact with visual media.
Voice and speech analysis	Social media listening	Chatbots and virtual assistants
Voice and speech-enabled AI marketing analytics tools allow market researchers to analyse and extract valuable insights from recorded phone calls, customer support interactions, and voice-based survey responses.	AI-driven social media listening tools check and analyse conversations on various social media platforms. These tools can identify trending topics, monitor brand mentions, track sentiment, and provide valuable insights into consumer preferences, and emerging market trends.	Chatbots and virtual assistants are used in market research to engage with consumers, collect data, and provide personalized recommendations. Almost 80% of the market already is using chatbots to conduct surveys, answer customer inquiries, and capture valuable insights from interactions, enabling organizations to gather data at scale and improve customer engagement.
Algorithmic trading	Demand forecasting	Concept testing and product innovation
AI and ML algorithms automate the execution of trades based on predefined standards, enhancing the trading process and eliminating emotional biases.	AI-driven demand forecasting models leverage historical sales data, and market trends, to predict future demand for products or services. Precise forecasting helps organizations increase inventory levels, and production planning, and reduce costs.	AI and ML-powered concept testing tools enable market researchers to test and evaluate new product concepts or features before launch.

Table 1. Different ways to conduct market analysis

**Conclusion**

We have discussed how AI and Machine Learning can be utilized in modern trading. To evaluate the performance of our model, we have used a few statistical parameters for the given system. With the help of statistical methods and machine learning algorithms, a model is proposed that helps financial analysts to understand and predict the stock prices. These predictions can be utilized by investors, policymakers and companies and help them in enhanced decision-making, strategic planning, risk management and profit maximization. In the above model we utilized dataset of a retail corporation and predicted stock performance based on several parameters like their historical data to better understand the future stock price trends.

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