Time Series Analysis And Forecastig For Stock Market

Download historical stock data from Alpha Vantage

```
import pandas as pd
import os

api_key = "your_alpha_vantage_key"
symbol = "AAPL"
url = f"https://www.alphavantage.co/query?
function=TIME_SERIES_DAILY&symbol={symbol}&outputsize=full&apikey={api
_key}&datatype=csv"

df = pd.read_csv(url)
df['timestamp'] = pd.to_datetime(df['timestamp'])
df.set_index('timestamp', inplace=True)
df = df.sort_index()
print(df.head())
# Save locally
os.makedirs("data", exist_ok=True)
df.to_csv("data/stock_data.csv")
```

	open	high	low	close	volume
timestamp					
1999-11-01	80.00	80.69	77.37	77.62	2487300
1999-11-02	78.00	81.69	77.31	80.25	3564600
1999-11-03	81.62	83.25	81.00	81.50	2932700
1999-11-04	82.06	85.37	80.62	83.62	3384700
1999-11-05	84.62	88.37	84.00	88.31	3721500

Preprocessing and Visualization

```
import matplotlib.pyplot as plt

# Load data
data = pd.read_csv("data/stock_data.csv", parse_dates=["timestamp"],
index_col="timestamp")

# Plot closing price
```

```
data["close"].plot(figsize=(12, 6), title="□ AAPL Closing Price")
plt.xlabel("Date")
plt.ylabel("Price")
plt.grid(True)
plt.show()
```

```
C:\Users\Pavithra\anaconda3\Lib\site-packages\IPython\core\
pylabtools.py:170: UserWarning: Glyph 128201 (\N{CHART WITH DOWNWARDS
TREND}) missing from font(s) DejaVu Sans.
  fig.canvas.print_figure(bytes_io, **kw)
```

ARIMA

```
from pmdarima import auto_arima
from sklearn.metrics import mean_squared_error, mean_absolute_error

train_arima = data["close"][:-30]
test_arima = data["close"][-30:]

model_arima = auto_arima(train_arima, seasonal=False, stepwise=True)
forecast_arima = model_arima.predict(n_periods=30)

plt.figure(figsize=(12,6))
plt.plot(train_arima, label="Train")
plt.plot(test_arima, label="Actual", color="green")
plt.plot(test_arima.index, forecast_arima, label="ARIMA Forecast",
color="red")
plt.title("ARIMA Forecast")
plt.legend()
```

```
plt.grid(True)
plt.show()

print("📊 ARIMA Evaluation:")
print("RMSE:", (mean_squared_error(test_arima, forecast_arima)))
print("MAE :", mean_absolute_error(test_arima, forecast_arima))

C:\Users\Pavithra\anaconda3\Lib\site-packages\sklearn\utils\
deprecation.py:151: FutureWarning: 'force_all_finite' was renamed to
'ensure_all_finite' in 1.6 and will be removed in 1.8.
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  warnings.warn(
C:\Users\Pavithra\anaconda3\Lib\site-packages\statsmodels\tsa\base\
tsa_model.py:836: ValueWarning: No supported index is available.
Prediction results will be given with an integer index beginning at
`start`.
  return get_prediction_index(
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'ensure_all_finite' in 1.6 and will be removed in 1.8.
  warnings.warn(
```
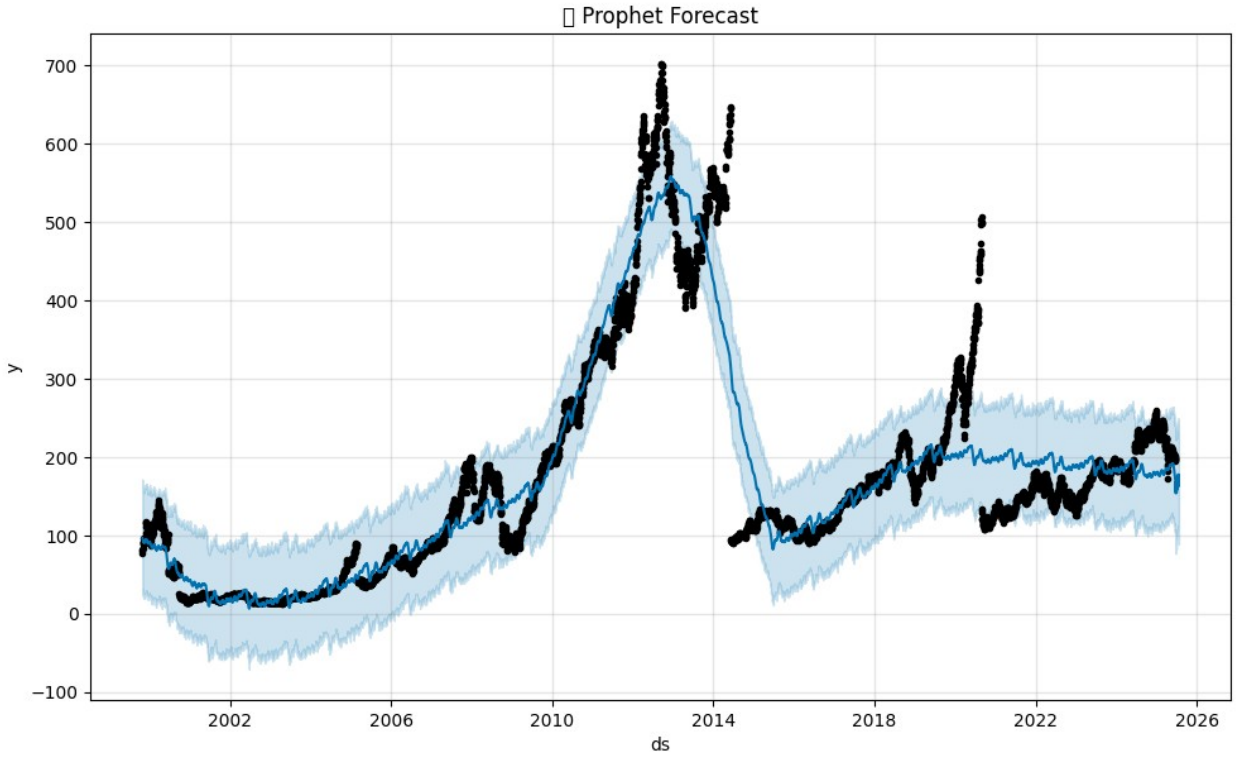

```
 ARIMA Evaluation:
RMSE: 64.04204666666665
MAE : 6.292666666666665
```

Prophet

```
from prophet import Prophet

df_prophet = data.reset_index()[["timestamp", "close"]]
df_prophet.columns = ["ds", "y"]

model = Prophet()
model.fit(df_prophet)

future = model.make_future_dataframe(periods=30)
forecast = model.predict(future)

model.plot(forecast)
plt.title(" Prophet Forecast")
plt.grid(True)
plt.show()
```

```
16:03:42 - cmdstanpy - INFO - Chain [1] start processing
16:03:54 - cmdstanpy - INFO - Chain [1] done processing
C:\Users\Pavithra\anaconda3\Lib\site-packages\IPython\core\
pylabtools.py:170: UserWarning: Glyph 128302 (\N{CRYSTAL BALL})
missing from font(s) DejaVu Sans.
  fig.canvas.print_figure(bytes_io, **kw)
```

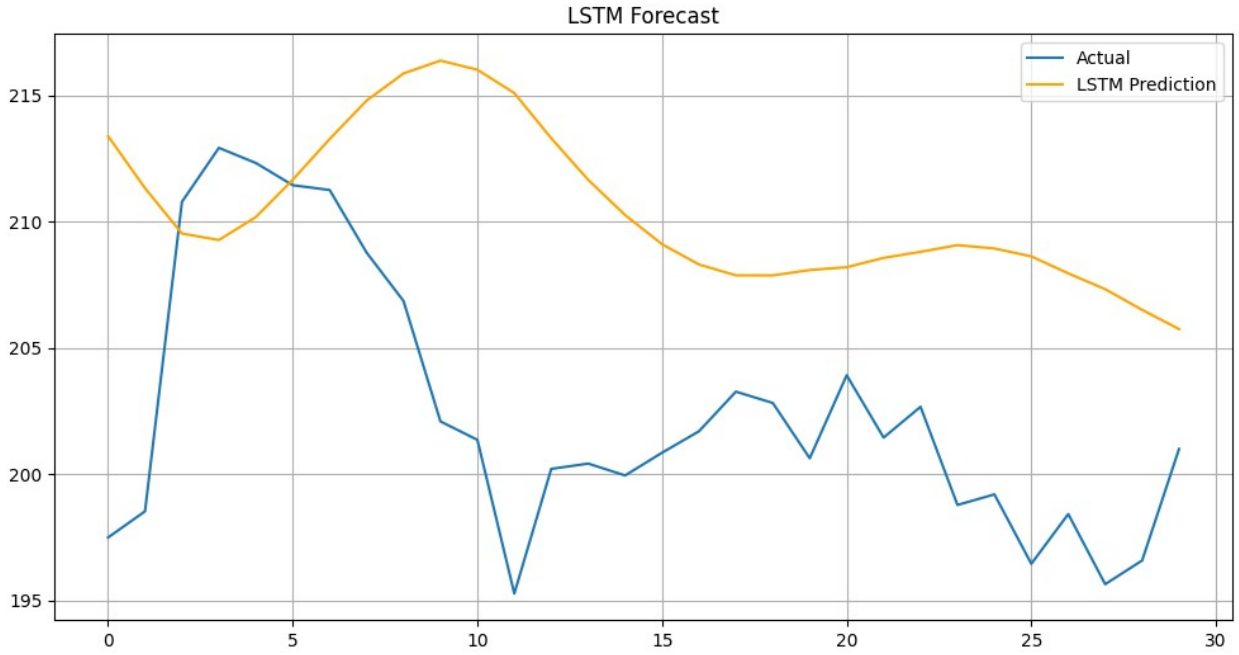


LSTM Model

```
import numpy as np
from sklearn.preprocessing import MinMaxScaler
from keras.models import Sequential
from keras.layers import LSTM, Dense, Dropout

# Prepare data
scaler = MinMaxScaler()
scaled_data = scaler.fit_transform(data["close"].values.reshape(-1,
1))

X, y = [], []
for i in range(60, len(scaled_data)):
    X.append(scaled_data[i-60:i, 0])
    y.append(scaled_data[i, 0])
X, y = np.array(X), np.array(y)
X = X.reshape((X.shape[0], X.shape[1], 1))

# Build model
model = Sequential()
model.add(LSTM(50, return_sequences=True, input_shape=(X.shape[1],
1)))
model.add(Dropout(0.2))
model.add(LSTM(50))
```

```
model.add(Dropout(0.2))
model.add(Dense(1))

model.compile(optimizer='adam', loss='mean_squared_error')
model.fit(X, y, epochs=5, batch_size=32)

# Predict next 30
inputs = scaled_data[-90:]
X_test = []
for i in range(60, 90):
    X_test.append(inputs[i-60:i, 0])
X_test = np.array(X_test).reshape(30, 60, 1)

#  Use correct model name here
predicted_lstm = model.predict(X_test)
predicted_lstm = scaler.inverse_transform(predicted_lstm)

# Compare with actual
actual_lstm = data["close"].values[-30:]

plt.figure(figsize=(12,6))
plt.plot(actual_lstm, label="Actual")
plt.plot(predicted_lstm, label="LSTM Prediction", color="orange")
plt.title("LSTM Forecast")
plt.legend()
plt.grid(True)
plt.show()
```

```
C:\Users\Pavithra\anaconda3\Lib\site-packages\keras\src\layers\rnn\
rnn.py:204: UserWarning: Do not pass an `input_shape`/`input_dim`
argument to a layer. When using Sequential models, prefer using an
`Input(shape)` object as the first layer in the model instead.
  super().__init__(**kwargs)

Epoch 1/5
200/200 ━━━━━━━━━━━━━━━━━━━━ 53s 86ms/step - loss: 0.0145
Epoch 2/5
200/200 ━━━━━━━━━━━━━━━━━━━━ 19s 95ms/step - loss: 0.0018
Epoch 3/5
200/200 ━━━━━━━━━━━━━━━━━━━━ 17s 84ms/step - loss: 0.0014
Epoch 4/5
200/200 ━━━━━━━━━━━━━━━━━━━━ 17s 85ms/step - loss: 0.0016
Epoch 5/5
200/200 ━━━━━━━━━━━━━━━━━━━━ 22s 107ms/step - loss: 0.0014
1/1 ━━━━━━━━━━━━━━━━━━━━ 2s 2s/step
```



Model Comparison

```
from sklearn.metrics import mean_squared_error, mean_absolute_error
import numpy as np

# □ Evaluation function
def evaluate(y_true, y_pred, model_name):
    rmse = np.sqrt(mean_squared_error(y_true, y_pred))
    mae = mean_absolute_error(y_true, y_pred)
    print(f"{model_name} Evaluation:")
    print(f"  □ RMSE: {rmse:.2f}")
    print(f"  □ MAE : {mae:.2f}\n")

# --------------------------
# □ Evaluate ARIMA
# --------------------------
# Ensure forecast_arima has 30 values (same as test_arima)
forecast_arima = model_arima.predict(n_periods=len(test_arima))
evaluate(test_arima, forecast_arima, "ARIMA")

# --------------------------
# □ Evaluate Prophet
# --------------------------
# Prophet actual and prediction (last 30 days)
model = Prophet()
model.fit(df_prophet)
future = model.make_future_dataframe(periods=30)
```

```
forecast_prophet = model.predict(future)

# Evaluation
actual_prophet = df_prophet["y"].values[-30:]
predicted_prophet = forecast_prophet["yhat"].values[-30:]
evaluate(actual_prophet, predicted_prophet, "Prophet")


# --------------------------
# □ Evaluate LSTM
# --------------------------
# Ensure shapes match: reshape predicted LSTM
actual_lstm = data["close"].values[-30:]
predicted_lstm = predicted_lstm.reshape(-1)  # from (30, 1) to (30,)
evaluate(actual_lstm, predicted_lstm, "LSTM")
```

```
C:\Users\Pavithra\anaconda3\Lib\site-packages\statsmodels\tsa\base\
tsa_model.py:836: ValueWarning: No supported index is available.
Prediction results will be given with an integer index beginning at
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  warnings.warn(

ARIMA Evaluation:
  □ RMSE: 8.00
  □ MAE : 6.29


19:22:04 - cmdstanpy - INFO - Chain [1] start processing
19:22:15 - cmdstanpy - INFO - Chain [1] done processing

Prophet Evaluation:
  □ RMSE: 36.03
  □ MAE : 34.63

LSTM Evaluation:
  □ RMSE: 9.65
  □ MAE : 8.47
```

Final Evaluation & Web Deployment

```
import streamlit as st
import pandas as pd

# Load your dataset
data = pd.read_csv("data/stock_data.csv", parse_dates=["timestamp"],
index_col="timestamp")

st.title("□ Stock Forecast App")
st.subheader("Closing Price Trend")
st.line_chart(data["close"])
```

```
2025-06-24 19:23:20.163
  Warning: to view this Streamlit app on a browser, run it with the
following
  command:

    streamlit run C:\Users\Pavithra\anaconda3\Lib\site-packages\
ipykernel_launcher.py [ARGUMENTS]

DeltaGenerator()
```

```
!pip install streamlit
```

```
Requirement already satisfied: streamlit in c:\users\pavithra\
anaconda3\lib\site-packages (1.32.0)
Requirement already satisfied: altair<6,>=4.0 in c:\users\pavithra\
anaconda3\lib\site-packages (from streamlit) (5.0.1)
Requirement already satisfied: blinker<2,>=1.0.0 in c:\users\pavithra\
anaconda3\lib\site-packages (from streamlit) (1.6.2)
Requirement already satisfied: cachetools<6,>=4.0 in c:\users\
pavithra\anaconda3\lib\site-packages (from streamlit) (5.3.3)
Requirement already satisfied: click<9,>=7.0 in c:\users\pavithra\
anaconda3\lib\site-packages (from streamlit) (8.1.7)
Requirement already satisfied: numpy<2,>=1.19.3 in c:\users\pavithra\
anaconda3\lib\site-packages (from streamlit) (1.26.4)
Requirement already satisfied: packaging<24,>=16.8 in c:\users\
pavithra\anaconda3\lib\site-packages (from streamlit) (23.2)
Requirement already satisfied: pandas<3,>=1.3.0 in c:\users\pavithra\
anaconda3\lib\site-packages (from streamlit) (2.2.3)
Requirement already satisfied: pillow<11,>=7.1.0 in c:\users\pavithra\
anaconda3\lib\site-packages (from streamlit) (10.3.0)
Requirement already satisfied: protobuf<5,>=3.20 in c:\users\pavithra\
anaconda3\lib\site-packages (from streamlit) (3.20.3)
Requirement already satisfied: pyarrow>=7.0 in c:\users\pavithra\
anaconda3\lib\site-packages (from streamlit) (14.0.2)
Requirement already satisfied: requests<3,>=2.27 in c:\users\pavithra\
anaconda3\lib\site-packages (from streamlit) (2.32.2)
Requirement already satisfied: rich<14,>=10.14.0 in c:\users\pavithra\
```

```
anaconda3\lib\site-packages (from streamlit) (13.3.5)
Requirement already satisfied: tenacity<9,>=8.1.0 in c:\users\
pavithra\anaconda3\lib\site-packages (from streamlit) (8.2.2)
Requirement already satisfied: toml<2,>=0.10.1 in c:\users\pavithra\
anaconda3\lib\site-packages (from streamlit) (0.10.2)
Requirement already satisfied: typing-extensions<5,>=4.3.0 in c:\
users\pavithra\anaconda3\lib\site-packages (from streamlit) (4.11.0)
Requirement already satisfied: gitpython!=3.1.19,<4,>=3.0.7 in c:\
users\pavithra\anaconda3\lib\site-packages (from streamlit) (3.1.37)
Requirement already satisfied: pydeck<1,>=0.8.0b4 in c:\users\
pavithra\anaconda3\lib\site-packages (from streamlit) (0.8.0)
Requirement already satisfied: tornado<7,>=6.0.3 in c:\users\pavithra\
anaconda3\lib\site-packages (from streamlit) (6.4.1)
Requirement already satisfied: watchdog>=2.1.5 in c:\users\pavithra\
anaconda3\lib\site-packages (from streamlit) (4.0.1)
Requirement already satisfied: jinja2 in c:\users\pavithra\anaconda3\
lib\site-packages (from altair<6,>=4.0->streamlit) (3.1.4)
Requirement already satisfied: jsonschema>=3.0 in c:\users\pavithra\
anaconda3\lib\site-packages (from altair<6,>=4.0->streamlit) (4.19.2)
Requirement already satisfied: toolz in c:\users\pavithra\anaconda3\
lib\site-packages (from altair<6,>=4.0->streamlit) (0.12.0)
Requirement already satisfied: colorama in c:\users\pavithra\
anaconda3\lib\site-packages (from click<9,>=7.0->streamlit) (0.4.6)
Requirement already satisfied: gitdb<5,>=4.0.1 in c:\users\pavithra\
anaconda3\lib\site-packages (from gitpython!=3.1.19,<4,>=3.0.7-
>streamlit) (4.0.7)
Requirement already satisfied: python-dateutil>=2.8.2 in c:\users\
pavithra\anaconda3\lib\site-packages (from pandas<3,>=1.3.0-
>streamlit) (2.9.0.post0)
Requirement already satisfied: pytz>=2020.1 in c:\users\pavithra\
anaconda3\lib\site-packages (from pandas<3,>=1.3.0->streamlit)
(2024.1)
Requirement already satisfied: tzdata>=2022.7 in c:\users\pavithra\
anaconda3\lib\site-packages (from pandas<3,>=1.3.0->streamlit)
(2023.3)
Requirement already satisfied: charset-normalizer<4,>=2 in c:\users\
pavithra\anaconda3\lib\site-packages (from requests<3,>=2.27-
>streamlit) (2.0.4)
Requirement already satisfied: idna<4,>=2.5 in c:\users\pavithra\
anaconda3\lib\site-packages (from requests<3,>=2.27->streamlit) (2.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in c:\users\
pavithra\anaconda3\lib\site-packages (from requests<3,>=2.27-
>streamlit) (2.2.2)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\
pavithra\anaconda3\lib\site-packages (from requests<3,>=2.27-
>streamlit) (2024.7.4)
Requirement already satisfied: markdown-it-py<3.0.0,>=2.2.0 in c:\
users\pavithra\anaconda3\lib\site-packages (from rich<14,>=10.14.0-
>streamlit) (2.2.0)
```

```
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in c:\users\
pavithra\anaconda3\lib\site-packages (from rich<14,>=10.14.0-
>streamlit) (2.15.1)
Requirement already satisfied: smmap<5,>=3.0.1 in c:\users\pavithra\
anaconda3\lib\site-packages (from gitdb<5,>=4.0.1->gitpython!
=3.1.19,<4,>=3.0.7->streamlit) (4.0.0)
Requirement already satisfied: MarkupSafe>=2.0 in c:\users\pavithra\
anaconda3\lib\site-packages (from jinja2->altair<6,>=4.0->streamlit)
(2.1.3)
Requirement already satisfied: attrs>=22.2.0 in c:\users\pavithra\
anaconda3\lib\site-packages (from jsonschema>=3.0->altair<6,>=4.0-
>streamlit) (23.1.0)
Requirement already satisfied: jsonschema-specifications>=2023.03.6 in
c:\users\pavithra\anaconda3\lib\site-packages (from jsonschema>=3.0-
>altair<6,>=4.0->streamlit) (2023.7.1)
Requirement already satisfied: referencing>=0.28.4 in c:\users\
pavithra\anaconda3\lib\site-packages (from jsonschema>=3.0-
>altair<6,>=4.0->streamlit) (0.30.2)
Requirement already satisfied: rpds-py>=0.7.1 in c:\users\pavithra\
anaconda3\lib\site-packages (from jsonschema>=3.0->altair<6,>=4.0-
>streamlit) (0.10.6)
Requirement already satisfied: mdurl~=0.1 in c:\users\pavithra\
anaconda3\lib\site-packages (from markdown-it-py<3.0.0,>=2.2.0-
>rich<14,>=10.14.0->streamlit) (0.1.0)
Requirement already satisfied: six>=1.5 in c:\users\pavithra\
anaconda3\lib\site-packages (from python-dateutil>=2.8.2-
>pandas<3,>=1.3.0->streamlit) (1.16.0)

streamlit run app.py

  Cell In[14], line 1
    streamlit run app.py
               ^
SyntaxError: invalid syntax
```