📈 Time Series Forecasting of AAPL Stock Prices Using ARIMA

Coding Samurai Data Science Internship – Project 5

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🎯 Problem Statement

To build a time series model that forecasts future stock prices of Apple Inc. using historical data.
The model should:

- Analyze trends and seasonality
- Ensure stationarity
- Provide accurate short-term forecasts
- Assist in understanding price movement dynamics

🚀 Project Objectives

- Perform EDA on AAPL stock price data
- Test for stationarity using the ADF test
- Apply differencing to achieve stationarity
- Determine ARIMA parameters (p,d,q)
- Build and evaluate ARIMA model
- Generate 30-day forecast with confidence intervals

🧰 Tools & Technologies

- **Python**
- **Libraries:** pandas, numpy, matplotlib, seaborn, statsmodels, yfinance
- **IDE:** PyCharm
- **Platform:** Local Machine (Windows)

📊 Dataset Details

- **Ticker:** AAPL (Apple Inc.)
- **Time Frame:** Jan 2020 – Jan 2025
- **Frequency:** Daily
- **Source:** Extracted using yfinance API
- **Focus:** 'Close' price for forecasting

🔍 Exploratory Data Analysis

- Visualized historical **'Close' price** from 2020–2025
- Identified **upward trend** with fluctuations
- Checked and handled **missing values**
- Observed **no significant seasonality**, but clear trend pattern
- Set the stage for time series modeling

📉 Stationarity Check

- Applied **Augmented Dickey-Fuller (ADF) Test**
- Initial series **not stationary** (high p-value)
- Applied **first-order differencing**
- ADF test post-differencing → **p-value ≈ 0.0**
- Data became stationary → suitable for ARIMA

🔢 ARIMA Parameter Selection

- Used **ACF** and **PACF** plots
- Determined ARIMA parameters:
  - **p = 1** (based on PACF cutoff)
  - **d = 1** (after differencing)
  - **q = 0** (minimal lag in ACF
- Final Model: **ARIMA(1, 1, 0)**
- Model chosen based on interpretability and performance

🧠 Model Fitting & Residual Analysis

- Trained ARIMA(1,1,0) model on differenced data
- AIC: **11093.57** → indicates good model fit
- Residual diagnostics:
  - **No autocorrelation** in residuals (white noise)
  - Passed **Ljung-Box test**
  - Residuals were **normally distributed**

📈 30-Day Forecast

- Forecasted **next 30 days** of AAPL closing prices
- Presented results with **confidence intervals**
- Observed **slight downward trend** with fluctuations
- Forecast was consistent with recent price behavior
- Suitable for short-term investment insight

Conclusion

- Successfully built ARIMA(1,1,0) model
- Forecasted AAPL stock prices with high confidence
- Residuals confirmed **model validity**
- Analysis is **scalable** for other stock symbols
- Can be extended with SARIMA or LSTM for advanced modeling

✅ Final Deliverables

- 📓 Jupyter Notebook with analysis & visualizations
- 📄 README.md file (well-documented project summary)
- 📝 LinkedIn blog post (insightful write-up)
- 🎞️ PowerPoint Presentation (you're looking at it 😎)

👨‍💻 Author

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