PROJECT REPORT

📊 Stock Price Forecasting using ARIMA

This project focuses on forecasting **TCS (Tata Consultancy Services)** stock prices using **time series analysis** and the **ARIMA (AutoRegressive Integrated Moving Average)** model. The goal is to model historical stock price trends and forecast future values, which is highly relevant in finance and trading.

📌 Introduction

Stock market prediction is a classic problem in finance and data science. In this project, we:

- Cleaned and preprocessed **TCS stock price data**.
- Performed **stationarity tests** and transformations.
- Built an **ARIMA model** for forecasting.
- Visualized forecasts with confidence intervals.

🎯 Objectives

- Prepare and clean stock market time series data.
- Handle duplicates, missing values, and date irregularities.
- Check and ensure stationarity using the **ADF test**.
- Train and evaluate an **ARIMA model**.
- Forecast **future TCS stock prices** with visualizations.

📂 Dataset

- **Company:** Tata Consultancy Services (TCS)
- **Type:** Daily stock price data (Closing price)
- **Characteristics:**
    - Indexed by **DateTime**
    - Missing values on weekends and holidays
    - Occasional duplicate entries

🔧 Methodology

1️⃣ Data Preprocessing

- Removed duplicate records by date.
- Converted dataset index to **DateTimeIndex**.
- Forward-filled missing values and set frequency to **Business Days (B)**.

2️⃣ Exploratory Data Analysis

- Computed **rolling mean** and **exponential weighted mean**.
- Analyzed **quarterly high/low prices**.
- Visual inspection revealed the data was **non-stationary**.

3️⃣ Stationarity Check

- **Augmented Dickey-Fuller (ADF) Test:**
  - Initial p-value > 0.05 → Data is **non-stationary**.
  - Applied **first-order differencing**.
  - New p-value < 0.05 → Data is now **stationary**.

4️⃣ Model Building (ARIMA)

- Used **ACF and PACF plots** to determine AR (`p`) and MA (`q`) terms.
- Built ARIMA(p,d,q) with `d=1`.
- Trained the model on **TCS stock prices**.

5️⃣ Forecasting

- Forecasted **future TCS stock prices**.
- Plotted results with **confidence intervals**.

📊 Results

- Differencing made the series stationary.
- ARIMA successfully modeled and forecasted TCS stock prices.
- Forecast plots aligned with realistic stock market trends.

⚙️ Tools & Libraries

- Python 3.8+
- Pandas
- NumPy
- Matplotlib / Seaborn
- Statsmodels

✨ *"Forecasting tomorrow’s market with today’s data."* 📈