

EX.No.10

## Vector auto regression model for multivariate time series data forecasting

Date:24.04.25

### AIM:

to develop vector auto regression model for multivariate time series data forecasting

### PROCEDURE AND CODE:

#### Step 1: Install and Import Required Libraries

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import yfinance as yf
from statsmodels.tsa.api import VAR
from statsmodels.tools.eval_measures import rmse
```

#### Step 2: Download Google Stock Data

```
data = yf.download('GOOGL', start='2010-01-01',
end='2024-01-01')

df = data[['Open', 'High', 'Low', 'Close', 'Volume']]

df.head()
```

#### Step 3: Visualize the Time Series

```
df[['Close']].plot(figsize=(10, 6), title="Google Stock
Closing Prices")

plt.xlabel("Date")
plt.ylabel("Price (USD)")
plt.show()
```

#### **Step 4: Train-Test Split**

```
train_size = int(len(df) * 0.8)
train, test = df.iloc[:train_size], df.iloc[train_size:]
```

#### **Step 5: Fit VAR Model**

```
model = VAR(train)
results = model.fit(maxlags=15, ic='aic') # Automatically
select optimal lag using AIC
print(results.summary())
```

#### **Step 6: Forecast Future Values**

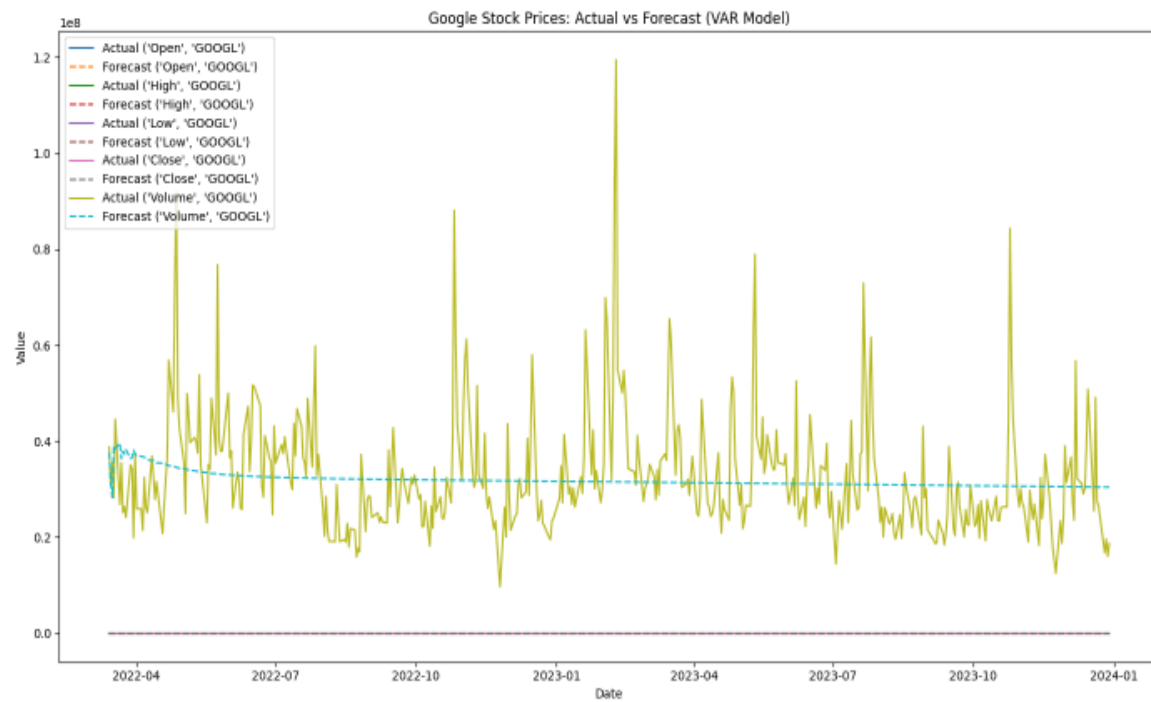
```
lag_order = results.k_ar
forecast_input = train.values[-lag_order:]
forecast = results.forecast(y=forecast_input,
steps=len(test))
forecast_df = pd.DataFrame(forecast, index=test.index,
columns=df.columns)
```

## Step 7: Compare Actual vs Predicted

```
plt.figure(figsize=(12, 6))
for col in df.columns:
    plt.plot(test[col], label=f'Actual {col}')
    plt.plot(forecast_df[col], '--', label=f'Forecast {col}')
plt.legend()
plt.title("VAR Model Forecast vs Actual")
plt.xlabel("Date")
plt.ylabel("Price (USD)")
plt.show()
```

## Step 8: Calculate RMSE for Each Variable

```
for col in df.columns:
    error = rmse(test[col], forecast_df[col])
    print(f'RMSE for {col}: {error:.4f}')
```



RMSE for each feature:

- ('Open', 'GOOGL'): 35.8149
- ('High', 'GOOGL'): 35.8342
- ('Low', 'GOOGL'): 34.6128
- ('Close', 'GOOGL'): 34.7943
- ('Volume', 'GOOGL'): 12788883.4947

## RESULT:

The program to develop the neural network based time series forecasting model has been executed successfully.