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**Program to Vector Auto Regression (VAR) for Multivariate Time Series Forecasting**

**Aim:**

Write a program implement to Vector Auto Regression (VAR) for Multivariate Time Series Forecasting

**Algorithm:**

1. **Load the Data**:
   * Read the CSV file containing the weather data.
   * Parse the date column as a datetime index.
2. **Clean the Data**:
   * Handle missing values by performing forward and backward filling.
   * Drop any remaining NaN values.
3. **Normalize the Data**:
   * Apply **Min-Max Scaling** to normalize each column's values between 0 and 1.
4. **Add Time-Based Features**:
   * Extract additional features from the datetime index: day, month and year
5. **Visualize the Data**:
   * Plot the time series for a specific column (e.g., temperature T) over time.
6. **Execute the Program**:
   * Sequentially call the functions to load, clean, normalize, add features, and visualize the data.

**Code:**

from statsmodels.tsa.api import VAR

from sklearn.preprocessing import StandardScaler

# Prepare multivariate dataset (Temperature + Lagged Temperature)

data = df.copy()

data['Lagged'] = data['Temperature'].shift(1)

data.dropna(inplace=True)

# Standardize the data

scaler = StandardScaler()

scaled = scaler.fit\_transform(data)

# Convert to DataFrame

scaled\_df = pd.DataFrame(scaled, index=data.index, columns=data.columns)

# Fit VAR model

model = VAR(scaled\_df)

results = model.fit(15)

# Forecast next 30 days

forecast\_input = scaled\_df.values[-15:]

forecast = results.forecast(y=forecast\_input, steps=30)

# Inverse transform

forecast\_df = pd.DataFrame(forecast, columns=scaled\_df.columns)

forecast\_original = scaler.inverse\_transform(forecast\_df)

# Plot Temperature Forecast

forecast\_dates = pd.date\_range(start=data.index[-1] + pd.Timedelta(days=1), periods=30)

plt.figure(figsize=(12, 6))

plt.plot(data.index[-100:], data['Temperature'][-100:], label='Historical Temperature')

plt.plot(forecast\_dates, forecast\_original[:, 0], label='VAR Forecast (30 Days)', color='purple')

plt.title("VAR Forecast of Temperature")

plt.xlabel("Date")

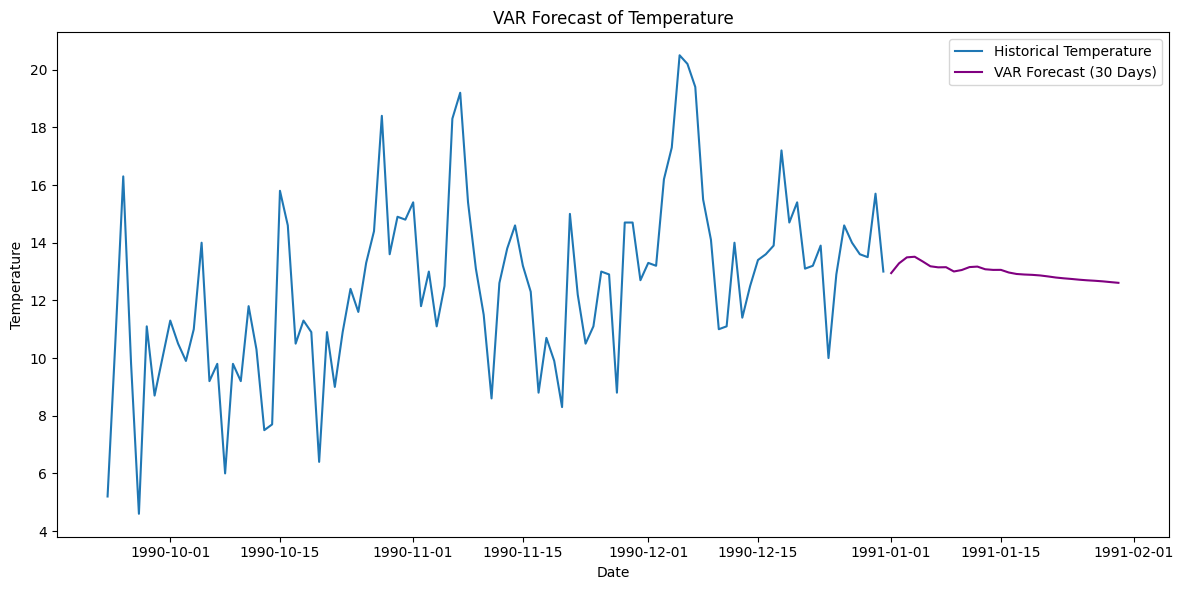
plt.ylabel("Temperature")

plt.legend()

plt.tight\_layout()

plt.show()

**Output:**



**Result:**

Thus, the program to implement VAR using the time series data has been done successfully.