**EX:No.3 221501028**

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**IMPLEMENTING LINEAR REGRESSION MODEL USING TIME SERIES DATASET**

**AIM:**

To implement linear regression model using time series dataset.

**ALGORITHM:**

**1. Import Required Libraries:** Load necessary libraries such as NumPy, Pandas, Matplotlib, and Scikit-learn for data handling, visualization, and modeling**.**

**2. Generate Synthetic Time Series Data:** Create a dataset with a linear trend and add Gaussian noise to simulate real-world variations.

**3. Prepare the Data for Training:** Define independent (Time) and dependent (Value) variables, and split the dataset into training and testing sets.

**4. Train the Linear Regression Model:** Fit the training data using the Linear Regression model from Scikit-learn.

**5. Make Predictions and Evaluate the Model:** Use the trained model to predict values and compute the RMSE (Root Mean Squared Error) for performance assessment.

**6. Visualize Results:** Plot the actual data points and the regression line to analyze the model’s accuracy.

**PROCESS:**

**#Importing libraries**

import numpy as np

import pandas as pd

import matplotlib.pyplot as plt

from sklearn.model\_selection import train\_test\_split

from sklearn.linear\_model import LinearRegression

from sklearn.metrics import mean\_squared\_error

**# Step 1: Generate Synthetic Time Series Data**

np.random.seed(42)

n = 100 # Number of data points

time = np.arange(n) # Time steps

trend = 0.5 \* time # Linear trend

noise = np.random.normal(0, 5, n) # Gaussian noise

y = trend + noise # Synthetic target variable

**# Create a DataFrame**

df = pd.DataFrame({'Time': time, 'Value': y})

**# Step 2: Split Data into Training and Testing Sets**

X = df[['Time']]

y = df['Value']

X\_train, X\_test, y\_train, y\_test = train\_test\_split(X, y, test\_size=0.2, shuffle=False)

**# Step 3: Train a Linear Regression Model**

model = LinearRegression()

model.fit(X\_train, y\_train)

**# Step 4: Predict and Evaluate**

y\_pred = model.predict(X)

mse = mean\_squared\_error(y\_test, model.predict(X\_test))

rmse = np.sqrt(mse)

**# Print Model Performance**

print(f'RMSE: {rmse:.2f}')

**# Plot Results**

plt.figure(figsize=(10, 5))

plt.scatter(X.values, y, label='Actual Data', color='blue', alpha=0.5)

plt.plot(X.values, y\_pred, label='Linear Regression Prediction', color='red', linewidth=2)

plt.xlabel('Time')

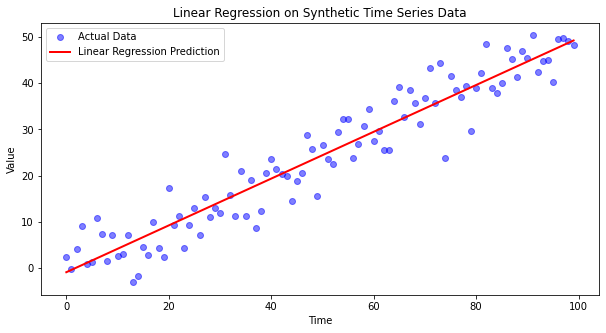
plt.ylabel('Value')

plt.legend()

plt.title('Linear Regression on Synthetic Time Series Data')

plt.show()

**OUTPUT:**



**RESULT:**

The program to implement linear regression is created and executed successfully.