**EX:No.9 221501012**

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**DEVELOP NEURAL NETWORK-BASED TIME SERIES FORCASTING MODEL.**

**AIM:**

To implement program for Develop neural network-based time series forecasting model.

**ALGORITHM:**

**OBJECTIVE:**

Smooth the electric production data to reduce noise, highlight trends, and prepare for forecasting.

**BACKGROUND:**

1.Time series data has short-term fluctuations.

2.Moving average reduces noise and clarifies trends.

3.Smoothed data improves forecast accuracy and interpretability.

**SCOPE OF THE PROGRAM:**

1.Load and clean dataset

2.Convert date column to datetime

3.Aggregate data monthly and yearly

4.Apply 3-month and 12-month moving averages

5.Plot original vs smoothed data

**ALGORITHM:**

1.Import libraries

2.Load dataset

3.Preprocess and set datetime index

4.Resample data (monthly, yearly)

5.Apply 3-month & 12-month smoothing

6.Visualize results

**PROCESS:**

**# Install required packages (if not already available)**

**# !pip install pandas numpy matplotlib scikit-learn tensorflow**

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

from sklearn.preprocessing import MinMaxScaler

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

from tensorflow.keras.models import Sequential

from tensorflow.keras.layers import Dense

**# Load dataset**

df = pd.read\_csv('/content/Electric\_Production.csv', parse\_dates=['DATE'], index\_col='DATE')

**# Use the relevant column**

data = df['IPG2211A2N'].values.reshape(-1, 1)

**# Normalize the data**

scaler = MinMaxScaler()

scaled\_data = scaler.fit\_transform(data)

**# Function to prepare time series data for supervised learning**

def create\_dataset(dataset, window\_size):

X, y = [], []

for i in range(len(dataset) - window\_size):

X.append(dataset[i:i+window\_size, 0])

y.append(dataset[i+window\_size, 0])

return np.array(X), np.array(y)

**# Define time window**

window\_size = 12

X, y = create\_dataset(scaled\_data, window\_size)

**# Split into training and testing sets (80% training)**

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

**# Build Neural Network model**

model = Sequential([

Dense(64, activation='relu', input\_shape=(window\_size,)),

Dense(32, activation='relu'),

Dense(1)

])

model.compile(optimizer='adam', loss='mse')

**# Train the model**

history = model.fit(X\_train, y\_train, epochs=100, batch\_size=16, validation\_data=(X\_test, y\_test), verbose=0)

**# Predict on test set**

predictions = model.predict(X\_test)

predictions = scaler.inverse\_transform(predictions.reshape(-1, 1))

actual = scaler.inverse\_transform(y\_test.reshape(-1, 1))

**# Plot results**

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

plt.plot(actual, label='Actual')

plt.plot(predictions, label='Predicted', color='red')

plt.title('Neural Network Forecast vs Actual')

plt.xlabel('Time Steps')

plt.ylabel('Electric Production')

plt.legend()

plt.grid(True)

plt.show()

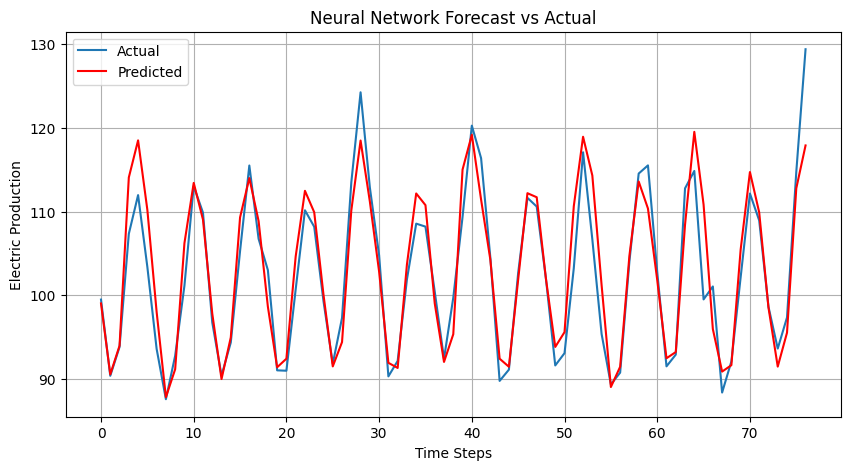
**# Show RMSE**

from sklearn.metrics import mean\_squared\_error

rmse = np.sqrt(mean\_squared\_error(actual, predictions))

print(f'RMSE: {rmse:.4f}')

**OUTPUT:**



**RESULT:**

The program to Develop neural network-based time series forecasting model created and executed successfully.