EX.No.9 **Neural Network based time series Forecasting model**

Date:17.04.25

AIM:

to develop the neural network based time series forecasting model

PROCEDURE AND CODE:

Step 1: Install and Import Required Libraries

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.preprocessing import MinMaxScaler
from sklearn.metrics import mean_squared_error
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
```

Step 2: Generate Synthetic Time Series Data

```
np.random.seed(0)
time = np.arange(100)
data = np.sin(0.2 * time) + np.random.normal(0, 0.1,
size=len(time))
plt.plot(time, data)
plt.title("Synthetic Time Series")
plt.xlabel("Time")
plt.ylabel("Value")
plt.show()
```

Step 3: Prepare Data for Supervised Learning

```
def create_dataset(series, window_size=5):
    X, y = [], []
    for i in range(len(series) - window_size):
        X.append(series[i:i + window_size])
        y.append(series[i + window_size])
    return np.array(X), np.array(y)


window_size = 5
X, y = create_dataset(data, window_size)
scaler = MinMaxScaler()
X_scaled = scaler.fit_transform(X)
y_scaled = scaler.fit_transform(y.reshape(-1, 1))
split = int(len(X) * 0.8)
X_train, X_test = X_scaled[:split], X_scaled[split:]
y_train, y_test = y_scaled[:split], y_scaled[split:]
```

Step 4: Build the Neural Network Model

We build a simple feedforward neural network with 2 hidden layers.

```
model = Sequential()
model.add(Dense(64, activation='relu',
input_shape=(window_size,)))
model.add(Dense(32, activation='relu'))
model.add(Dense(1))  # Output layer
model.compile(optimizer='adam', loss='mse')
```

Step 5: Train the Model

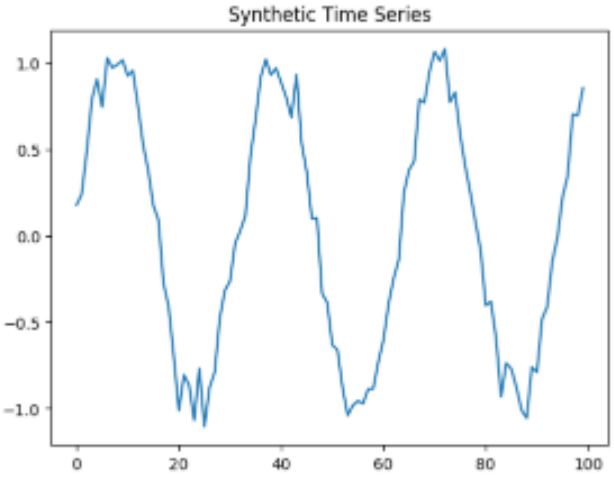
We train for 100 epochs and use a validation split from the training data.

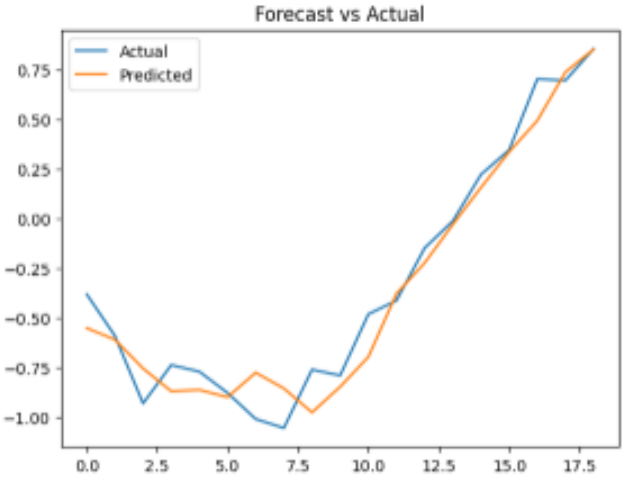
```
history = model.fit(X_train, y_train, epochs=100,
verbose=0, validation_split=0.1)
```

Step 6: Evaluate the Model

We make predictions and compare them to actual test data

```
y_pred_scaled = model.predict(X_test)

y_pred = scaler.inverse_transform(y_pred_scaled)

y_test_inv = scaler.inverse_transform(y_test)

plt.plot(range(len(y_test_inv)), y_test_inv,
label='Actual')

plt.plot(range(len(y_pred)), y_pred, label='Predicted')

plt.legend()

plt.title("Forecast vs Actual")

plt.xlabel("Time")

plt.ylabel("Value")

plt.show()

rmse = np.sqrt(mean_squared_error(y_test_inv, y_pred))

print(f"Test RMSE: {rmse:.4f}")
```






```
Test RMSE: 0.1327
```

RESULT:

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