Roll Number: 210701120

Ex No: 6 A RECURRENT NEURAL NETWORK

Aim:

To build a recurrent neural network with Keras/TensorFlow.

Procedure:

1. Download and load the dataset.
2. Perform analysis and preprocessing of the dataset.
3. Build a simple neural network model using Keras/TensorFlow.
4. Compile and fit the model.
5. Perform prediction with the test dataset.
6. Calculate performance metrics.

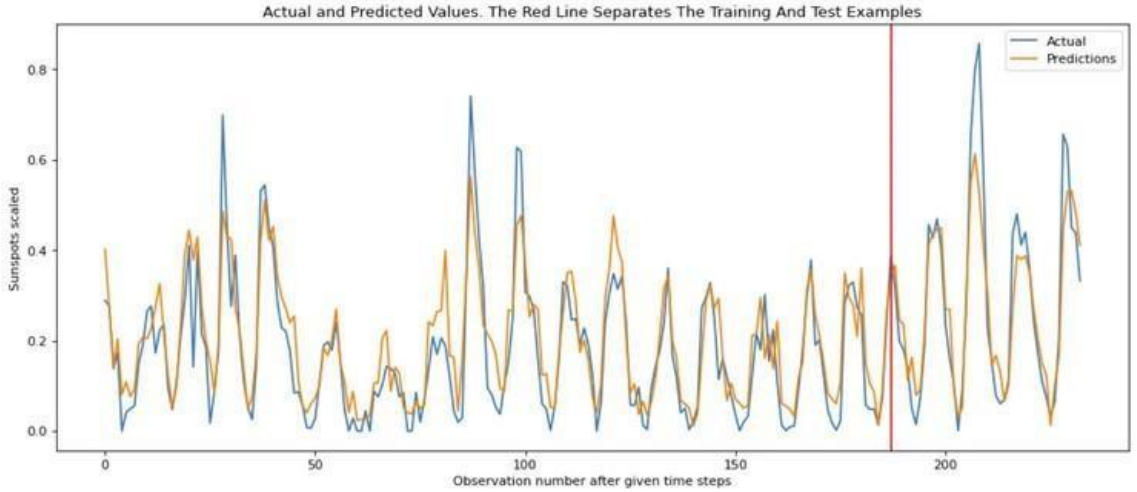
Program:

```
# Parameter split_percent defines the ratio of training examples def get_train_test(url, split_percent=0.8): df = read_csv(url, usecols=[1], engine='python') data = np.array(df.values.astype('float32')) scaler = MinMaxScaler(feature_range=(0, 1)) data = scaler.fit_transform(data).flatten() n = len(data)
  # Point for splitting data into train and
  test split = int(n*split_percent)
  train_data = data[range(split)]
  test_data = data[split:] return
  train_data, test_data, data

sunspots_url =
'https://raw.githubusercontent.com/jbrownlee/Datasets/master/monthly-sunspots.csv' train_data, test_data, data = get_train_test(sunspots_url)
```

```
# Prepare the input X and target Y
def get_XY(dat, time_steps):
# Indices of target array
Y_ind = np.arange(time_steps, len(dat), time_steps)
Y =
dat[Y_ind] #
Prepare X
rows_x =
len(Y)
X = dat[range(time_steps*rows_x)] X
= np.reshape(X, (rows_x, time_steps,
1)) return X, Y


time_steps = 12 trainX, trainY =
get_XY(train_data, time_steps) testX, testY
= get_XY(test_data, time_steps)

model = create_RNN(hidden_units=3, dense_units=1,
input_shape=(time_steps,1),
            activation=['tanh', 'tanh'])
model.fit(trainX, trainY, epochs=20, batch_size=1,
verbose=2) def print_error(trainY, testY, train_predict,
test_predict):
  # Error of predictions train_rmse =
  math.sqrt(mean_squared_error(trainY, train_predict))
  test_rmse = math.sqrt(mean_squared_error(testY,
  test_predict))
  # Print RMSE print('Train RMSE: %.3f
  RMSE' % (train_rmse))
```

```
print('Test RMSE: %.3f RMSE' % (test_rmse))

# make predictions train_predict
=              model.predict(trainX)
test_predict                    =
model.predict(testX)

# Mean square error print_error(trainY, testY,
train_predict, test_predict)
# Plot the result def plot_result(trainY, testY, train_predict, test_predict): actual
= np.append(trainY, testY) predictions = np.append(train_predict, test_predict)
rows = len(actual) plt.figure(figsize=(15, 6), dpi=80) plt.plot(range(rows),
actual) plt.plot(range(rows), predictions) plt.axvline(x=len(trainY), color='r')
plt.legend(['Actual', 'Predictions']) plt.xlabel('Observation number after given
time steps') plt.ylabel('Sunspots scaled') plt.title('Actual and Predicted Values.
The Red Line Separates The Training And Test Examples')
plot_result(trainY, testY, train_predict, test_predict)
```

Output:



```
187/187 - 1s - 4ms/step - loss: 0.0050
Epoch 11/20
187/187 - 1s - 4ms/step - loss: 0.0048
Epoch 12/20
187/187 - 1s - 4ms/step - loss: 0.0047
Epoch 13/20
187/187 - 1s - 4ms/step - loss: 0.0048
Epoch 14/20
187/187 - 1s - 4ms/step - loss: 0.0046
Epoch 15/20
187/187 - 1s - 4ms/step - loss: 0.0047
Epoch 16/20
187/187 - 1s - 4ms/step - loss: 0.0047
Epoch 17/20
187/187 - 1s - 4ms/step - loss: 0.0045
Epoch 18/20
187/187 - 1s - 4ms/step - loss: 0.0046
Epoch 19/20
187/187 - 1s - 4ms/step - loss: 0.0046
Epoch 20/20
187/187 - 1s - 4ms/step - loss: 0.0045
6/6 ━━━━━━━━━━━━━━━━━━━━ 1s 56ms/step
2/2 ━━━━━━━━━━━━━━━━━━━━ 0s 0s/step
Train RMSE: 0.070 RMSE
Test RMSE: 0.089 RMSE
```

RESULT:

A simple RNN has been successfully created using timeseries data.