39_Sanskruti Nijai

EXPERIMENT NO 07

Design and implement LSTM model for handwriting recognition, speech recognition, machine translation, speech activity detection, robot control, video games, time series forecasting etc.

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

```
df = pd.read_csv('monthly-milk-production-pounds.csv',index_col='Month',parse_dates=True)
df.index.freq='MS'
```

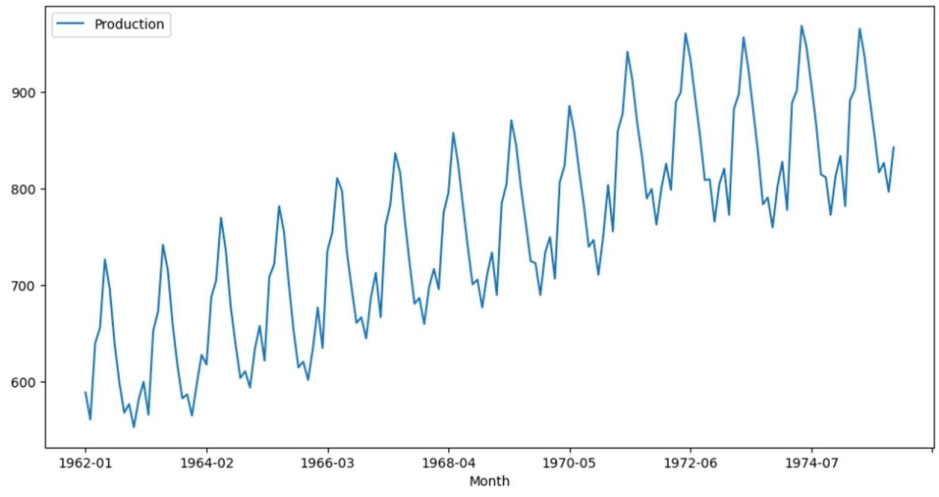
```
df.head()
```

Month	Production
1962-01	589.0
1962-02	561.0
1962-03	640.0
1962-04	656.0
1962-05	727.0

```
df.plot(figsize=(12,6))
```

```
<Axes: xlabel='Month'>
```

```
<Axes: xlabel='Month'>
```




```
from statsmodels.tsa.seasonal import seasonal_decompose
```

```
[ ] len(df)
```

```
168
```

```
[ ] train = df.iloc[:156]
    test = df.iloc[156:]
```

```
[ ] from sklearn.preprocessing import MinMaxScaler
    scaler = MinMaxScaler()
```

```
[ ] df.head(),df.tail()
```

```
(            Production
 Date
 1962-01-01         589
 1962-02-01         561
 1962-03-01         640
 1962-04-01         656
 1962-05-01         727,
             Production
 Date
 1975-08-01         858
 1975-09-01         817
 1975-10-01         827
 1975-11-01         797
 1975-12-01         843)
```

```
scaler.fit(train)
scaled_train = scaler.transform(train)
scaled_test = scaler.transform(test)
```

```
[ ] scaled_train[:10]
```

```
array([[0.08653846],
       [0.01923077],
       [0.20913462],
       [0.24759615],
       [0.41826923],
       [0.34615385],
       [0.20913462],
       [0.11057692],
       [0.03605769],
       [0.05769231]])
```

```
[ ] from keras.preprocessing.sequence import TimeseriesGenerator
```

```
[ ] # define generator
    n_input = 3
    n_features = 1
    generator = TimeseriesGenerator(scaled_train, scaled_train, length=n_input, batch_size=1)
```

```
X,y = generator[0]
print(f'Given the Array: \n{X.flatten()}')
print(f'Predict this y: \n {y}')
```

```
Given the Array:
[0.08653846 0.01923077 0.20913462]
Predict this y:
 [[0.24759615]]
```

+ Code + Text

```
[ ] X.shape
```

```
(1, 3, 1)
```

```
# We do the same thing, but now instead for 12 months
n_input = 12
generator = TimeseriesGenerator(scaled_train, scaled_train, length=n_input, batch_size=1)
```

```
[ ] from keras.models import Sequential
    from keras.layers import Dense
    from keras.layers import LSTM
```

```
[ ] # define model
    model = Sequential()
    model.add(LSTM(100, activation='relu', input_shape=(n_input, n_features)))
    model.add(Dense(1))
    model.compile(optimizer='adam', loss='mse')
```

```
model.summary()
```

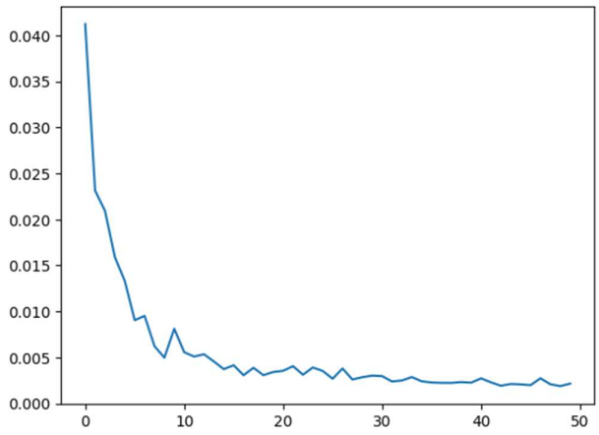
```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 lstm (LSTM)                 (None, 100)               40800

 dense (Dense)               (None, 1)                 101

=================================================================
Total params: 40901 (159.77 KB)
Trainable params: 40901 (159.77 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

```
[ ] # fit model
    model.fit(generator,epochs=50)
```

```
144/144 [==============================] - 1s 7ms/step - loss: 0.0040
Epoch 23/50
144/144 [==============================] - 1s 7ms/step - loss: 0.0031
Epoch 24/50
144/144 [==============================] - 1s 6ms/step - loss: 0.0039
Epoch 25/50
144/144 [==============================] - 1s 6ms/step - loss: 0.0035
Epoch 26/50
144/144 [==============================] - 1s 6ms/step - loss: 0.0027
Epoch 27/50
144/144 [==============================] - 1s 6ms/step - loss: 0.0038
```

```
loss_per_epoch = model.history.history['loss']
plt.plot(range(len(loss_per_epoch)),loss_per_epoch)
```

```
[<matplotlib.lines.Line2D at 0x7940b2ec7100>]
```




```
[ ] last_train_batch = scaled_train[-12:]
```

```
[ ] last_train_batch = last_train_batch.reshape((1, n_input, n_features))
```

```
[ ] model.predict(last_train_batch)
```

```
1/1 [==============================] - 0s 206ms/step
array([[0.6740278]], dtype=float32)
```

```
[ ] scaled_test[0]
```

```
array([0.67548077])
```

```
[ ] test_predictions = []

    first_eval_batch = scaled_train[-n_input:]
    current_batch = first_eval_batch.reshape((1, n_input, n_features))

    for i in range(len(test)):

        # get the prediction value for the first batch
        current_pred = model.predict(current_batch)[0]

        # append the prediction into the array
        test_predictions.append(current_pred)

        # use the prediction to update the batch and remove the first value
        current_batch = np.append(current_batch[:,1:,:],[[current_pred]],axis=1)
```

```
1/1 [==============================] - 0s 26ms/step
1/1 [==============================] - 0s 22ms/step
1/1 [==============================] - 0s 22ms/step
1/1 [==============================] - 0s 22ms/step
1/1 [==============================] - 0s 24ms/step
1/1 [==============================] - 0s 25ms/step
1/1 [==============================] - 0s 22ms/step
1/1 [==============================] - 0s 21ms/step
1/1 [==============================] - 0s 21ms/step
1/1 [==============================] - 0s 26ms/step
1/1 [==============================] - 0s 27ms/step
1/1 [==============================] - 0s 22ms/step
```

```
[ ] test_predictions
```

```
[array([0.6740278], dtype=float32),
 array([0.6351541], dtype=float32),
 array([0.81465983], dtype=float32),
 array([0.8758115], dtype=float32),
 array([0.9919943], dtype=float32),
 array([0.9742231], dtype=float32),
 array([0.9031107], dtype=float32),
```

```
[ ] true_predictions = scaler.inverse_transform(test_predictions)
```

```
[ ] from sklearn.metrics import mean_squared_error
    from math import sqrt
    rmse=sqrt(mean_squared_error(test['Production'],test['Predictions']))
    print(rmse)
```

```
20.078180854790947
```