Creating dataset with sliding windows & Model building

PNT2022TMID26965

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
ds=pd.read_csv(r"/content/Crude-Oil-Prices-Daily.csv",parse_dates
=["Date"], index_col ="Date")
ds.head()
ds[:10]
```

```
            Closing Value
Date
1986-01-02          25.56
1986-01-03          26.00
1986-01-06          26.53
1986-01-07          25.85
1986-01-08          25.87
1986-01-09          26.03
1986-01-10          25.65
1986-01-13          25.08
1986-01-14          24.97
1986-01-15          25.18
```

```
ds.isnull().sum()
```

```
Closing Value    7
dtype: int64
```

```
ds.dropna(axis=0,inplace=True)
ds.isnull().sum()
```

```
Closing Value    0
dtype: int64
```

```
data=ds.reset_index()['Closing Value']
data
```

```
0       25.56
1       26.00
2       26.53
3       25.85
4       25.87
        ...
8211    73.89
8212    74.19
8213    73.05
8214    73.78
```

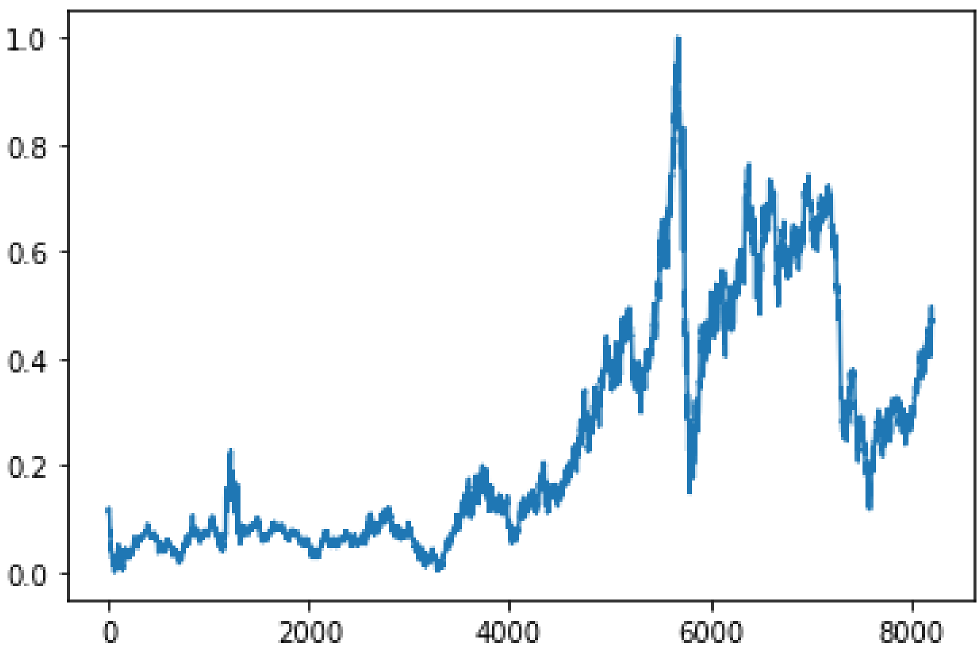
```
8215    73.93
Name: Closing Value, Length: 8216, dtype: float64
```

```
from sklearn.preprocessing import MinMaxScaler
scaler=MinMaxScaler(feature_range=(0,1))
data=scaler.fit_transform(np.array(data).reshape(-1,1))
data
```

```
array([[0.11335703],
       [0.11661484],
       [0.12053902],
       ...,
       [0.46497853],
       [0.47038353],
       [0.47149415]])
```

```
plt.plot(data)
```

```
[<matplotlib.lines.Line2D at 0x7f334e6d1150>]
```




```
training_size=int(len(data)*0.65)
test_size=len(data)-training_size
train_data,test_data=data[0:training_size,:],data[training_size:len(da
ta),:1]
training_size,test_size
```

```
(5340, 2876)
```

```
train_data.shape
```

```
(5340, 1)
```

```
def create_dataset(dataset,time_step=1):
  dataX,dataY=[],[]
  for i in range(len(dataset)-time_step-1):
    a=dataset[i:(i+time_step),0]
    dataX.append(a)
    dataY.append(dataset[i+time_step,0])
  return np.array(dataX),np.array(dataY)
```

```
time_step=10
x_train,y_train=create_dataset(train_data,time_step)
x_test,y_test=create_dataset(test_data,time_step)
print(x_train.shape)
print(y_train.shape)
```

```
(5329, 10)
(5329,)
```

```
print(x_test.shape)
print(y_test.shape)
```

```
(2865, 10)
(2865,)
```

```
x_train
```

```
array([[0.11335703, 0.11661484, 0.12053902, ..., 0.10980305, 0.1089886
,
        0.11054346],
       [0.11661484, 0.12053902, 0.11550422, ..., 0.1089886 ,
0.11054346,
        0.10165852],
       [0.12053902, 0.11550422, 0.1156523 , ..., 0.11054346,
0.10165852,
        0.09906708],
       ...,
       [0.36731823, 0.35176958, 0.36080261, ..., 0.36391234,
0.37042796,
        0.37042796],
       [0.35176958, 0.36080261, 0.35354657, ..., 0.37042796,
0.37042796,
        0.37879461],
       [0.36080261, 0.35354657, 0.35295424, ..., 0.37042796,
0.37879461,
        0.37916482]])
```

```
x_test
```

```
array([[0.38005331, 0.36872501, 0.37324152, ..., 0.3537687 ,
0.35465719,
        0.3499926 ],
       [0.36872501, 0.37324152, 0.38205242, ..., 0.35465719, 0.3499926
,
```

```
        0.3465867 ],
       [0.37324152, 0.38205242, 0.38042352, ..., 0.3499926 , 0.3465867
,
        0.34355101],
       ...,
       [0.40604176, 0.41218718, 0.41041019, ..., 0.46794017,
0.47297497,
        0.47119799],
       [0.41218718, 0.41041019, 0.43513994, ..., 0.47297497,
0.47119799,
        0.47341922],
       [0.41041019, 0.43513994, 0.4417296 , ..., 0.47119799,
0.47341922,
        0.46497853]])
```

```
x_train1=x_train.reshape(x_train.shape[0],x_train.shape[1],1)
x_test=x_test.reshape(x_test.shape[0],x_test.shape[1],1)
x_train1
```

```
array([[[0.11335703],
        [0.11661484],
        [0.12053902],
        ...,
        [0.10980305],
        [0.1089886 ],
        [0.11054346]],

       [[0.11661484],
        [0.12053902],
        [0.11550422],
        ...,
        [0.1089886 ],
        [0.11054346],
        [0.10165852]],

       [[0.12053902],
        [0.11550422],
        [0.1156523 ],
        ...,
        [0.11054346],
        [0.10165852],
        [0.09906708]],

       ...,

       [[0.36731823],
        [0.35176958],
        [0.36080261],
        ...,
        [0.36391234],
```

```
         [0.37042796],
         [0.37042796]],

        [[0.35176958],
         [0.36080261],
         [0.35354657],
         ...,
         [0.37042796],
         [0.37042796],
         [0.37879461]],

        [[0.36080261],
         [0.35354657],
         [0.35295424],
         ...,
         [0.37042796],
         [0.37879461],
         [0.37916482]]])
```

Model building

Importing model building libraries

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import LSTM
```

Initializing the model

```
model=Sequential()
```

Adding LSTM and output layers

```
model.add(LSTM(50,return_sequences=True,input_shape=(10,1)))
model.add(LSTM(50,return_sequences=True))
model.add(LSTM(50))

model.add(Dense(1))

model.summary()
```

```
Model: "sequential"

_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 lstm (LSTM)                 (None, 10, 50)            10400

 lstm_1 (LSTM)               (None, 10, 50)            20200

 lstm_2 (LSTM)               (None, 50)                20200

 dense (Dense)               (None, 1)                 51
```

```
=================================================================
Total params: 50,851
Trainable params: 50,851
Non-trainable params: 0
_________________________________________________________________
```

Configuring the learning process

```
model.compile(loss='mean_squared_error',optimizer='adam')
```

Model training

```
model.fit(x_train,y_train,validation_data=(x_test,y_test),epochs=3,bat
ch_size=64,verbose=1)
```

```
Epoch 1/3
84/84 [==============================] - 10s 48ms/step - loss: 0.0021
- val_loss: 0.0011
Epoch 2/3
84/84 [==============================] - 3s 30ms/step - loss: 1.3056e-
04 - val_loss: 7.6737e-04
Epoch 3/3
84/84 [==============================] - 2s 29ms/step - loss: 1.2407e-
04 - val_loss: 7.6907e-04
```

```
<keras.callbacks.History at 0x7f32f48cef10>
```

Evaluation

```
train_predict=scaler.inverse_transform(train_data)
test_predict=scaler.inverse_transform(test_data)
```

```
import math
from sklearn.metrics import mean_squared_error
math.sqrt(mean_squared_error(train_data,train_predict))
```

```
29.347830443269938
```

Model saving

```
from tensorflow.keras.models import load_model
```

```
model.save("crude_oil.hs")
```

```
WARNING:absl:Found untraced functions such as lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses,
lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses,
lstm_cell_2_layer_call_fn while saving (showing 5 of 6). These
functions will not be directly callable after loading.
```

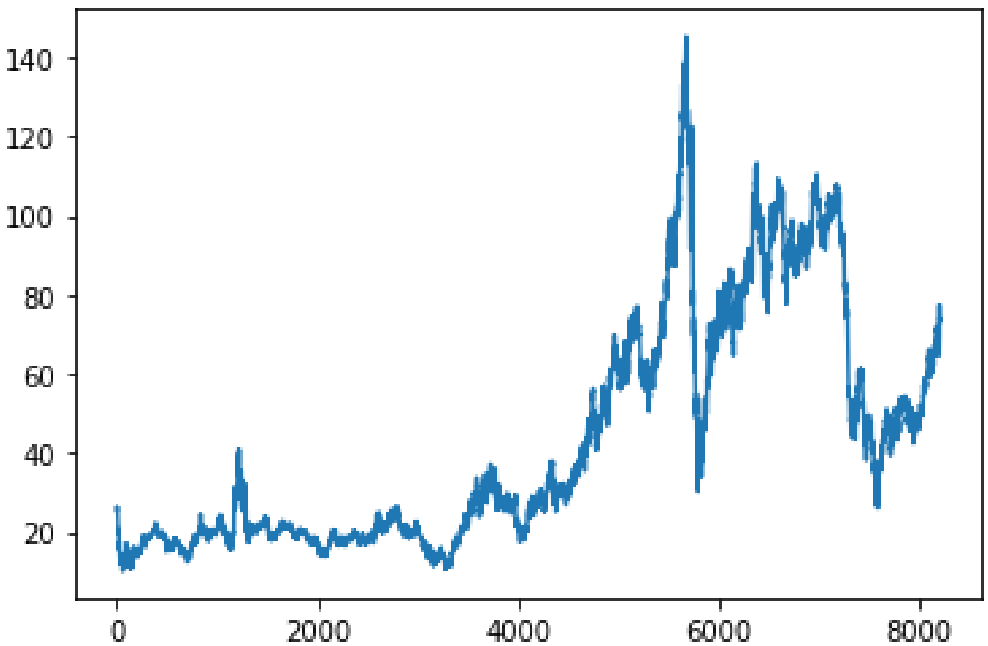
Model testing

```
look_back=10
trainpredictPlot = np.empty_like(data)
```

```
trainpredictPlot[:, :]= np.nan
trainpredictPlot[look_back:len(train_predict)+look_back, :] =
train_predict

testPredictplot = np.empty_like(data)
testPredictplot[:,: ] = np.nan
testPredictplot[look_back:len(test_predict)+look_back, :] =
test_predict

plt.plot(scaler.inverse_transform(data))
plt.show()
```




```
len(test_data)
```

```
2876
```

```
x_input=test_data[2866:].reshape(1,-1)
x_input.shape
```

```
(1, 10)
```

```
temp_input=list(x_input)
temp_input=temp_input[0].tolist()
temp_input
```

```
[0.44172960165852215,
 0.48111950244335855,
 0.49726047682511476,
 0.4679401747371539,
 0.4729749740855915,
 0.47119798608026064,
 0.47341922108692425,
```

```
 0.4649785280616022,
 0.4703835332444839,
 0.47149415074781587]
```

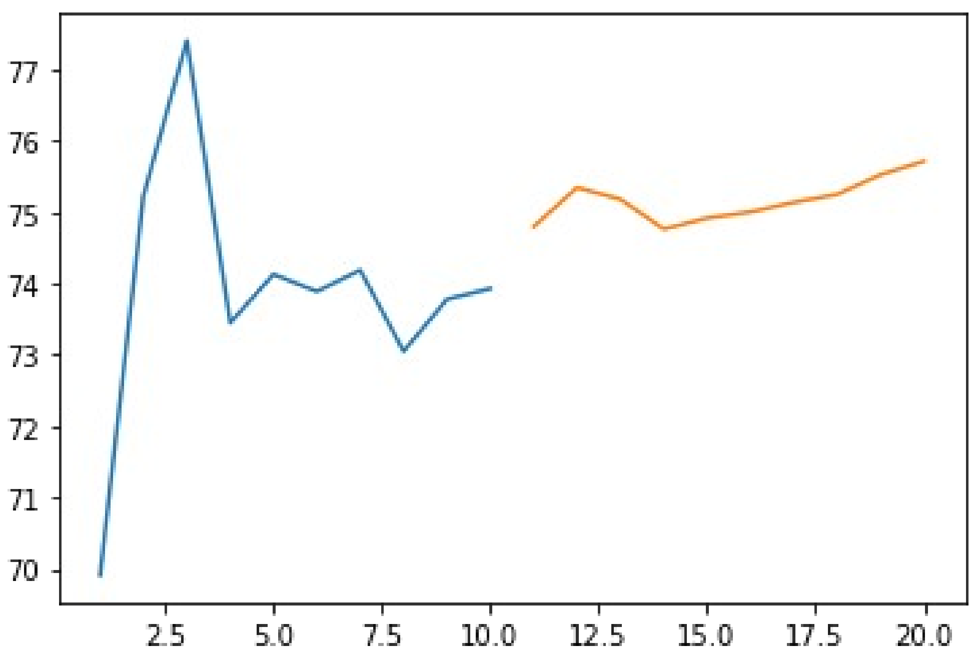
```
lst_output=[]
n_steps=10
i=0
while(i<10):
    if(len(temp_input)>10):
       x_input=np.array(temp_input[1:])
       print("{} day input {}".format(i,x_input))
       x_input=x_input.reshape(1,-1)
       x_input = x_input.reshape((1, n_steps, 1))
       yhat = model.predict(x_input, verbose=0)
       print("{} day output {}".format(i,yhat))
       temp_input.extend(yhat[0].tolist())
       temp_input=temp_input[1:]
       lst_output.extend(yhat.tolist())
       i=i+1
    else:
       x_input = x_input.reshape((1, n_steps,1))
       yhat = model.predict(x_input, verbose=0)
       print(yhat[0])
       temp_input.extend(yhat[0].tolist())
       print(len(temp_input))
       lst_output.extend(yhat.tolist())
       i=i+1
```

```
[0.4779267]
11
1 day input [0.4811195  0.49726048 0.46794017 0.47297497 0.47119799
0.47341922
 0.46497853 0.47038353 0.47149415 0.4779267 ]
1 day output [[0.48198324]]
2 day input [0.49726048 0.46794017 0.47297497 0.47119799 0.47341922
0.46497853
 0.47038353 0.47149415 0.4779267  0.48198324]
2 day output [[0.48077223]]
3 day input [0.46794017 0.47297497 0.47119799 0.47341922 0.46497853
0.47038353
 0.47149415 0.4779267  0.48198324 0.48077223]
3 day output [[0.4776754]]
4 day input [0.47297497 0.47119799 0.47341922 0.46497853 0.47038353
0.47149415
 0.4779267  0.48198324 0.48077223 0.47767541]
4 day output [[0.47881684]]
5 day input [0.47119799 0.47341922 0.46497853 0.47038353 0.47149415
0.4779267
 0.48198324 0.48077223 0.47767541 0.47881684]
5 day output [[0.4794408]]
6 day input [0.47341922 0.46497853 0.47038353 0.47149415 0.4779267
```

```
0.48198324
 0.48077223 0.47767541 0.47881684 0.47944081]
6 day output [[0.4804469]]
7 day input [0.46497853 0.47038353 0.47149415 0.4779267  0.48198324
0.48077223
 0.47767541 0.47881684 0.47944081 0.4804469 ]
7 day output [[0.48127162]]
8 day input [0.47038353 0.47149415 0.4779267  0.48198324 0.48077223
0.47767541
 0.47881684 0.47944081 0.4804469  0.48127162]
8 day output [[0.48332173]]
9 day input [0.47149415 0.4779267  0.48198324 0.48077223 0.47767541
0.47881684
 0.47944081 0.4804469  0.48127162 0.48332173]
9 day output [[0.4847059]]
```

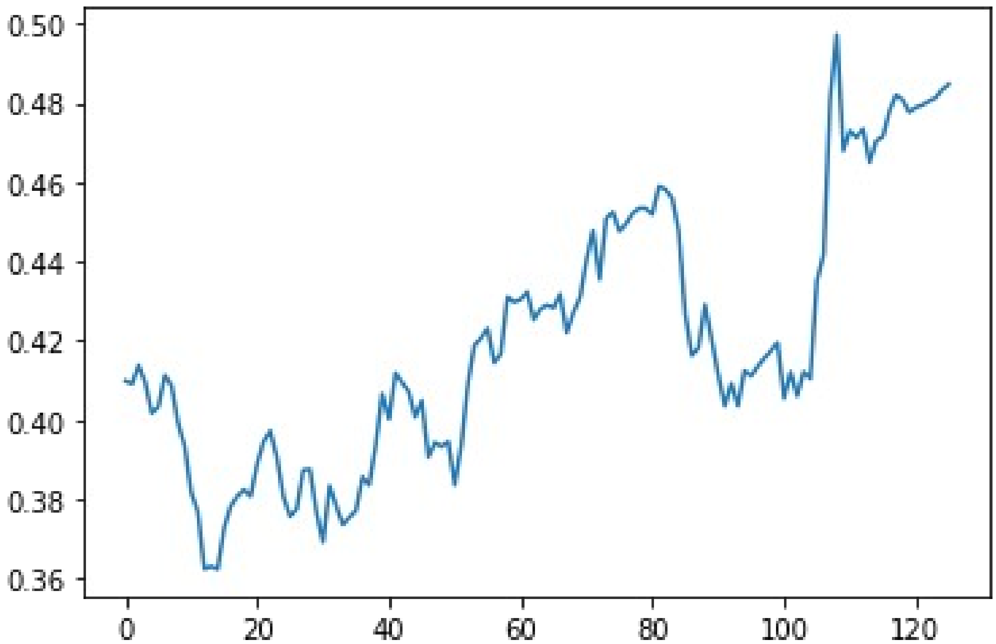
```
day_new=np.arange(1,11)
day_pred=np.arange(11,21)
len(data)
plt.plot(day_new, scaler.inverse_transform(data[8206:]))
plt.plot(day_pred, scaler.inverse_transform(lst_output))
```

```
[<matplotlib.lines.Line2D at 0x7f32ebb04950>]
```




```
df3=data.tolist()
df3.extend(lst_output)
plt.plot(df3[8100:])
```

```
[<matplotlib.lines.Line2D at 0x7f32efc1dad0>]
```




```
df3=scaler.inverse_transform(df3).tolist()
plt.plot(scaler.inverse_transform(data))
```

```
[<matplotlib.lines.Line2D at 0x7f32f00b5890>]
```