MODEL BUILDING-TEST THE MODEL

Team ID	PNT2022TMID52922
Project Name	Crude Oil Price Prediction

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

```
[ ] data = pd.read_excel("/content/drive/MyDrive/Crude Oil Prices Daily.xlsx")
    data.head()
```

	Date	Closing Value
0	1986-01-02	25.56
1	1986-01-03	26.00
2	1986-01-06	26.53
3	1986-01-07	25.85
4	1986-01-08	25.87

```
[ ] data.isnull().any()
```

```
Date            False
Closing Value    True
dtype: bool
```

```
[ ] data.dropna(axis=0,inplace=True)
```

```
[ ] data.isnull().sum()
```

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

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

```
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
```

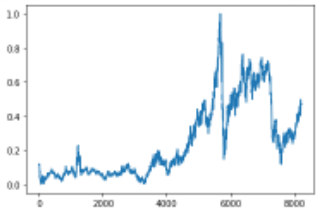
```
[ ] from sklearn.preprocessing import MinMaxScaler
    scaler=MinMaxScaler(feature_range=(0,1))
    data_oil=scaler.fit_transform(np.array(data_oil).reshape(-1,1))
```

```
[ ] data_oil
```

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

```
[ ] plt.plot(data_oil)
```

```
[<matplotlib.lines.Line2D at 0x7f05a724c690>]
```



```
training_size=int(len(data_oil)*0.65)
test_size=len(data_oil)-training_size
train_data,test_data=data_oil[0:training_size,:],data_oil[training_size:len(data_oil),: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,)
(None, None)
```

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

```
(2865, 10)
(2865,)
(None, None)
```

```
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_train=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)
```

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

```
model=Sequential()
```

```
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
_________________________________________________________________
```

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

```
[ ] model.fit(x_train,y_train,validation_data=(x_test,y_test),epochs=3,batch_size=64,verbose=1)
```

```
Epoch 1/3
84/84 [==============================] - 8s 30ms/step - loss: 0.0020 - val_loss: 0.0012
Epoch 2/3
84/84 [==============================] - 1s 17ms/step - loss: 1.3052e-04 - val_loss: 8.6409e-04
Epoch 3/3
84/84 [==============================] - 1s 17ms/step - loss: 1.3058e-04 - val_loss: 7.7004e-04
<keras.callbacks.History at 0x7f0548caa6d0>
```

```
[ ] train_predict=scaler.inverse_transform(train_data)
    test_predict=scaler.inverse_transform(test_data)
    ### Calculate RMSE performance metrics
    import math
    from sklearn.metrics import mean_squared_error
    math.sqrt(mean_squared_error(train_data,train_predict))
```

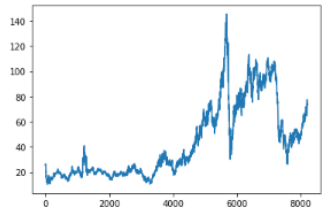
```
29.347830443269938
```

```
[ ] 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, ls
```

```
look_back=10
trainpredictPlot = np.empty_like(data_oil)
trainpredictPlot[:, :]= np.nan
trainpredictPlot[look_back:len(train_predict)+look_back, :] = train_predict
# shift test predictions for plotting
testPredictplot = np.empty_like(data_oil)
testPredictplot[:,: ] = np.nan
testPredictplot[look_back:len(test_predict)+look_back, :] = test_predict
# plot baseline and predictions
plt.plot(scaler.inverse_transform(data_oil))
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,
 0.46794017473715391,
 0.47297497408555915,
 0.47119798608026064,
 0.47341922108692425,
 0.4649785280616022,
 0.4708335332444839,
 0.47149415074781587]
```

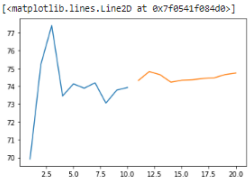
+ Code + Text

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

```
[0.47439992]
11
1 day input [0.4811195  0.49726048 0.46794017 0.47297497 0.47119799 0.47341922
 0.46497853 0.47038353 0.47149415 0.47439992]
1 day output [[0.47809386]]
2 day input [0.49726048 0.46794017 0.47297497 0.47119799 0.47341922 0.46497853
 0.47038353 0.47149415 0.47439992 0.47809386]
2 day output [[0.47678912]]
3 day input [0.46794017 0.47297497 0.47119799 0.47341922 0.46497853 0.47038353
 0.47149415 0.47439992 0.47809386 0.47678912]
3 day output [[0.4736882]]
4 day input [0.47297497 0.47119799 0.47341922 0.46497853 0.47038353 0.47149415
 0.47439992 0.47809386 0.47678912 0.47368819]
4 day output [[0.47448394]]
5 day input [0.47119799 0.47341922 0.46497853 0.47038353 0.47149415 0.47439992
 0.47809386 0.47678912 0.47368819 0.47448394]
5 day output [[0.47471228]]
6 day input [0.47341922 0.46497853 0.47038353 0.47149415 0.47439992 0.47809386
 0.47678912 0.47368819 0.47448394 0.47471228]
6 day output [[0.47522154]]
7 day input [0.46497853 0.47038353 0.47149415 0.47439992 0.47809386 0.47678912
 0.47368819 0.47448394 0.47471228 0.47522154]
7 day output [[0.47549203]]
8 day input [0.47038353 0.47149415 0.47439992 0.47809386 0.47678912 0.47368819
 0.47448394 0.47471228 0.47522154 0.47549203]
8 day output [[0.47683635]]
9 day input [0.47149415 0.47439992 0.47809386 0.47678912 0.47368819 0.47448394
 0.47471228 0.47522154 0.47549203 0.47683635]
9 day output [[0.477492]]
```

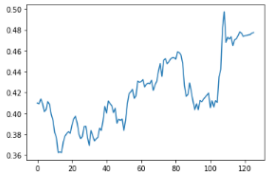
```
day_new=np.arange(1,11)
day_pred=np.arange(11,21)
len(data_oil)
plt.plot(day_new, scaler.inverse_transform(data_oil[8206:]))
plt.plot(day_pred, scaler.inverse_transform(lst_output))
```

```
[<matplotlib.lines.Line2D at 0x7f0541f084d0>]
```




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

```
[<matplotlib.lines.Line2D at 0x7f0541e65910>]
```




```
df3=scaler.inverse_transform(df3).tolist()
```

```
plt.plot(scaler.inverse_transform(data_oil))
```

```
[<matplotlib.lines.Line2D at 0x7f05444310d0>]
```