Delivery of Sprint-1

Date	**31 October 2022**
Team ID	**PNT2022TMID21644**
Project Name	**Crude Oil Price Prediction**

MODEL BUILDING

Importing The 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 Layers

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

Adding Output Layers

```
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
_________________________________________________________________
```

Configure The Learning Process

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

Train The Model

```
model.fit(X_train, y_train, validation_data = (X_test, ytest), epochs
= 10, batch_size = 64, verbose = 1)
Epoch 1/10
84/84 [==============================] - 8s 33ms/step - loss: 0.0019 -
val_loss: 9.9616e-04
Epoch 2/10
84/84 [==============================] - 1s 17ms/step - loss: 1.2329e-
04 - val_loss: 7.3913e-04
Epoch 3/10
84/84 [==============================] - 1s 17ms/step - loss: 1.2148e-
04 - val_loss: 0.0014
Epoch 4/10
84/84 [==============================] - 1s 18ms/step - loss: 1.2151e-
04 - val_loss: 7.6063e-04
Epoch 5/10
84/84 [==============================] - 1s 17ms/step - loss: 1.2602e-
04 - val_loss: 0.0020
Epoch 6/10
84/84 [==============================] - 1s 17ms/step - loss: 1.2412e-
04 - val_loss: 0.0011
Epoch 7/10
84/84 [==============================] - 1s 17ms/step - loss: 1.1884e-
04 - val_loss: 7.1855e-04
Epoch 8/10
84/84 [==============================] - 1s 17ms/step - loss: 1.1737e-
04 - val_loss: 7.6043e-04
Epoch 9/10
84/84 [==============================] - 1s 17ms/step - loss: 1.1241e-
04 - val_loss: 9.7294e-04
Epoch 10/10
84/84 [==============================] - 1s 17ms/step - loss: 1.1236e-
04 - val_loss: 6.5660e-04
<keras.callbacks.History at 0x2505dbb7970>
```

Model Evaluation

```
train_predict=model.predict(X_train)
test_predict=model.predict(X_test)
167/167 [==============================] - 2s 3ms/step
90/90 [==============================] - 0s 3ms/step

train_predict = scaler.inverse_transform(train_predict)
test_predict = scaler.inverse_transform(test_predict)
import math
from sklearn.metrics import mean_squared_error
math.sqrt(mean_squared_error(y_train,train_predict))
28.851078372476536
```

Save The Model

```
from tensorflow.keras.models import load_model
model.save("Crude_oil.h5")
```

Test The Model

```
look_back = 0
trainPredictPlot = np.empty_like(data_oil)
trainPredictPlot[:, :] = np.nan
trainPredictPlot[look_back:len(train_predict) + look_back, :] =
train_predict

testPredictPlot = np.empty_like(data_oil)
testPredictPlot[:,:] = np.nan
testPredictPlot[len(train_predict)+(look_back*2)+1: len(data_oil)-1,
:] = test_predict

plt.plot(scaler.inverse_transform(data_oil))
plt.plot(trainPredictPlot)
plt.plot(testPredictPlot)
plt.title("Testing The Model")
plt.show()
```

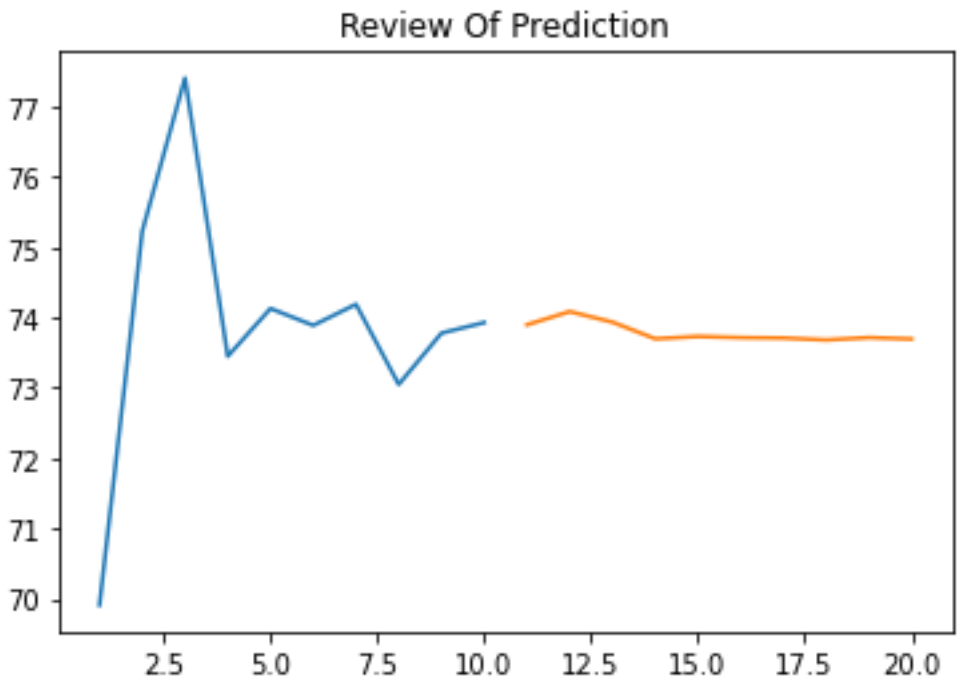

```
len(test_data)
2876
```

```
x_input = test_data[2866:].reshape(1,-1)
x_input.shape
(1, 10)
```

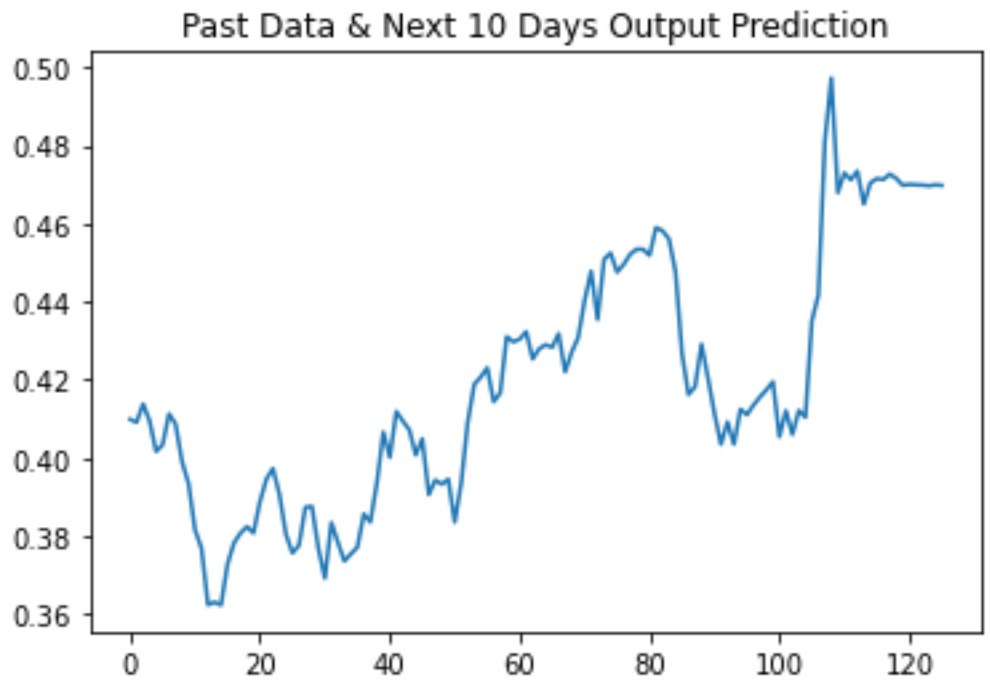
```
temp_input = list(x_input)
temp_input = temp_input[0].tolist()
temp_input
[0.44172960165852215,
 0.48111950244335855,
 0.49726047682511476,
 0.4679401747371539,
 0.4729749740855915,
 0.47119798608026064,
 0.47341922108692425,
 0.4649785280616022,
 0.4703835332444839,
 0.47149415074781587]
```

```
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
[0.47125974]
11
1 day input [0.4811195  0.49726048 0.46794017 0.47297497 0.47119799
0.47341922
 0.46497853 0.47038353 0.47149415 0.47125974]
1 day output [[0.47265336]]
2 day input [0.49726048 0.46794017 0.47297497 0.47119799 0.47341922
0.46497853
 0.47038353 0.47149415 0.47125974 0.47265336]
2 day output [[0.4715367]]
3 day input [0.46794017 0.47297497 0.47119799 0.47341922 0.46497853
0.47038353
 0.47149415 0.47125974 0.47265336 0.4715367 ]
3 day output [[0.46978694]]
4 day input [0.47297497 0.47119799 0.47341922 0.46497853 0.47038353
0.47149415
 0.47125974 0.47265336 0.4715367  0.46978694]
4 day output [[0.4700314]]
5 day input [0.47119799 0.47341922 0.46497853 0.47038353 0.47149415
0.47125974
```

```
 0.47265336 0.4715367  0.46978694 0.47003141]
5 day output [[0.4699089]]
6 day input [0.47341922 0.46497853 0.47038353 0.47149415 0.47125974
0.47265336
 0.4715367  0.46978694 0.47003141 0.46990889]
6 day output [[0.46986535]]
7 day input [0.46497853 0.47038353 0.47149415 0.47125974 0.47265336
0.4715367
 0.46978694 0.47003141 0.46990889 0.46986535]
7 day output [[0.46965963]]
8 day input [0.47038353 0.47149415 0.47125974 0.47265336 0.4715367
0.46978694
 0.47003141 0.46990889 0.46986535 0.46965963]
8 day output [[0.4699126]]
9 day input [0.47149415 0.47125974 0.47265336 0.4715367  0.46978694
0.47003141
 0.46990889 0.46986535 0.46965963 0.46991259]
9 day output [[0.46976325]]



day_new = np.arange(1,11)
day_pred = np.arange(11,21)
len(data_oil)
8216




plt.plot(day_new,scaler.inverse_transform(data_oil[8206:]))
plt.title("Review Of Prediction")
plt.plot(day_pred,scaler.inverse_transform(lst_output))
plt.show()
```




```
df3 = data_oil.tolist()
df3.extend(lst_output)
plt.title("Past Data & Next 10 Days Output Prediction")
plt.plot(df3[8100:])
[<matplotlib.lines.Line2D at 0x250696187c0>]
```




```
df3 = scaler.inverse_transform(df3).tolist()
plt.title("Past Data & Next 10 Days Output Prediction After Reversing
The Scaled Values")
plt.plot(df3)
[<matplotlib.lines.Line2D at 0x25069758a30>]
```

Past Data & Next 10 Days Output Prediction After Reversing The Scaled Values