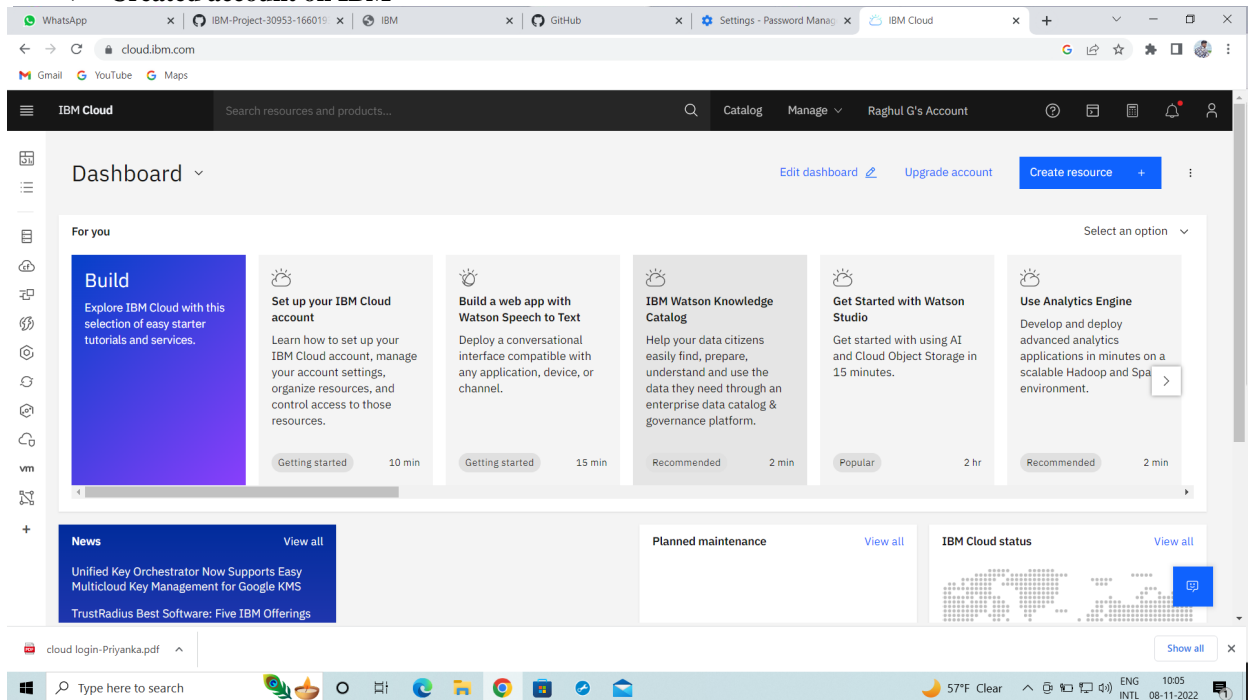


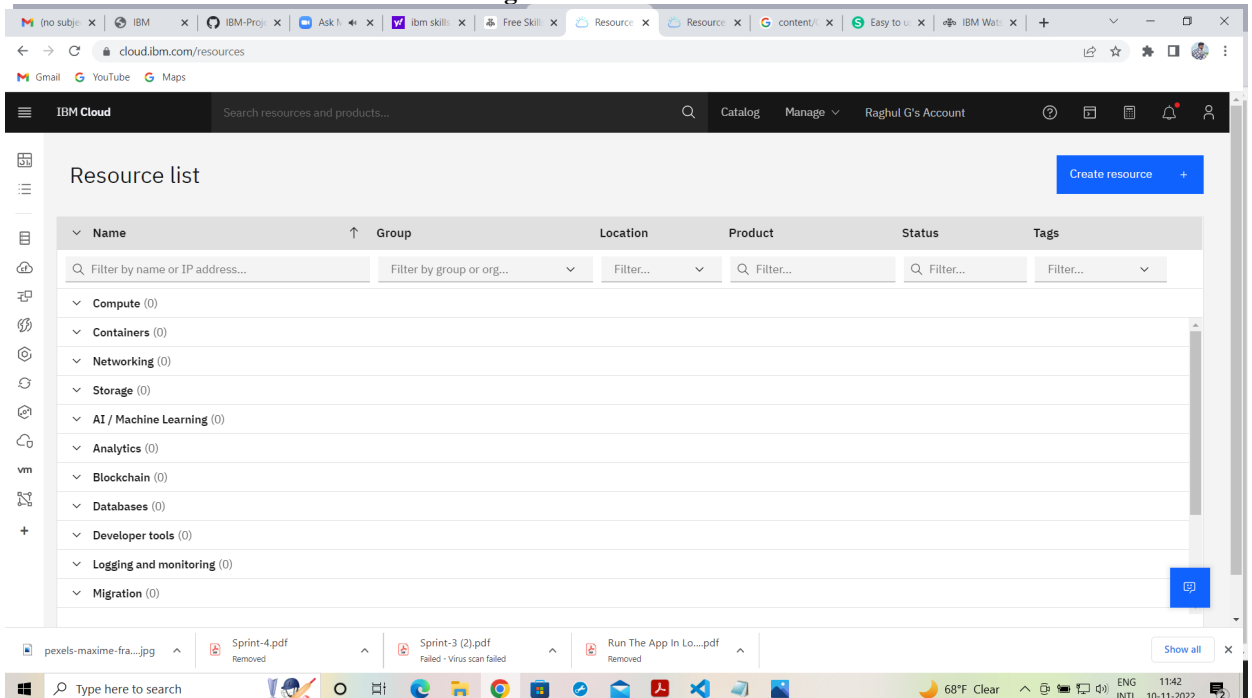
Delivery of Sprint-4

Date	09 November 2022
Team ID	PNT2022TMID36951
Project Name	Crude Oil Price Prediction

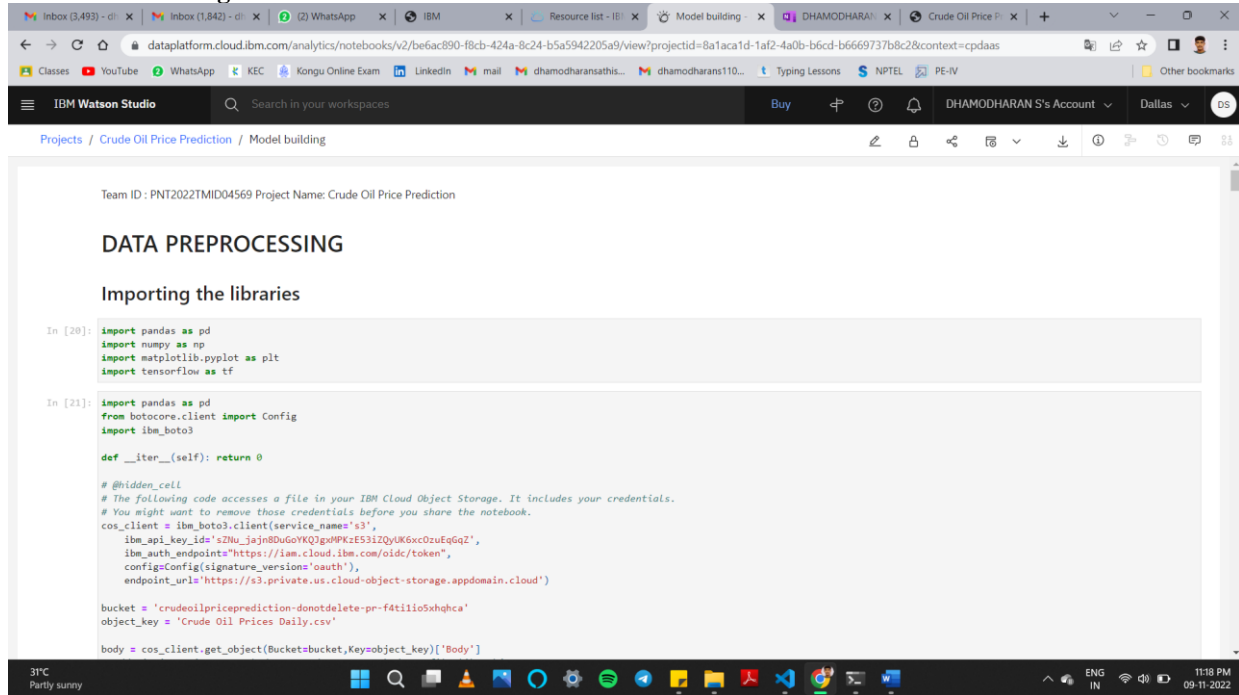
- Register for IBM Cloud:
❖ Created account on IBM



- ❖ Activated Watson machine learning and Watson Studio:



- **Train the model on IBM:**
 - ❖ **Model building in IBM Watson studio:**



Team ID : PNT2022TMD04569 Project Name: Crude Oil Price Prediction

DATA PREPROCESSING

Importing the libraries

```
In [20]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import tensorflow as tf

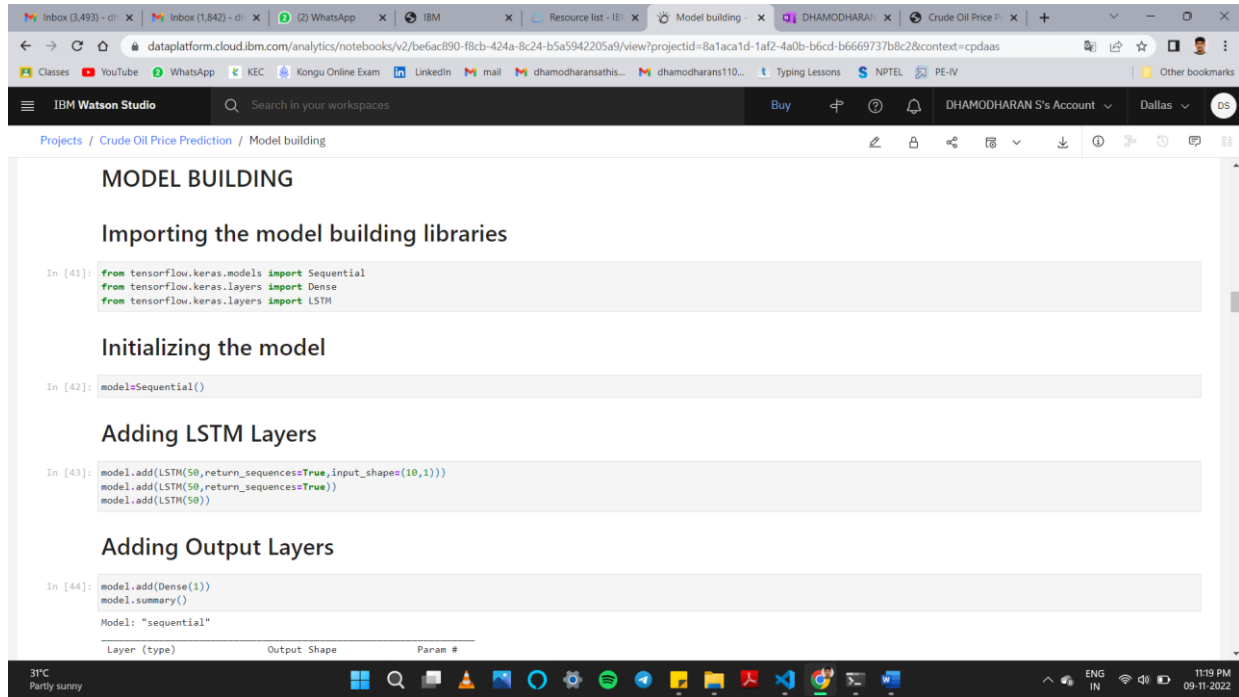
In [21]: import pandas as pd
from boto3.client import Config
import ibm_boto3

def __iter__(self): return 0

# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials.
# You might want to remove those credentials before you share the notebook.
cos_client = ibm_boto3.client(service_name='s3',
    ibm_api_key_id='s2Wu_jajn8DuGoYKQgWPKzE53iZQyUK6xc0zuEg6q2',
    ibm_auth_endpoint='https://iam.cloud.ibm.com/oidc/token',
    config=Config(signature_version='oauth'),
    endpoint_url='https://s3.private.us.cloud-object-storage.appdomain.cloud')

bucket = 'crudeoilpriceprediction-donotdelete-pr-f4t1lio5xhqhca'
object_key = 'Crude Oil Prices Daily.csv'

body = cos_client.get_object(Bucket=bucket, Key=object_key)['Body']
```



MODEL BUILDING

Importing the model building libraries

```
In [41]: from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import LSTM
```

Initializing the model

```
In [42]: model=Sequential()
```

Adding LSTM Layers

```
In [43]: 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

```
In [44]: model.add(Dense(1))
model.summary()

Model: "sequential"
```

Layer (type)	Output Shape	Param #
--------------	--------------	---------

IBM Watson Studio

Projects / Crude Oil Price Prediction / Model building

```
In [61]: !pip install ibm_watson_machine_learning

Requirement already satisfied: ibm_watson_machine_learning in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (1.0.255)
Requirement already satisfied: requests in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm_watson_machine_learning) (2.26.0)
Requirement already satisfied: lomond in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm_watson_machine_learning) (0.3.3)
Requirement already satisfied: importlib-metadata in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm_watson_machine_learning) (4.8.2)
Requirement already satisfied: urllib3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm_watson_machine_learning) (1.26.7)
Requirement already satisfied: pandas<1.5.0,>=0.24.2 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm_watson_machine_learning) (1.3.4)
Requirement already satisfied: packaging in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm_watson_machine_learning) (21.3)
Requirement already satisfied: tabulate in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm_watson_machine_learning) (0.8.9)
Requirement already satisfied: certifi in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm_watson_machine_learning) (2022.9.24)
Requirement already satisfied: ibm-cos-sdk==2.11.* in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm_watson_machine_learning) (2.11.0)
Requirement already satisfied: jmespath<1.0.0,>=0.7.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-cos-sdk==2.11.*->ibm_watson_machine_learning) (0.10.0)
Requirement already satisfied: ibm-cos-sdk-core==2.11.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-cos-sdk==2.11.*->ibm_watson_machine_learning) (2.11.0)
Requirement already satisfied: ibm-cos-sdk-s3transfer==2.11.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-cos-sdk==2.11.*->ibm_watson_machine_learning) (2.11.0)
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-cos-sdk-core==2.11.0->ibm-cos-sdk==2.11.*->ibm_watson_machine_learning) (2.8.2)
Requirement already satisfied: pytz>=2017.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas<1.5.0,>=0.24.2->ibm_watson_machine_learning) (2021.3)
Requirement already satisfied: numpy>=1.17.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas<1.5.0,>=0.24.2->ibm_watson_machine_learning) (1.20.3)
Requirement already satisfied: six>=1.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from python-dateutil<3.0.0,>=2.1->ibm-cos-sdk-core==2.11.0->ibm-cos-sdk==2.11.*->ibm_watson_machine_learning) (1.15.0)
Requirement already satisfied: charset-normalizer==2.0.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests->ibm_watson_machine_learning) (2.0.4)
Requirement already satisfied: idna<4,>=2.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests->ibm_watson_machine_learning) (3.3)
Requirement already satisfied: zipp>=0.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from importlib-metadata->ibm_watson_machine_learning) (3.6.0)
Requirement already satisfied: pyparsing<3.0.5,>=2.0.2 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from packaging->ibm_watson_machine_learning) (3.0.4)
```

```
In [62]: from ibm_watson_machine_learning import APIClient

uml_credentials = {
    "url": "https://us-south.ml.cloud.ibm.com",
    "apikey": "r6EZjmg7n63ChqRtp_rY3E6xVQm3IYUu0AftuH"
}
client = APIClient(uml_credentials)
```

```
In [63]: def guid_from_space_name(client, space_name):
        space = client.spaces.get_details()
        return(next(item for item in space['resources'] if item['entity']['name']== space_name)['metadata']['id'])
```

31°C
Partly sunny

IBM Watson Studio

Projects / Crude Oil Price Prediction / Model building

```
In [64]: space_uid = guid_from_space_name(client, 'models')
        print("Space UID = " + space_uid)

Space UID = 0fc5e179-3342-4216-a402-f74fa4d20809
```

```
In [65]: client.set_default_space(space_uid)
```

```
Out[65]: 'SUCCESS'
```

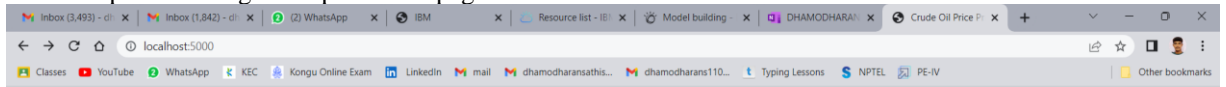
```
In [66]: client.software_specifications.list()
```

NAME	ASSET_ID	TYPE
default_py3.6	0062b8c9-8b7d-44a0-a9b9-46c416adcb9	base
kernel-spark3.2-scala2.12	020d69ce-7ac1-5e68-ac1a-31189867356a	base
pytorch-onnx_1.3-py3.7-edt	069ea134-3346-5748-b513-49120e15d288	base
scikit-learn_0.20-py3.6	09c5a1d0-9c1e-4473-a344-eb7b665ff687	base
spark-mllib_3.0-scala_2.12	09f4cffe-90a7-5899-b9ed-1ef348baedee	base
pytorch-onnx_rt22.1-py3.9	0b848dd4-e681-5599-ba41-b5f6fcc6471	base
ai-function_0.1-py3.6	0cdb0f1e-5376-4f4d-92dd-da3b69a9bda	base
shiny-r3.6	0e6e79df-875e-4f24-8ae9-62d2c2148306	base
tensorflow_2.4-py3.7-horovod	1092590a-307d-563d-9b62-4eb7d64b3f22	base
pytorch_1.1-py3.6	10ac12d6-6b30-4ccd-8392-3e922c096a92	base
tensorflow_1.15-py3.6-ddl	111e41b3-de2d-5422-a4d6-bf776828c4b7	base
runtime-22.1-py3.9	12883a17-24d8-5082-900f-bab31bf6f3cb	base
scikit-learn_0.22-py3.6	154010fa-5b3b-4ac1-82af-4d5e5a8bc85	base
default_r3.6	1b70aec3-ab34-4b87-8aa0-a4a3c8296a36	base
pytorch-onnx_1.3-py3.6	1bc6029a-cc97-56da-b8e0-39c3880dbbe7	base
kernel-spark3.3-r3.6	1c9e5454-f216-59dd-a20e-474a5cdf5988	base
pytorch-onnx_rt22.1-py3.9-edt	1d362186-7ad5-5b59-8b6c-9d0880bde37f	base
tensorflow_2.1-py3.6	1eb25b84-d6ed-5d0e-b6a5-3fbdf1665666	base
spark-mllib_3.2	20847f72-0a98-58c7-9ff5-a77b012eb8f5	base
tensorflow_2.4-py3.8-horovod	217c16fe-178f-56bf-824a-b19f20564c49	base
runtime-22.1-py3.9-cuda	26215f05-08c3-5a41-a1b0-da66306ce58	base
do_py3.8	295addb5-9ef9-547e-9bf4-92ae3563e720	base
autoai-ts_3.8-py3.8	2aa0c932-798f-5ae9-abd6-15e0c2402fb5	base

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Partly sunny

- **Integrate Flask with scoring end point:**

Home page: This is our home page where we get to know the summary of the project. By clicking on predict future price it will go to prediction page.



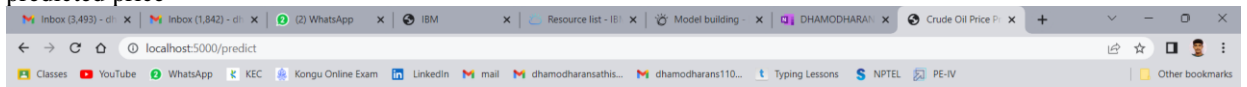
Crude Oil Price Prediction

Demand for oil is inelastic, therefore the rise in price is good news for producers because they will see an increase in their revenue. Oil importers, however, will experience increased costs of purchasing oil. Because oil is the largest traded commodity, the effects are quite significant. A rising oil price can even shift economic/political power from oil importers to oil exporters. The crude oil price movements are subject to diverse influencing factors.

[Predict Future Price](#)



Prediction page: In this page, by entering 10 days price and click the submit button, will give the predicted price



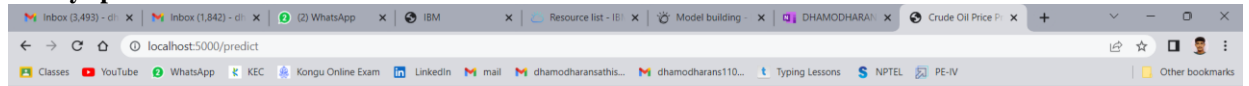
Crude Oil Price Prediction

Enter the crude oil price for

Submit



10 days price are entered:



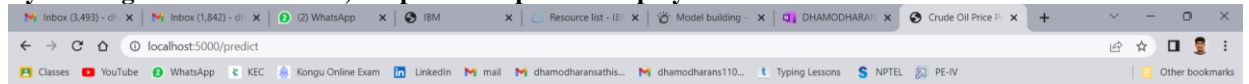
Crude Oil Price Prediction

43,54,34,66,55,46,65,49,50

Submit



By clicking the submit button, the predicted price is displayed:



Crude Oil Price Prediction

Enter the crude oil price for

Submit

[1.5764625072479248]

