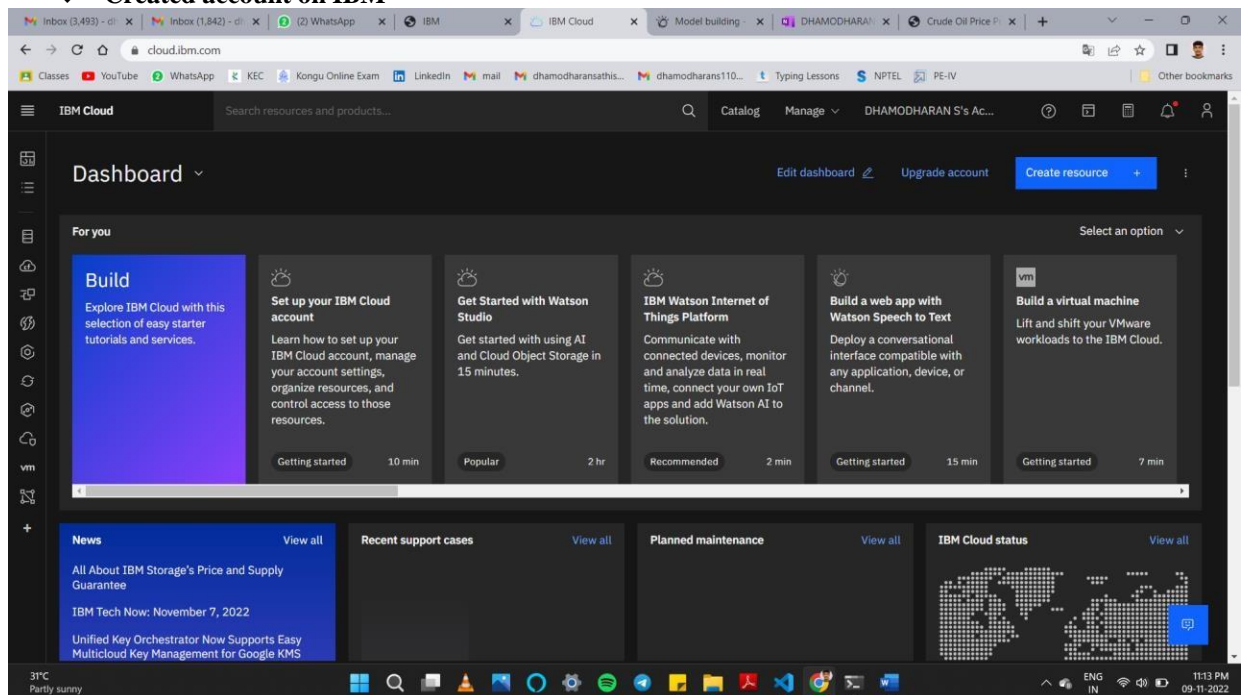
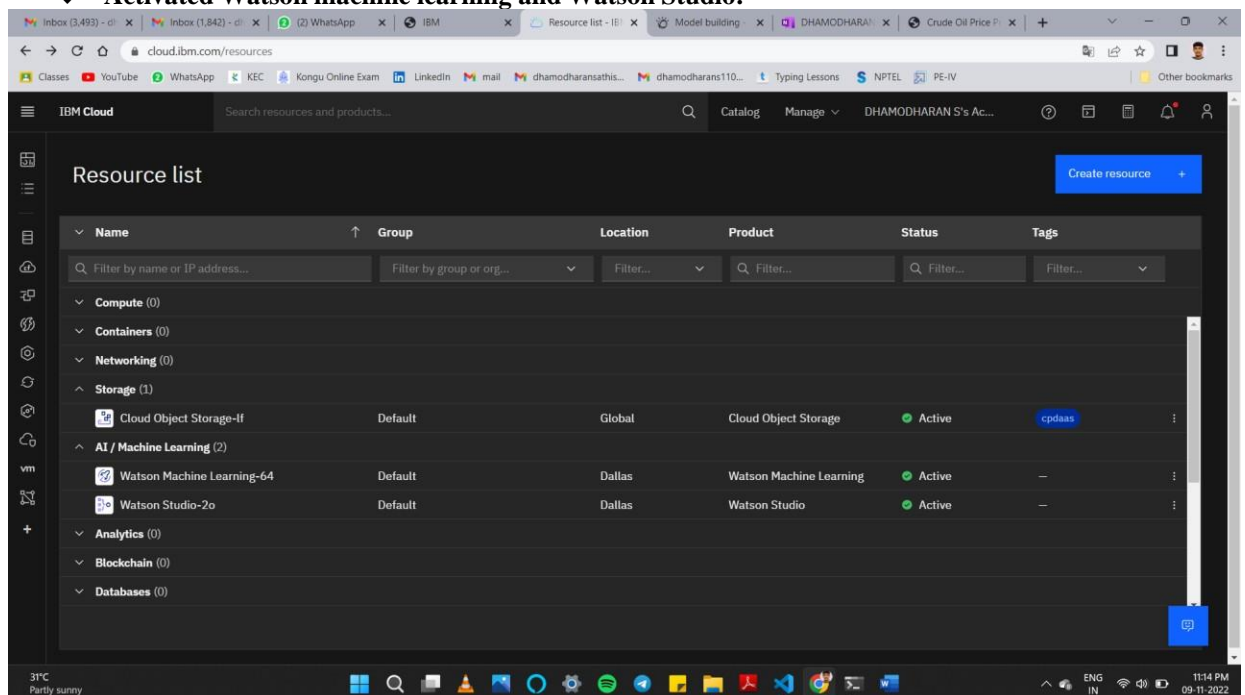


- **Register for IBM Cloud:**  
❖ **Created account on IBM**



- ❖ **Activated Watson machine learning and Watson Studio:**



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

Team ID : PNT2022TMID04569 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='s2Nw_jaj8DuGoYKQ3gWPKzE53iZQyUK6xc0zuEqGq2',
    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-f4t1iio5xhqhca'
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 #
--------------	--------------	---------

```
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": "r6E7jmg7n63ChgBp_rY3E6xV0Qm3IYUUn0AFTuH"
        }
        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'])
```

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

Space UID = 0fc5e179-3342-4216-a482-f74fa4d28809

In [65]: client.set_default_space(space_uid)

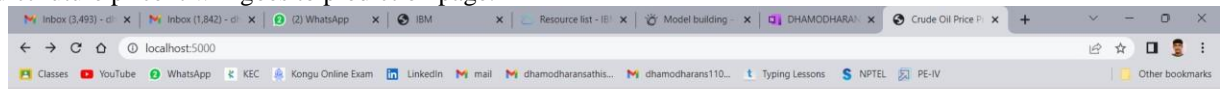
Out[65]: 'SUCCESS'

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

-----
NAME                ASSET_ID                TYPE
default_py3.6       0062b8c9-8b7d-44a0-a9b9-46c416adcbd9 base
kernel-spark3.2-scala2.12 020d69ce-7ac1-5e68-ac1a-31189867356a base
pytorch-onnx_1.3-py3.7-edt 069ea134-3346-5748-b513-40120e15d288 base
scikit-learn_0.20-py3.6 09c5a1b0-9c1e-4473-a34d-ab78665ff687 base
spark-mllib_3.0-scala_2.12 09f4cffe-90a7-5899-b9ed-1ef348aebdce base
pytorch-onnx_rt22.1-py3.9 0b848dd4-e681-5599-be41-b5f6fcc6471 base
ai-function_0.1-py3.6 0cdeb0fe-5376-4f4d-92dd-da3b69aa9bda base
shiny-r3.6          0e6e79df-875e-4f24-8ae9-62dcc2148306 base
tensorflow_2.4-py3.7-horovod 1092590a-307d-563d-9b62-4eb7d64b3f22 base
pytorch_1.1-py3.6 10ac1266-bb30-4ccd-8392-3e922c096a92 base
tensorflow_1.15-py3.6-ddl 111e41b3-d62d-5422-a4d6-bf7768284b7 base
runtime-22.1-py3.9 12b83a17-24d8-5082-900f-0ab31fbfd3cb base
scikit-learn_0.22-py3.6 154010fa-5b3b-4ac1-82af-4d5ee5abbc85 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 1d362186-7ad5-5b59-806c-9a08808de37f base
tensorflow_2.1-py3.6 1ab25804-d6ed-5d6e-b6a5-3fbdff166566 base
spark-mllib_3.2      20047f72-0a98-58c7-9ff5-a77b012eb8f5 base
tensorflow_2.4-py3.8-horovod 217c16f6-178f-56bf-824a-b19f20564c49 base
runtime-22.1-py3.9-cuda 26215f05-08c3-5a41-a1b0-da66306ce658 base
do_py3.8            295addb5-9ef9-547e-9bf4-92ae3563e720 base
autoai-ts_3.8-py3.8 2aa0c932-798f-5ae9-ab06-15e0c2402f5 base
tensorflow_2.4-py3.6 2a32c27f-5af6-424d-8000-4642c0a00000 base
```

- **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.



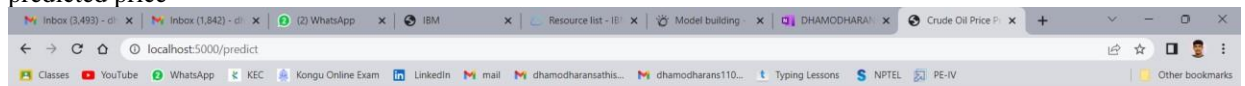
## Crude Oil Price Prediction

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

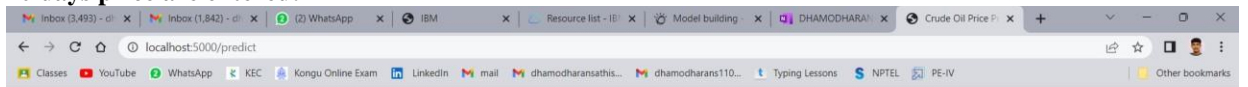


## Crude Oil Price Prediction

Enter the crude oil price for



10 days price are entered:



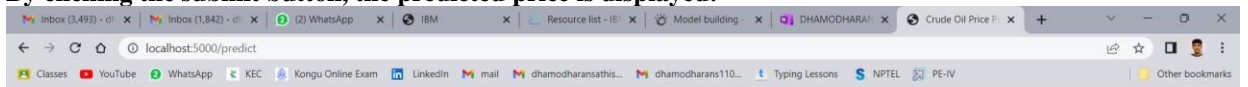
## Crude Oil Price Prediction

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

