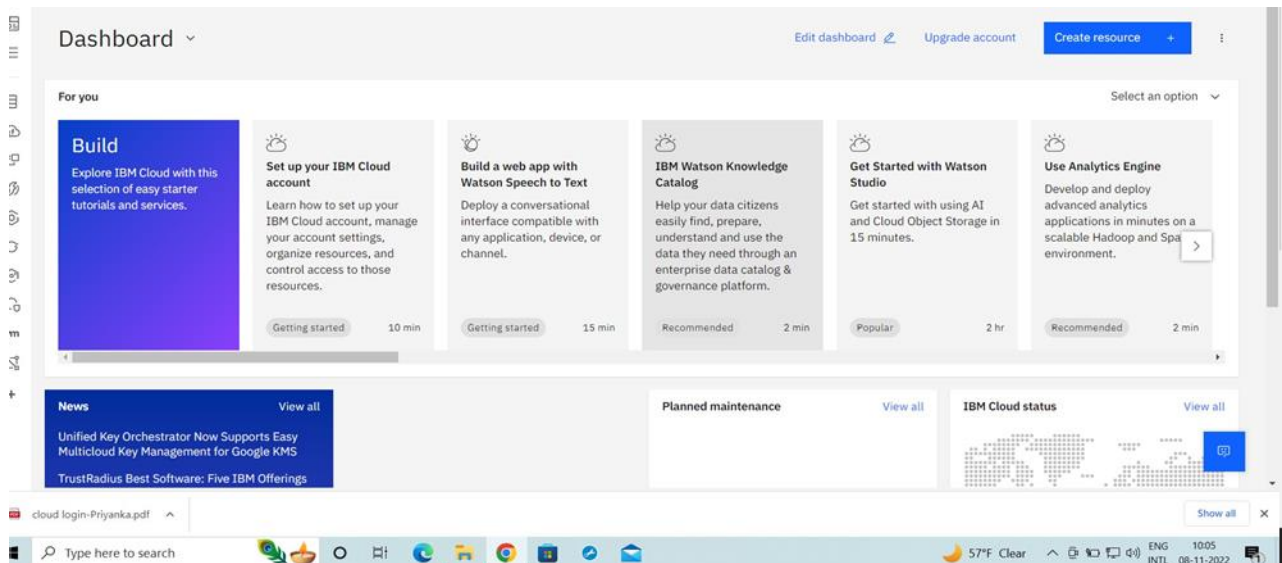


Delivery of Sprint-4

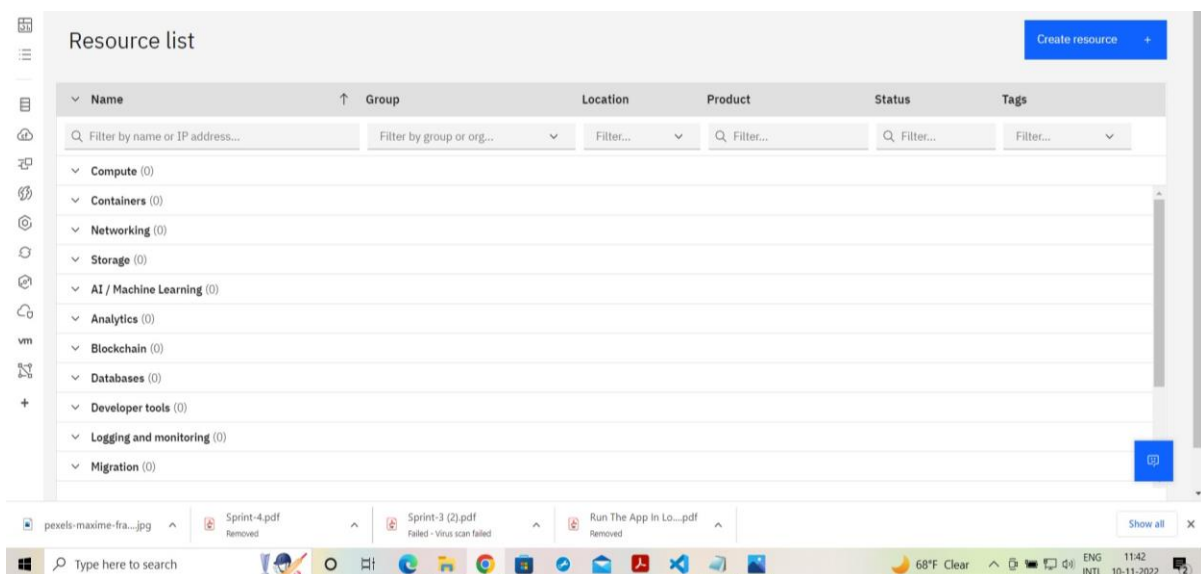
| | |
|--------------|----------------------------|
| Date | 14 November 2022 |
| Team ID | PNT2022TMID31476 |
| Project Name | Crude Oil Price Prediction |

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:**

Projects / Crude Oil Price Prediction / Model building

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 botocore.client import Config
import 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 = boto3.client(service_name='s3',
    iam_api_key_id='sZNu_jajN8DuGoYKQgXMPKzE53iZQyUK6xc0zuEg6q2',
    iam_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-f4ti1i05shqhca'
object_key = 'Crude Oil Prices Daily.csv'

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

31°C
Partly sunny

11:18 PM
09-11-2022

Projects / Crude Oil Price Prediction / Model building

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 # |
|--------------|--------------|---------|
| LSTM(50) | | |
| LSTM(50) | | |
| LSTM(50) | | |
| Dense(1) | | |

31°C
Partly sunny

11:19 PM
09-11-2022

```
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: lxml 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_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_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 packaging->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
        wml_credentials = {
            "url": "https://us-south.ml.cloud.ibm.com",
            "apikey": "r6Ezjpmg7n63ChgRbp_rY3E6xV0_MQm3IYDUm0AftuH"
        }
        client = APIClient(wml_credentials)

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

31°C
Partly sunny
```

```
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-f74fa4d28009

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          02b0d69ce-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         09f4cfff-90a7-5899-b9ed-lef348aebdee   base
pytorch-onnx_rt22.1-py3.9          0b848dd4-e681-5599-be41-b56f6ccc6471   base
ai-function_0.1-py3.6              0cdeb0f1e-5376-4f4d-92dd-da3b69aa9bda   base
shiny-r3.6                         0e6e79df-075e-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                12b3a17-24d8-5082-900f-0ab31fbfd3cb   base
scikit-learn_0.22-py3.6            154010fa-5b3b-4ac1-82af-4d5ee5abb085   base
default_r3.6                       1b70a9c3-ab34-4b07-8aa0-a4a3c8296a36   base
pytorch-onnx_1.3-py3.6             1bc6029a-cc97-56da-b8e0-39c3880dbbe7   base
kernel-spark3.3-r3.6               1c9e5454-f216-59d9-a20e-474a5cdf9888   base
pytorch-onnx_rt22.1-py3.9-edt      1d362186-7ad5-5b59-8b6c-9d0880bde37f   base
tensorflow_2.1-py3.6               1eb25b84-d5ed-5dde-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-abd6-15e0c2402fb5   base
tensorflow_1.15-py3.6              2b31-37f-73f6-130b-089-c27d26c0b4-...
-----
```

- **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](#)

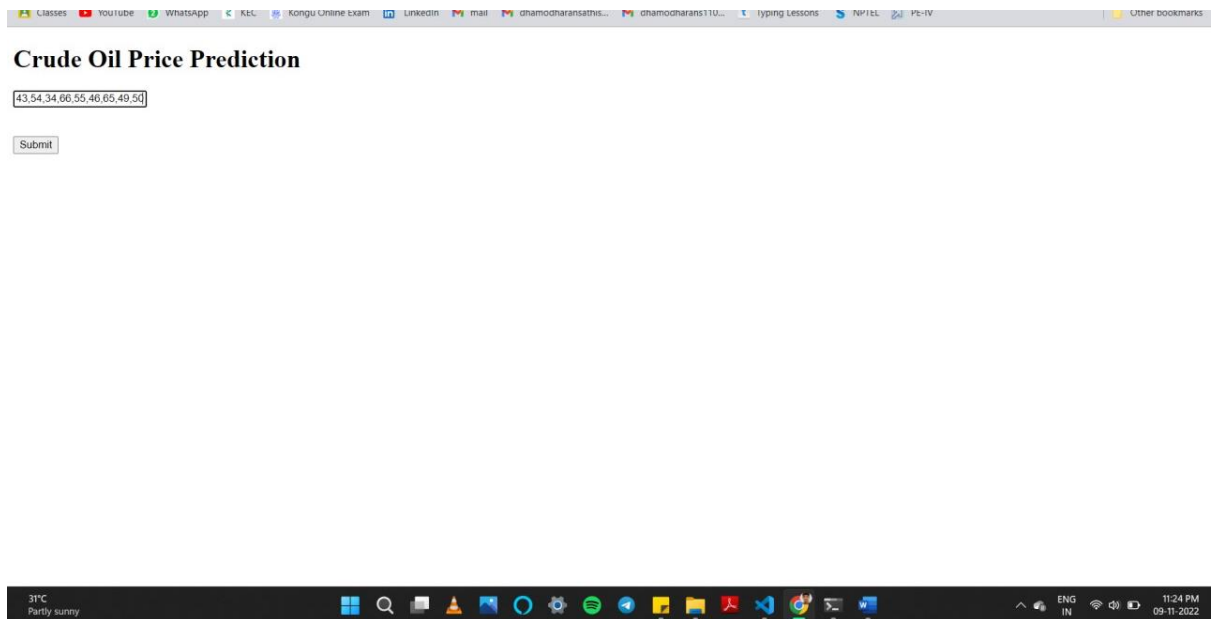


Prediction page: In this page, by entering 10 days price and click the submit button, will give the predicted price

Crude Oil Price Prediction



10 days price are entered:



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

