

## **Phase 4 : Project Development Part 2**

### **Project title:**

Machine learning model deployment with IBM cloud Watson Studio.

### **Problem Statement:**

Become a wizard of predictive analytics with IBM Cloud Watson Studio. Train machine learning models to predict the outcomes in real time. Deploy the models as web services and integrate them into your applications. Unlock the magic of data driven insights and make informed decisions like never before.

### **Contents of the document:**

- Installing the required libraries
- Adding Watson Machine Learning service credentials to access
- WatsonMachineLearningAPIClient library
- Storing the model in WML repository
- Web service

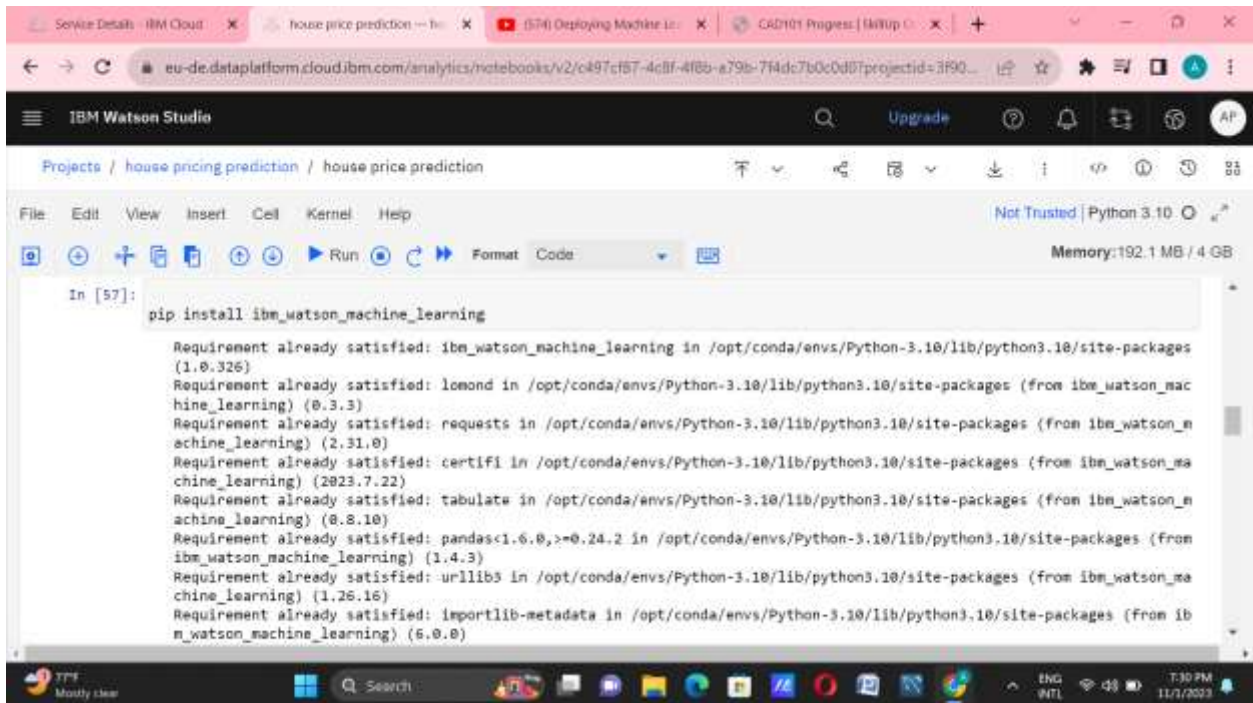
### **Project Overview:**

House Price Prediction Analysis aims to use Machine learning analysis algorithms to predict the price of houses based on their features like number of rooms, number of bedrooms, age of the house, population of the respective area where the house is located, location of the house and the area income with other relevant factors if available. By this Machine Learning model user can predict the price of the house that can be sold.

### **Step:1**

Install `ibm_watson_machine_learning` by the command

```
#pip install ibm_watson_machine_learning
```



The screenshot shows the IBM Watson Studio web interface. The browser address bar indicates the URL: `eu-de.dataplatform.cloud.ibm.com/analytics/notebooks/v2/c497cf57-4c8f-4f6b-a79b-7f4dc7b0c0d8?projectId=3f90...`. The interface displays a Jupyter Notebook for a project named "house price prediction". The command prompt shows the execution of `pip install ibm_watson_machine_learning`. The output indicates that all required dependencies are already satisfied, including `ibm_watson_machine_learning` (1.0.326), `lomond` (0.3.3), `requests` (2.31.0), `certifi` (2023.7.22), `tabulate` (0.8.10), `pandas` (1.4.3), `urllib3` (1.26.16), and `importlib-metadata` (6.0.0).

```
In [57]: pip install ibm_watson_machine_learning

Requirement already satisfied: ibm_watson_machine_learning in /opt/conda/envs/Python-3.10/lib/python3.10/site-packages (1.0.326)
Requirement already satisfied: lomond in /opt/conda/envs/Python-3.10/lib/python3.10/site-packages (from ibm_watson_machine_learning) (0.3.3)
Requirement already satisfied: requests in /opt/conda/envs/Python-3.10/lib/python3.10/site-packages (from ibm_watson_machine_learning) (2.31.0)
Requirement already satisfied: certifi in /opt/conda/envs/Python-3.10/lib/python3.10/site-packages (from ibm_watson_machine_learning) (2023.7.22)
Requirement already satisfied: tabulate in /opt/conda/envs/Python-3.10/lib/python3.10/site-packages (from ibm_watson_machine_learning) (0.8.10)
Requirement already satisfied: pandas<1.6.0,>=0.24.2 in /opt/conda/envs/Python-3.10/lib/python3.10/site-packages (from ibm_watson_machine_learning) (1.4.3)
Requirement already satisfied: urllib3 in /opt/conda/envs/Python-3.10/lib/python3.10/site-packages (from ibm_watson_machine_learning) (1.26.16)
Requirement already satisfied: importlib-metadata in /opt/conda/envs/Python-3.10/lib/python3.10/site-packages (from ibm_watson_machine_learning) (6.0.0)
```

## Step 2:

Import `WatsonMachineLearningAPIClient` library. Watson studio uses Watson Machine Learning service credentials to access WML service, so paste the credentials.

The screenshot shows the IBM Watson Studio web interface. The browser tabs include 'Service Details - IBM Cloud', 'house price prediction -- h...', 'CAD101 Progress | SkillUp', and 'WhatsApp'. The address bar shows the URL: `eu-de.dataplatform.cloud.ibm.com/analytics/notebooks/v2/c497cf57-4c8f-4f8b-a79b-7f4dc7b0c0d0/view?projectId=...`. The page title is 'IBM Watson Studio'. The breadcrumb navigation is 'Projects / house pricing prediction / house price prediction'. The notebook code is as follows:

```
In [38]: wml_credentials={
        "url": "https://eu-gb.ml.cloud.ibm.com",
        "apikey": "uhj5Kan018xAN155qCwVPjNvYK7c1VLo5iN450NU33nW",
    }

In [59]: from ibm_watson_machine_learning import APIClient
wml_client = APIClient(wml_credentials)
wml_client.spaces.list()

Note: 'limit' is not provided. Only first 50 records will be displayed if the number of records exceed 50

-----
ID              NAME      CREATED
-----
bdd1ea02-0e7c-4901-9e68-cae00e9617e7 yehovah 2023-10-31T16:38:00.892Z

Out[59]:
-----
ID              NAME      CREATED
-----
0 bdd1ea02-0e7c-4901-9e68-cae00e9617e7 yehovah 2023-10-31T16:38:00.892Z

In [44]: SPACE_ID="bdd1ea02-0e7c-4901-9e68-cae00e9617e7"

In [89]: wml_client.set_default_space(SPACE_ID)

Out[89]: 'SUCCESS'
```

### Step-3:

In this step we have to specify our machine learning model properties and store the model in WML repository.

The screenshot shows the IBM Watson Studio web interface with the same browser tabs and URL as the previous image. The breadcrumb navigation is 'Projects / house pricing prediction / house price prediction'. The notebook code is as follows:

```
0 bdd1ea02-0e7c-4901-9e68-cae00e9617e7 yehovah 2023-10-31T16:38:00.892Z

In [44]: SPACE_ID="bdd1ea02-0e7c-4901-9e68-cae00e9617e7"

In [89]: wml_client.set_default_space(SPACE_ID)

Out[89]: 'SUCCESS'

In [40]: model=classifier

In [71]: software_spec_uid=wml_client.software_specifications.get_id_by_name('scikit-learn_0.23')
model_props = {

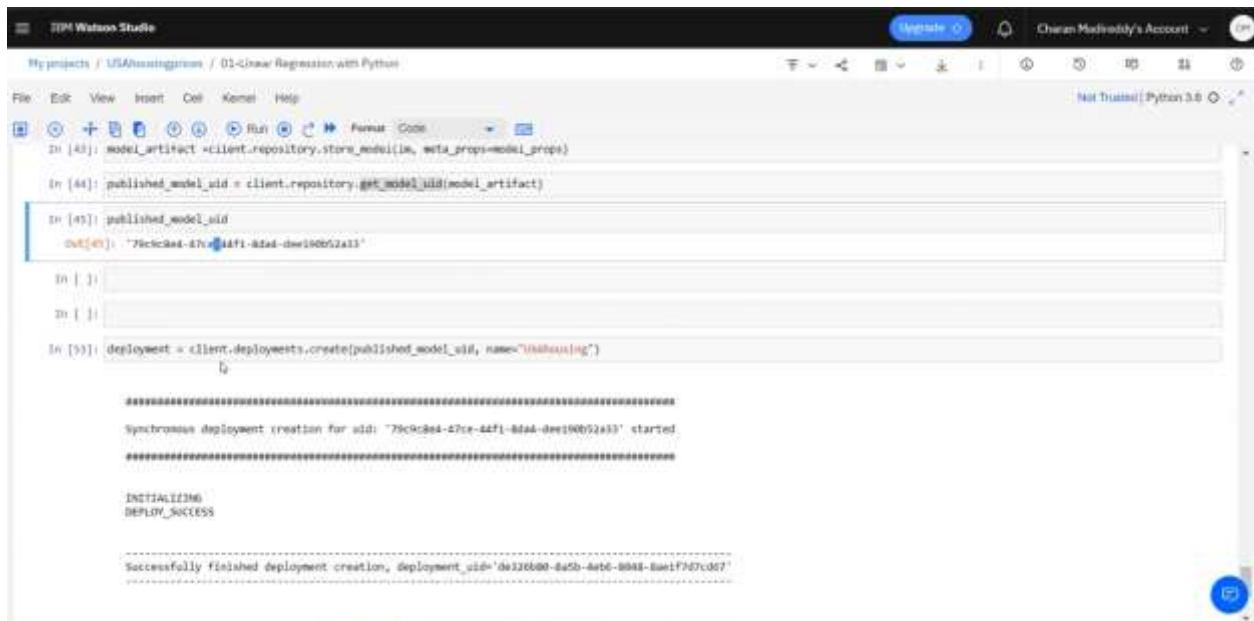
    wml_client.repository.ModelMetaNames.NAME: "MyModel",

    wml_client.repository.ModelMetaNames.TYPE: "scikit-learn_0.23",
    wml_client.repository.ModelMetaNames.SOFTWARE_SPEC_UID: software_spec_uid,
}

In [72]: saved_model=wml_client.repository.store_model(model=classifier,meta_props=model_props)
```

## Step :4

Successfully we have deployed our model in IBM Watson Studio.



```
In [43]: model_artifact = client.repository.store_model(lm, meta_props=model_props)

In [44]: published_model_uid = client.repository.get_model_uid(model_artifact)

In [45]: published_model_uid
Out[45]: '79c9c8e4-47ce-44f1-82a4-dbe190b52a33'

In [ ]:

In [ ]:

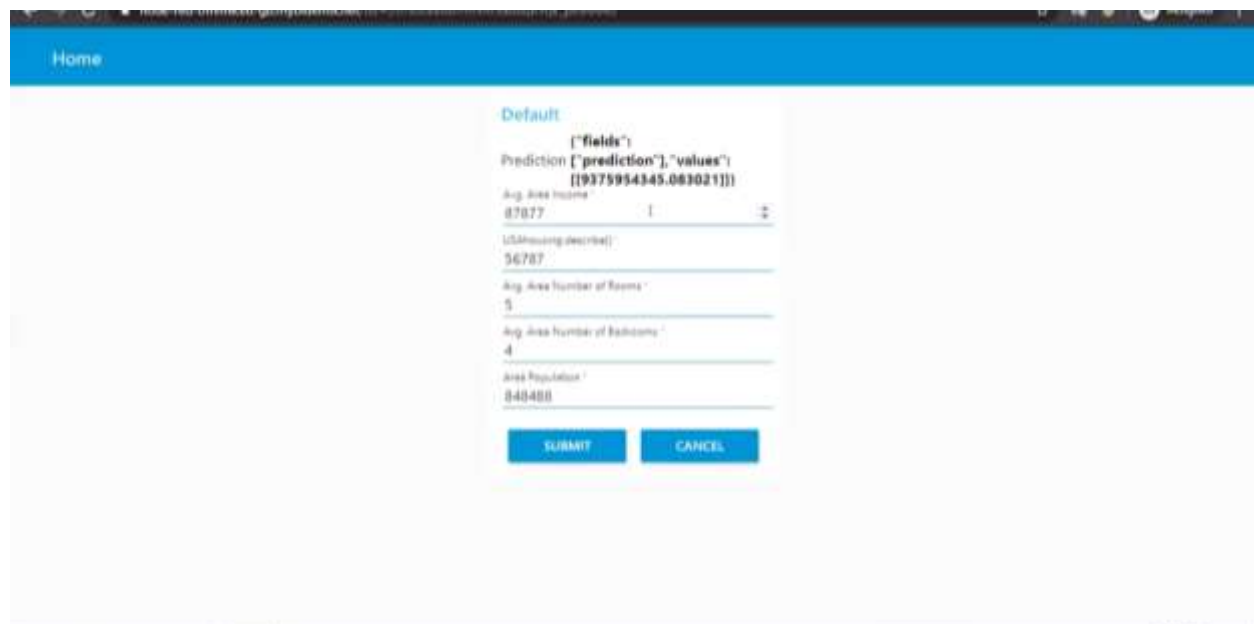
In [53]: deployment = client.deployments.create(published_model_uid, name="USAHousing")

#####
Synchronous deployment (creation for uid: '79c9c8e4-47ce-44f1-82a4-dbe190b52a33') started
#####

INITIALIZING
DEPLOY_SUCCESS

-----
Successfully finished deployment creation, deployment_uid='de326800-8a5b-4a56-b848-8ae1f7d7c067'
```

**Step 5:** Now we have deployed our machine learning model as a Web service. Once the model is deployed ,it can be used to make predictions or provide other intelligent services to web users.



Home

Default

["fields":  
Prediction ["prediction"],"values":  
[[9375954345.083021]]]

Avg Area Income : 87877

USAHousing describe() : 56787

Avg Area Number of Rooms : 5

Avg Area Number of Bedrooms : 4

Area Population : 848488

SUBMIT CANCEL