IBM PHASE 5 project

PREDICT HOME VALUE USING IBM WATSON MACHINE LEARNING AND DB2 DATABASE.

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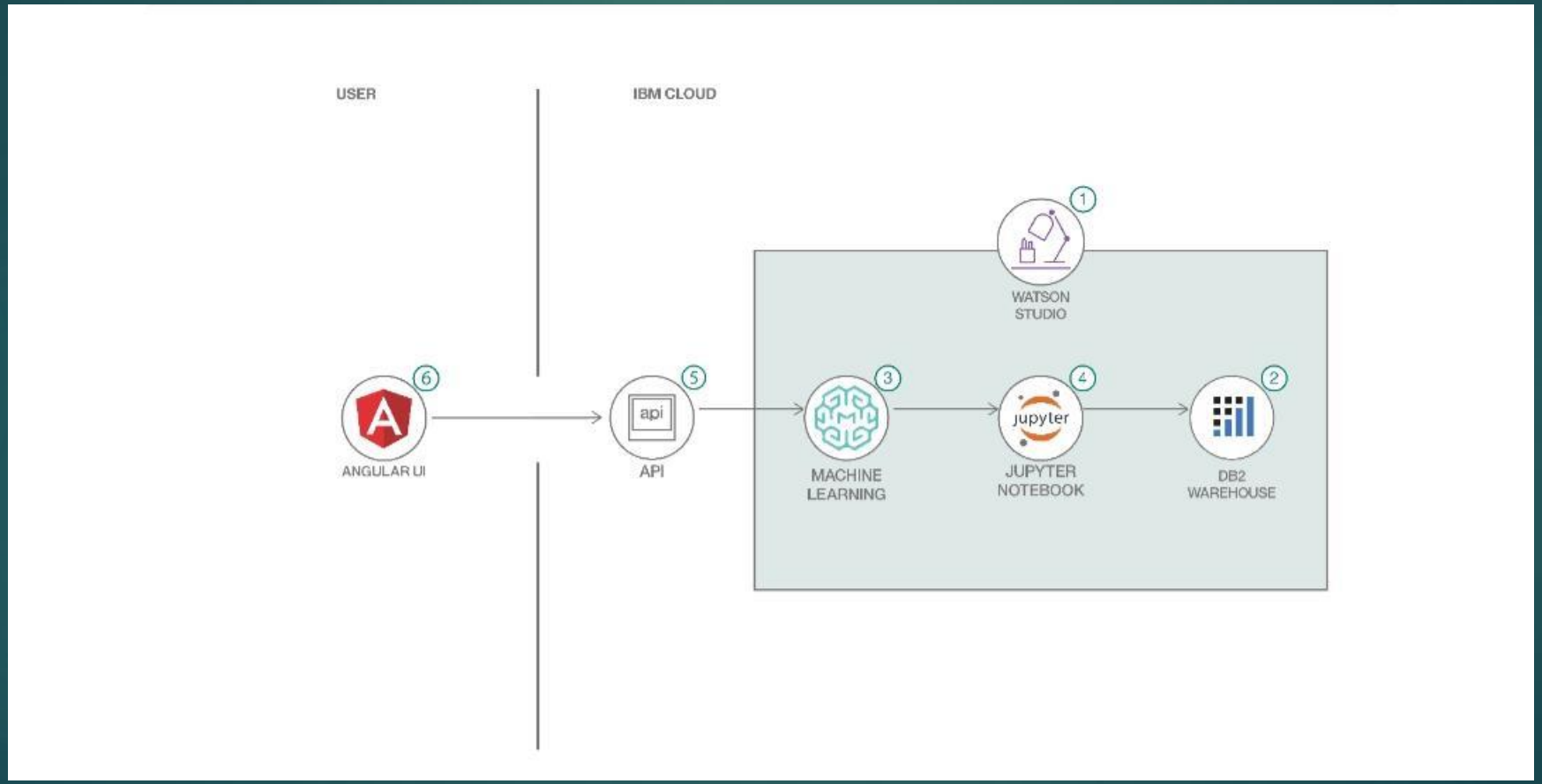
Use IBM watson studio and Db2 on cloud to create a machine learning model to predict home value

- Data keeps on growing and extracting meaningful information out of that data is very important. Using machine learning models from the existing data helps a company to not only extract meaningful insights but also predict future results.
- This code pattern will demonstrate a data scientist's journey in creating a machine learning model using IBM Watson Studio and IBM Db2 On Cloud.This deployed model can now be used by exposing an API and use the input data to the API to predict the home value.

Flow chart


USER
IBM CLOUD
1
WATSON STUDIO
6
ANGULAR UI
5
api
API
3
MACHINE LEARNING
4
jupyter
JUPYTER NOTEBOOK
2
DB2 WAREHOUSE

Explanation

- Create a Watson Studio Project on IBM Cloud.
- IBM DB2 on Cloud database stores information that will be used for machine learning and predictions.
- Watson Machine Learning helps to create ML models so that new predictions can be run against the model.
- Jupyter notebook uses IBM Db2 on Cloud and Watson Machine Learning to create the machine learning model.
- The model is exposed through an API
- Angular UI uses the API to send new data for predictions.

Steps

- Clone the repo
- Create an IBM cloud account
- Load data into IBM Db2 On cloud
- Setup watson studio Project
- Creating and deploying a machine learning model
- Testing Using UI

1.CLONE THE REPO

- Before we start anything, we need to clone the repo. The repo has our dataset and python notebook which we will use when creating Our model

2.CREATE AN IBM CLOUD ACCOUNT

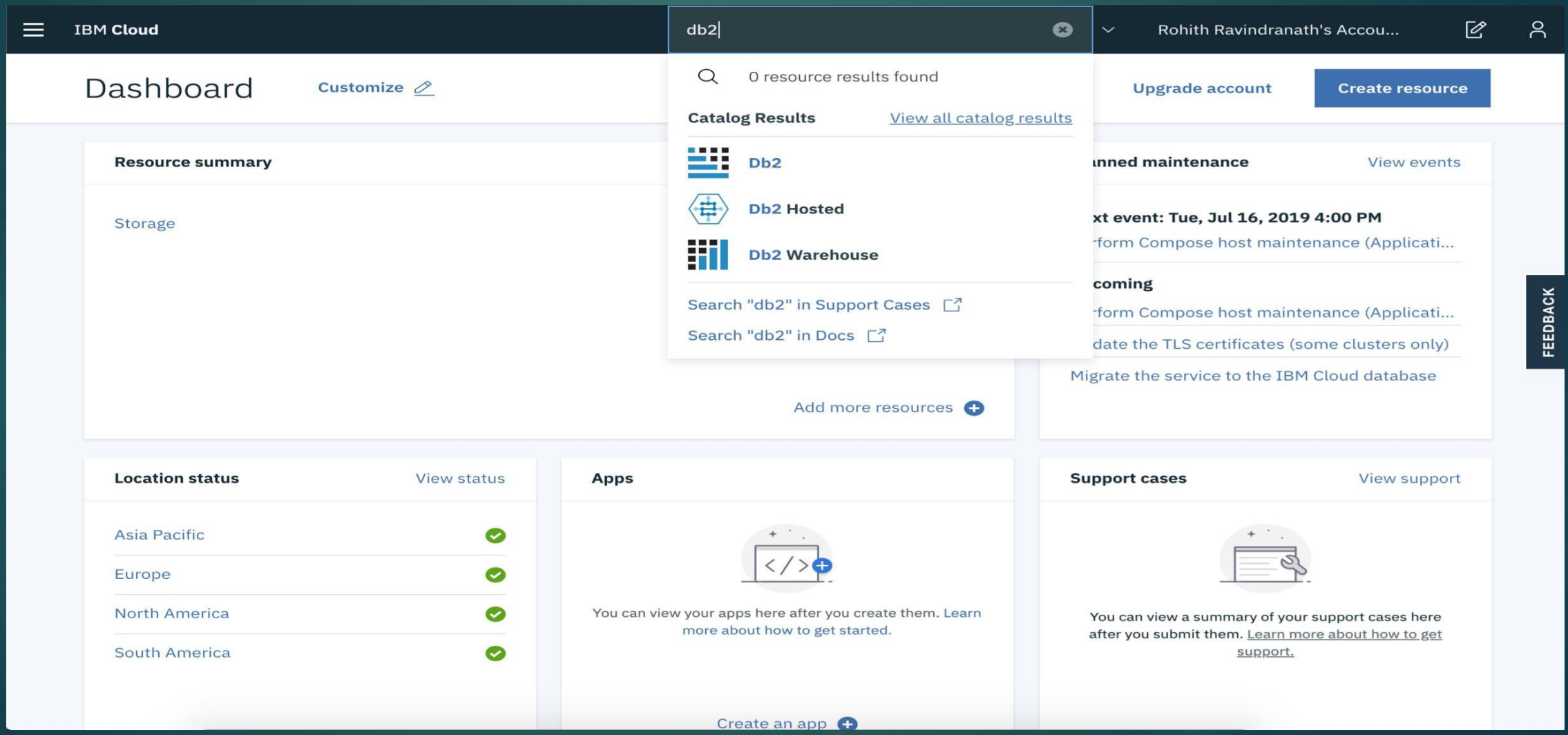
- Create a free IBM on Cloud Account if you don't already have one using the following link:
- **IBM cloud :** creating this account will give us access to Db2 on Cloud and Watson Studio services.

3.LOAD DATA INTO IBM Db2 ON CLOUD

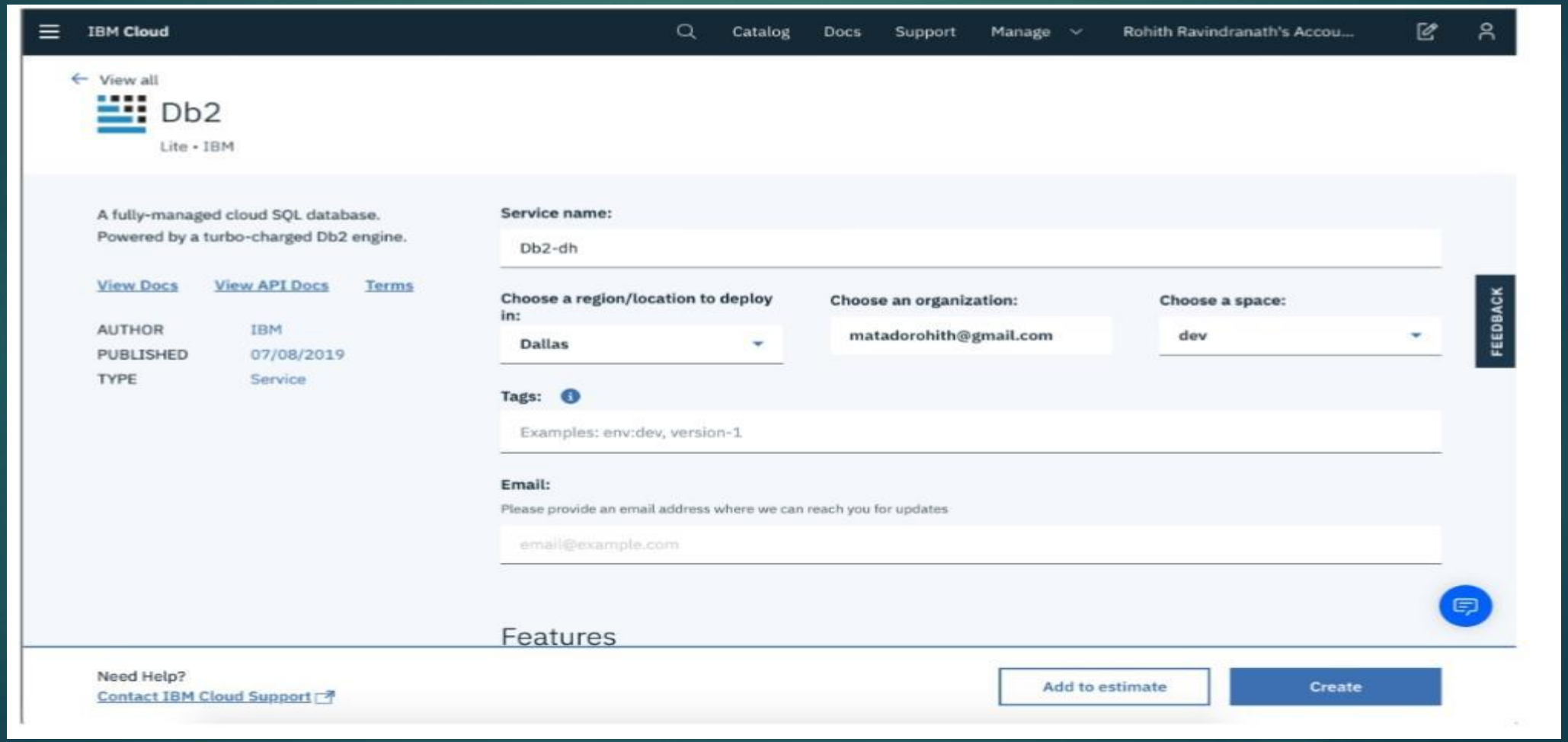
- **Now that we have created our IBM Cloud account. We need to create a Db2 on Cloud service. Once we have create that, we will then we able to load our data into our database.**
- **Create Db2 on Cloud Service.**
- **Load Data into Db2 on Cloud.**

3a.CREATE Db2 ON CLOUD SERVICE.

- Go to the dashboard of your IBM Cloud account and follow the steps to create your Db2 On cloud services.



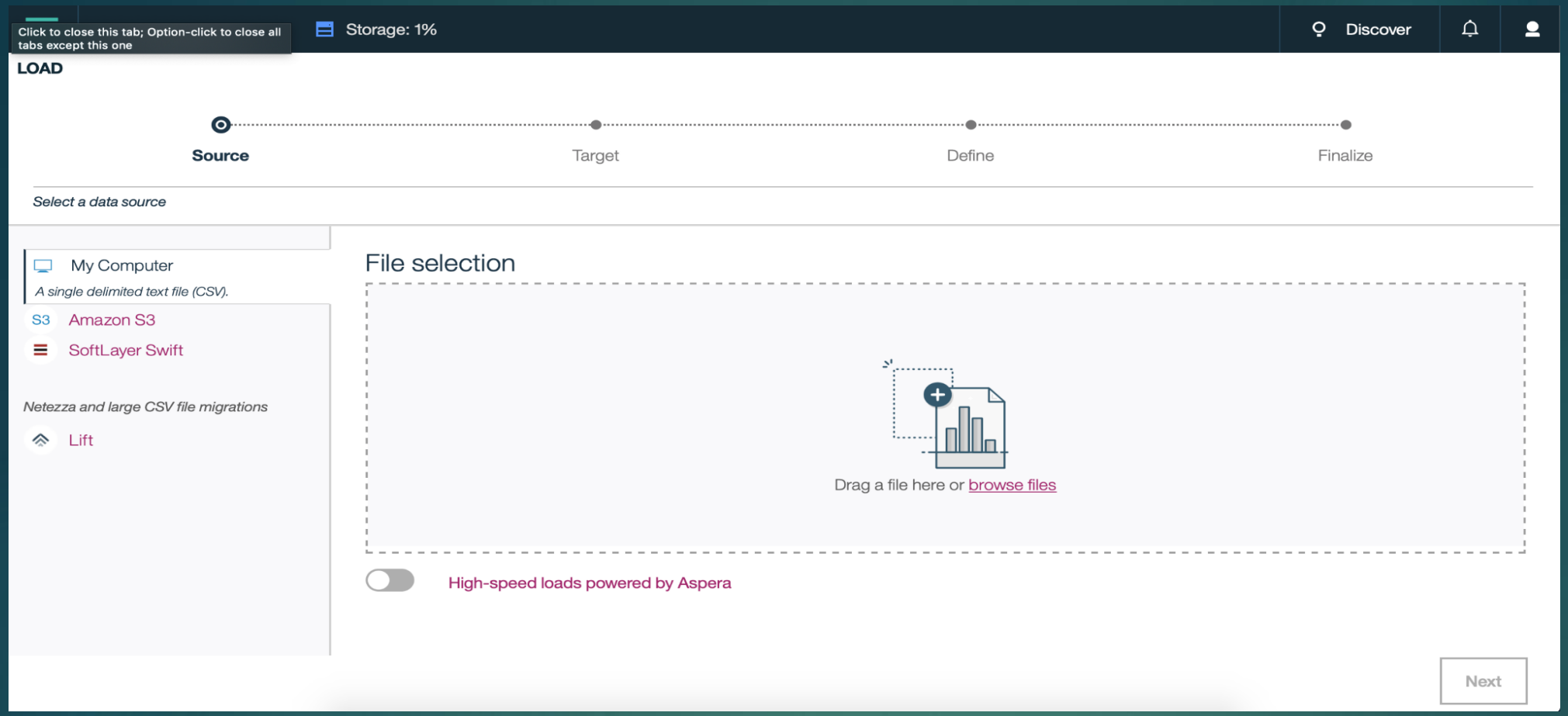
- In the search bar at the top of your dashboard, search Db2.
- Although there are different database options to choose from, for the purposes of this tutorial we will be using the Db2 option. Click Db2 when that option appears in the search bar.



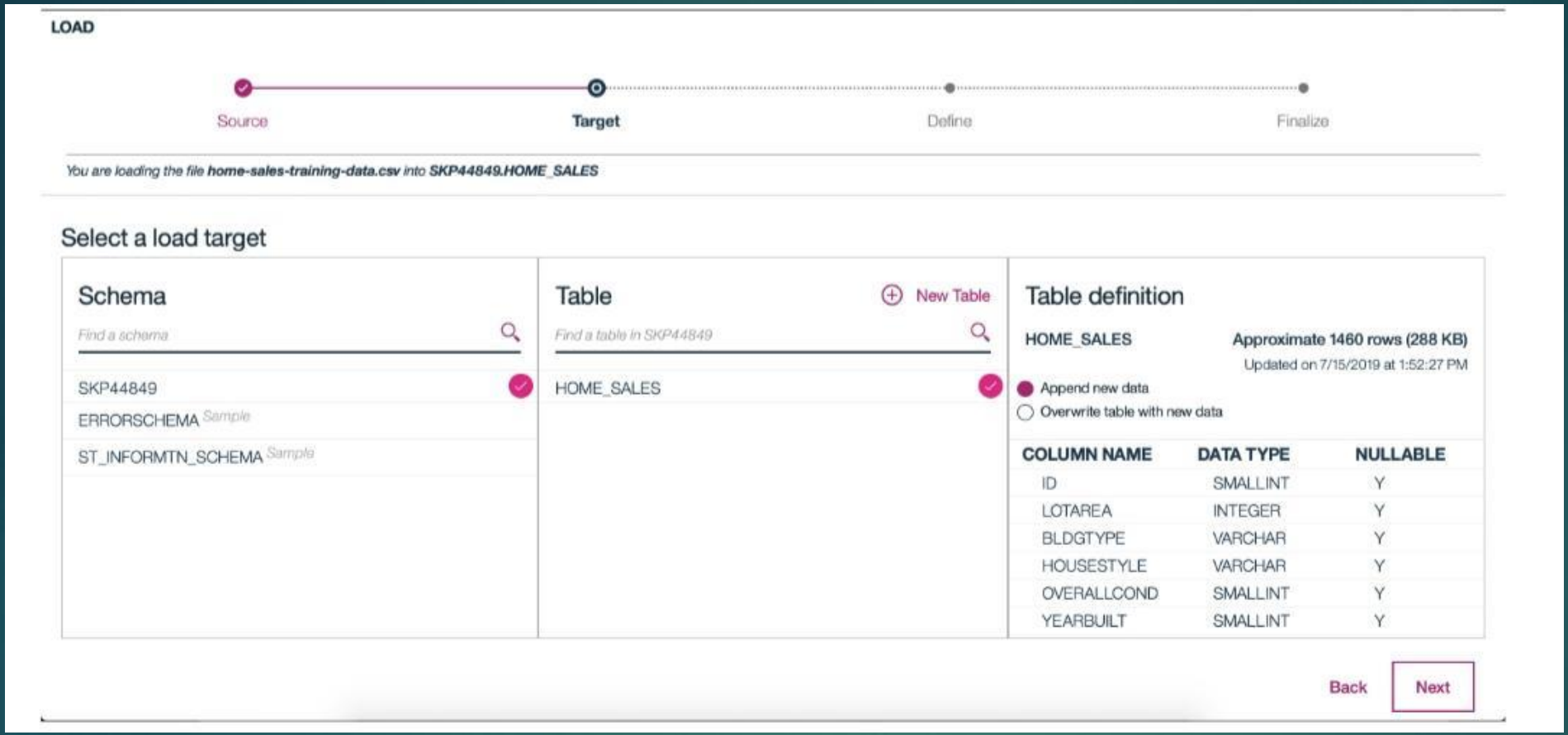
- For the service name, enter in Data-Science-Track.
- Make sure you pick the region that is closest to where you currently reside.
- Scroll down to the Pricing Plan section and choose the Lite plan.
- Once you have created your database instance, we can go back to the dashboard and click on the View Resources link under the Resource Summary section. You should then be able to see and verify that your Db2 instance has been created under the Cloud Foundry Services tab.

3b. LOAD DATA INTO DB2 ON CLOUD

- **Go to the dashboard of your IBM Cloud account and follow the steps to load your data onto Db2 On Cloud service.**
- **In the search bar, search Data-Science-Track and click on your Db2 on Cloud service.**



- Click on Open Console which will direct you to the Db2 on Cloud Console.
- Click on Load under the Hamburger menu.
- Click on browse files and select home-sales-training-data.csv from your computer.
- Click Next.



- *The next step is to decide where our data will be stored. Click on the first schema that shows up, then select New Table.*
- *Enter HOME_SALES as our table name and select Create and finally Next.*
- *Make sure the column names and datatypes are correct, and click Next.*
- *Click Begin Load.*

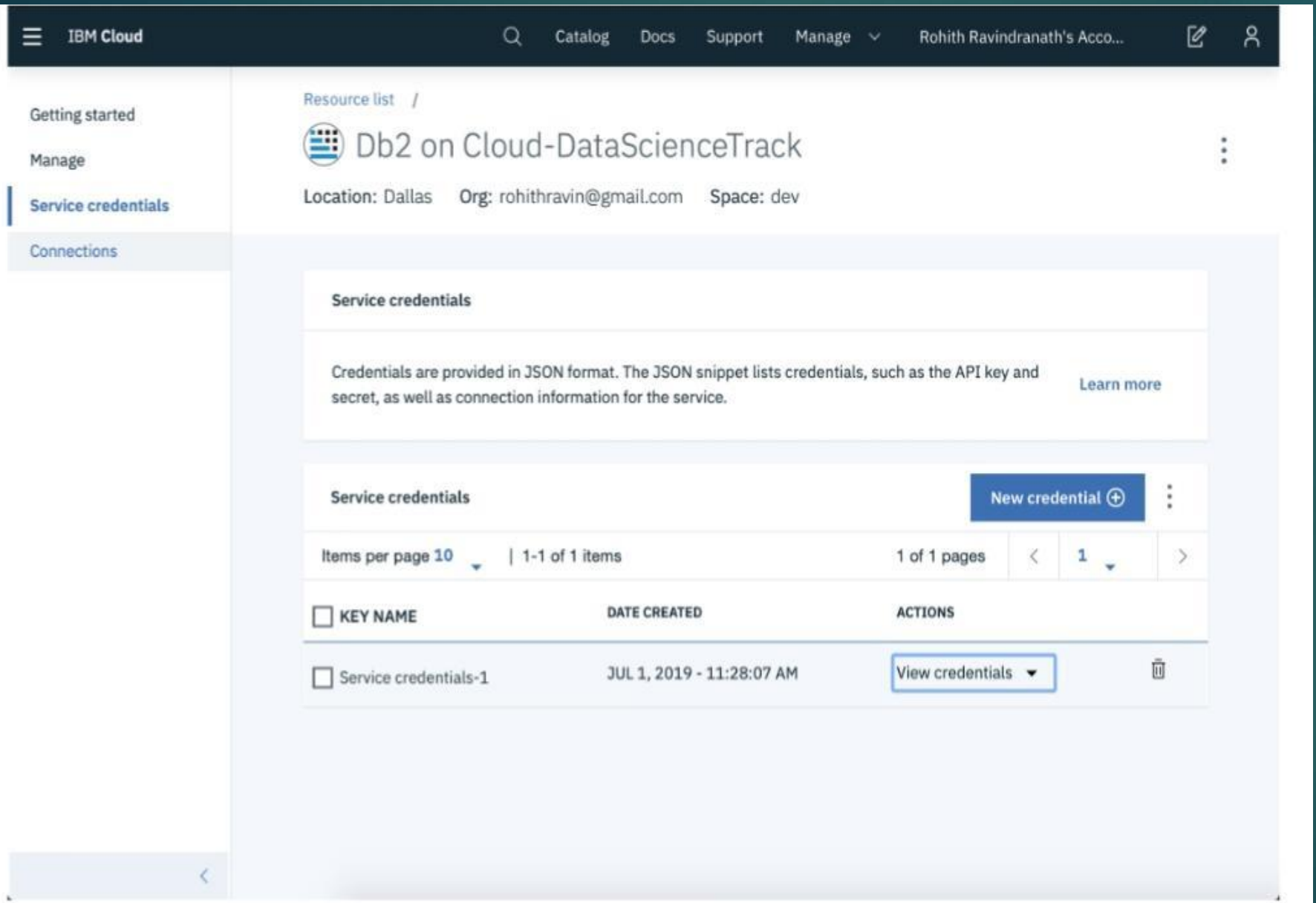
4.SETUP WATSON STUDIO PROJECT

- Setting up our project environment can be broken down in the follow steps.
-
- Get Db2 on Cloud credentials
- Creating Watson Studio service
- Creating a Watson Studio project
- Connect Db2 on Cloud with Watson Studio

4a.GET db2 ON CLOUD CREDENTIALS

Before we create a Watson Studio service, we need to first create credentials for our database so that Watson Studio can connect to it.

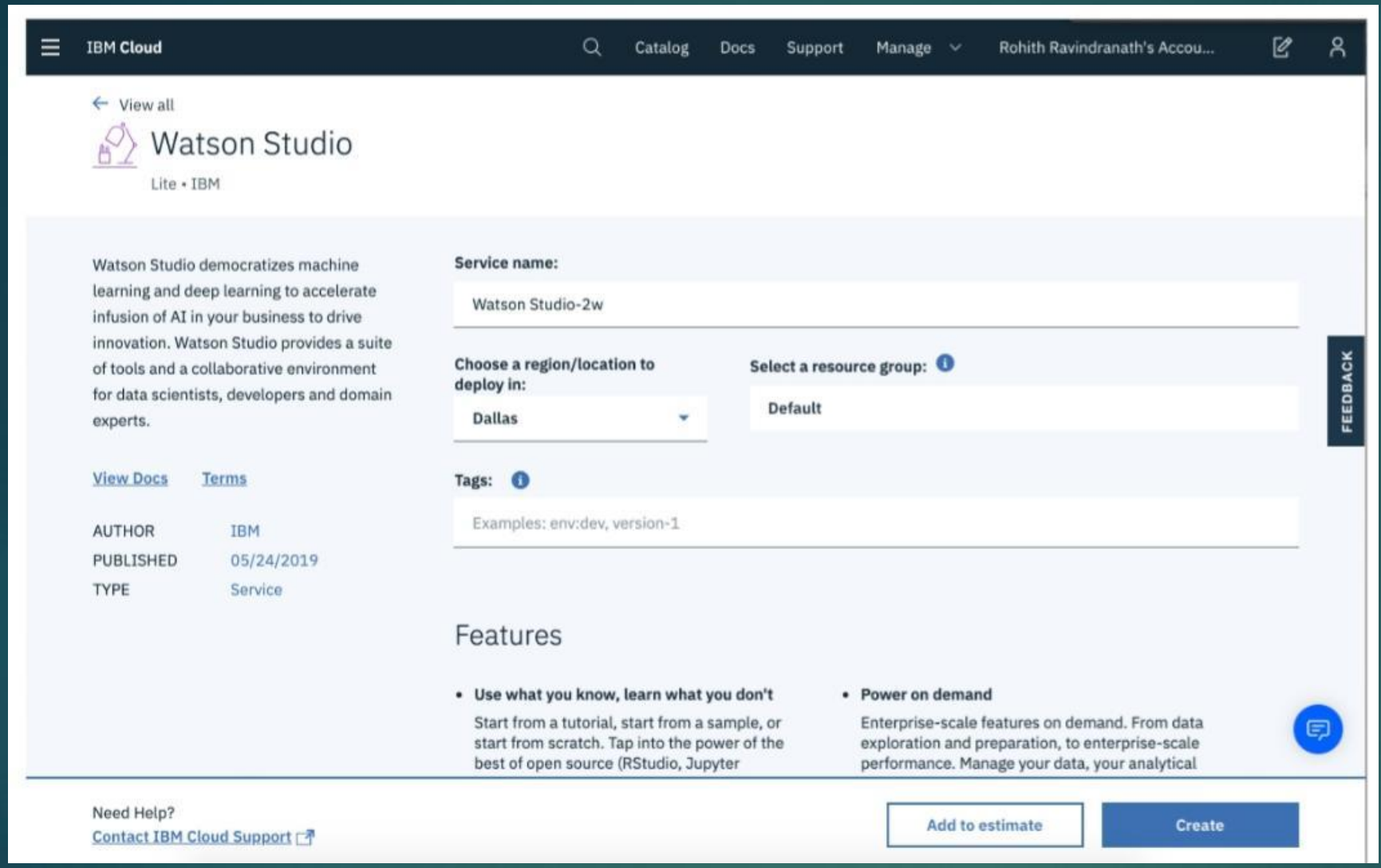
- In the search bar, search Data-Science-Track and click on your Db2 on Cloud service
- Click on Service Credentials on the left hand side.



Click on New Credentials and then Add. Make sure to save the credentials for later use.

- The key information that is important for us is:

  1.HOSTNAME
  2.UI
  3.PWD
  4.DATABASE

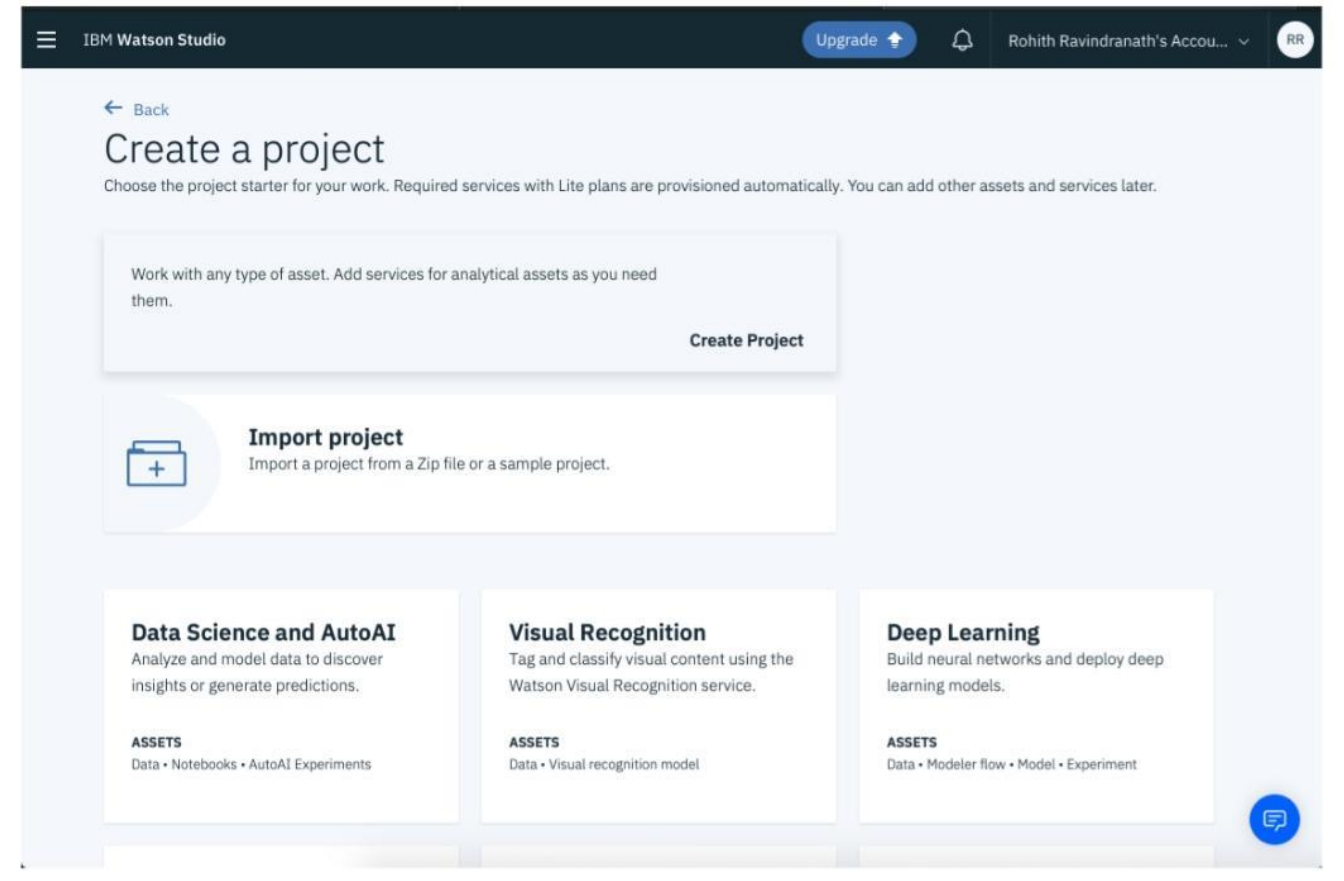


Fill out all the fields and choose 'Lite' plan. Click Create and then Get Started.

This will redirect you to the Watson Studio homepage.

4b.CREATING WATSON STUDIO SERVICE

Go to Catalog and search for Watson Studio and click on that option.



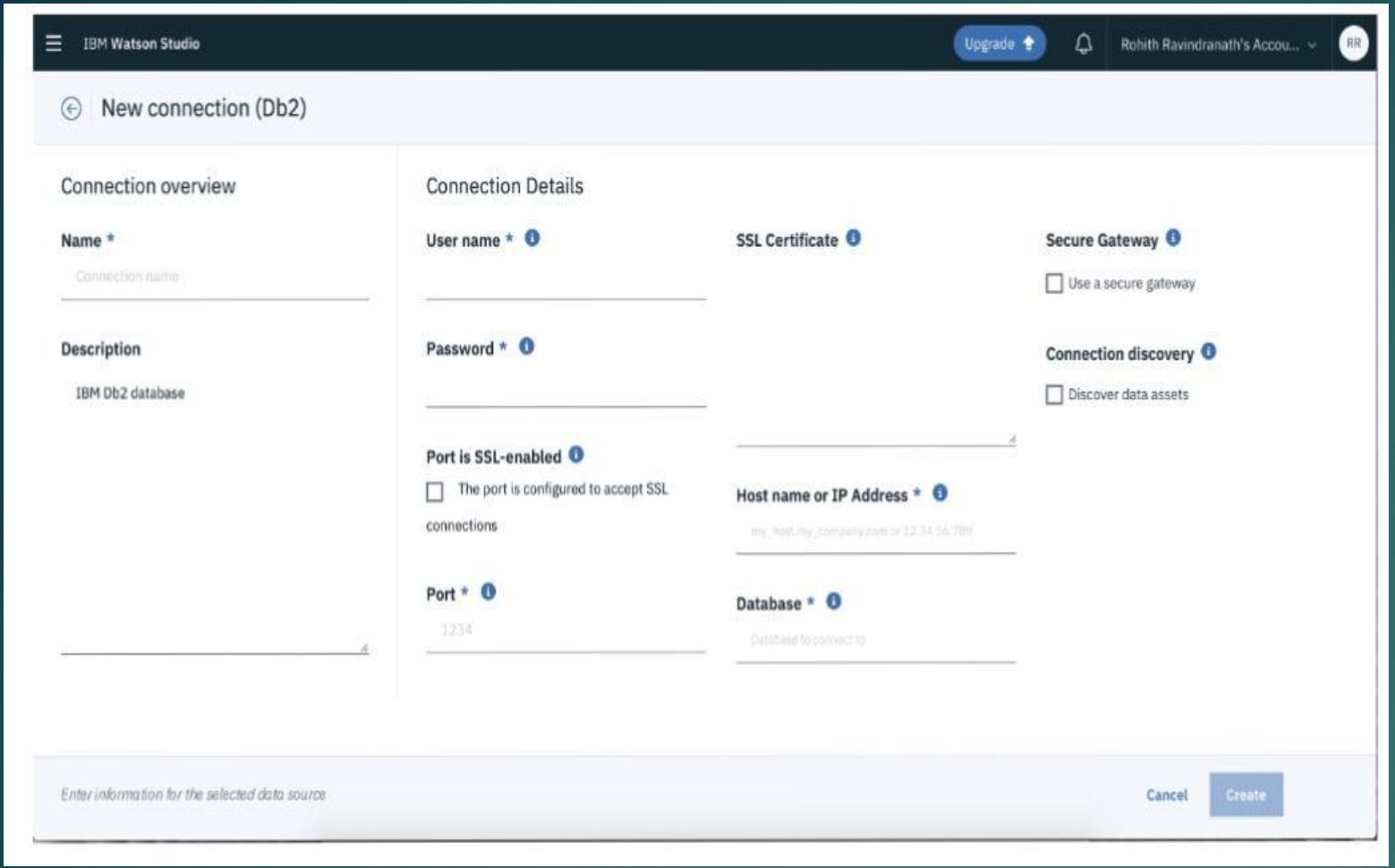
4c.CREATING WATSON STUDIO PROJECT

Select Create a Project and then select Standard.
If you haven't created object storage earlier, go to the bottom of the page and click the link Cloud Object Storage. Choose the Lite plan and click Create.

Go back to the project page and make sure to choose the Cloud Object Storage that you have created earlier.
Fill out the project details and click Create.
This will take you to your project dashboard/homepage.

4d.CONNECT db2 ON CLOUD WITH WATSON STUDIO

On the top of the project homepage, select Add to project and then click Connection.
Select Db2 connection opton

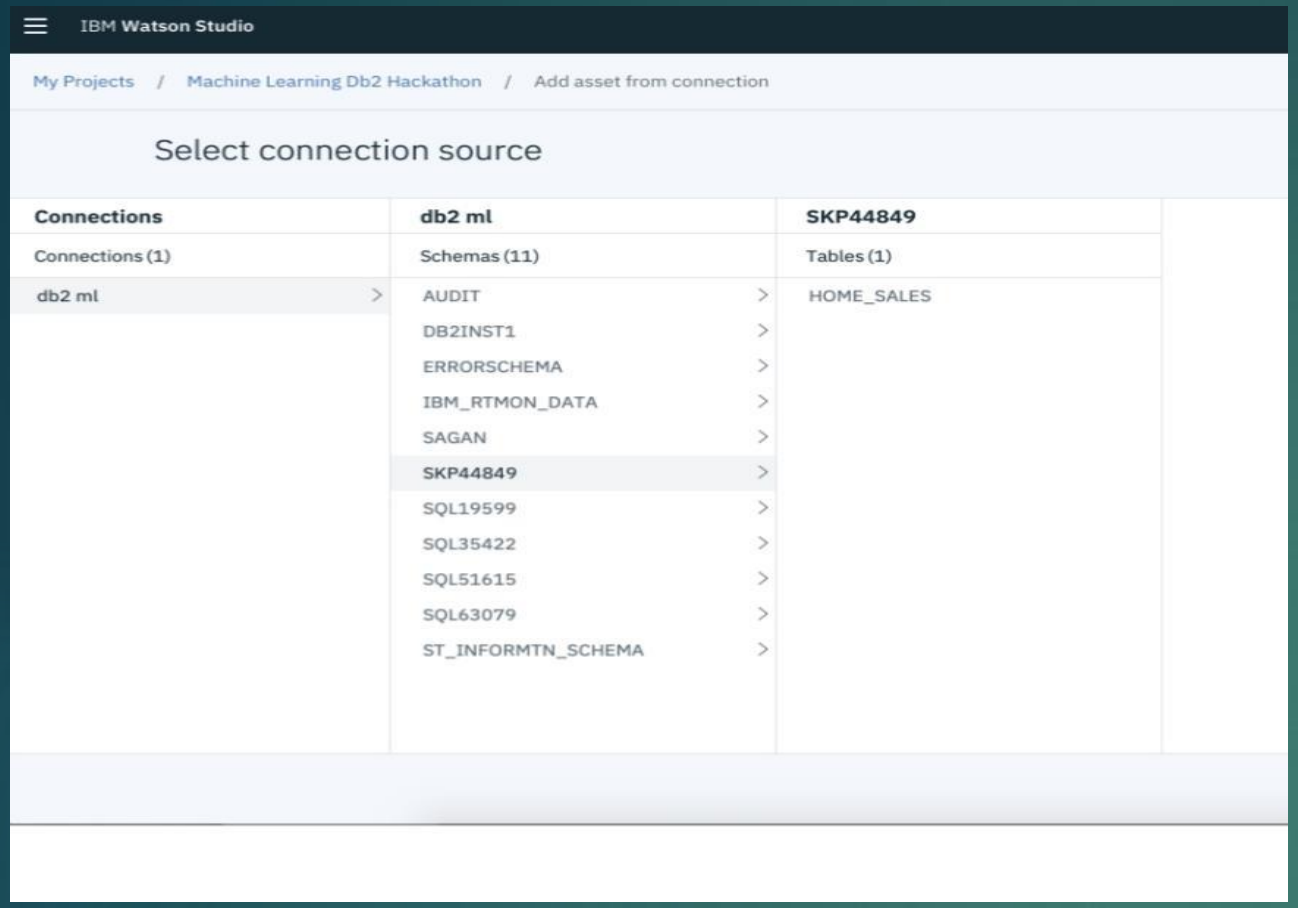


This will take you to a connection configuration page. Here, we will enter the Db2 credentials that we got from Step 4a. Make sure to use 50000 for the Port option.
Click Create once you have entered all the required information.

This will redirect you to the asset page for this project, and you should see your new Db2 connection as one of the assets.

Now that we have our database connected to our project, we need to also connect our data that is stored in our database to the project as well.

On the top of the project homepage, select Add to project and then click Connected data. Select select source

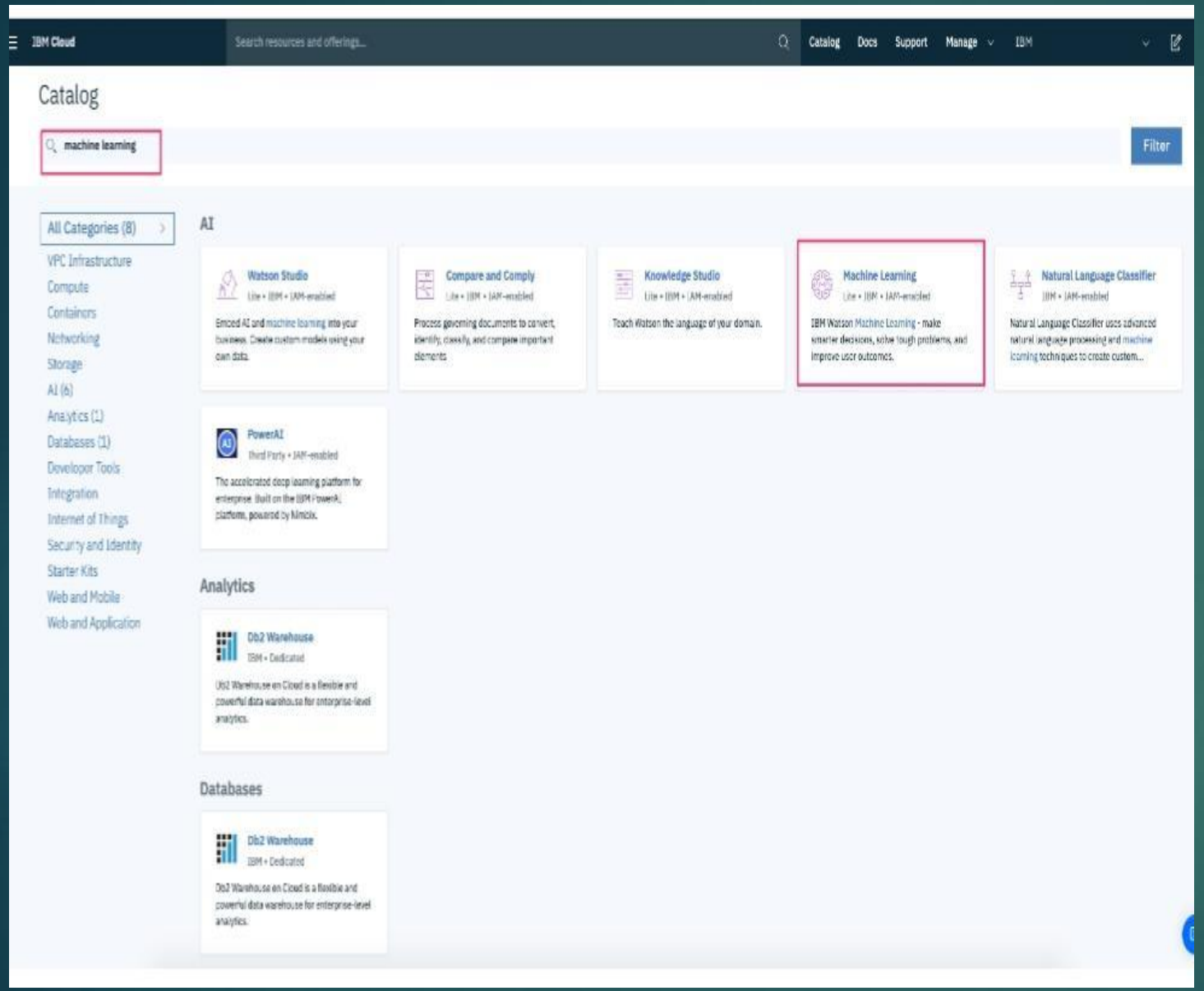


Select our database, scheme and finally our table HOME_SALES.
Click Select.
Let's name this connected data as HOME_SALES and then click Select.

We have finally created our Watson Studio service. Within that, created a project where our database and data are connected. We can now finally start coding and building our model!

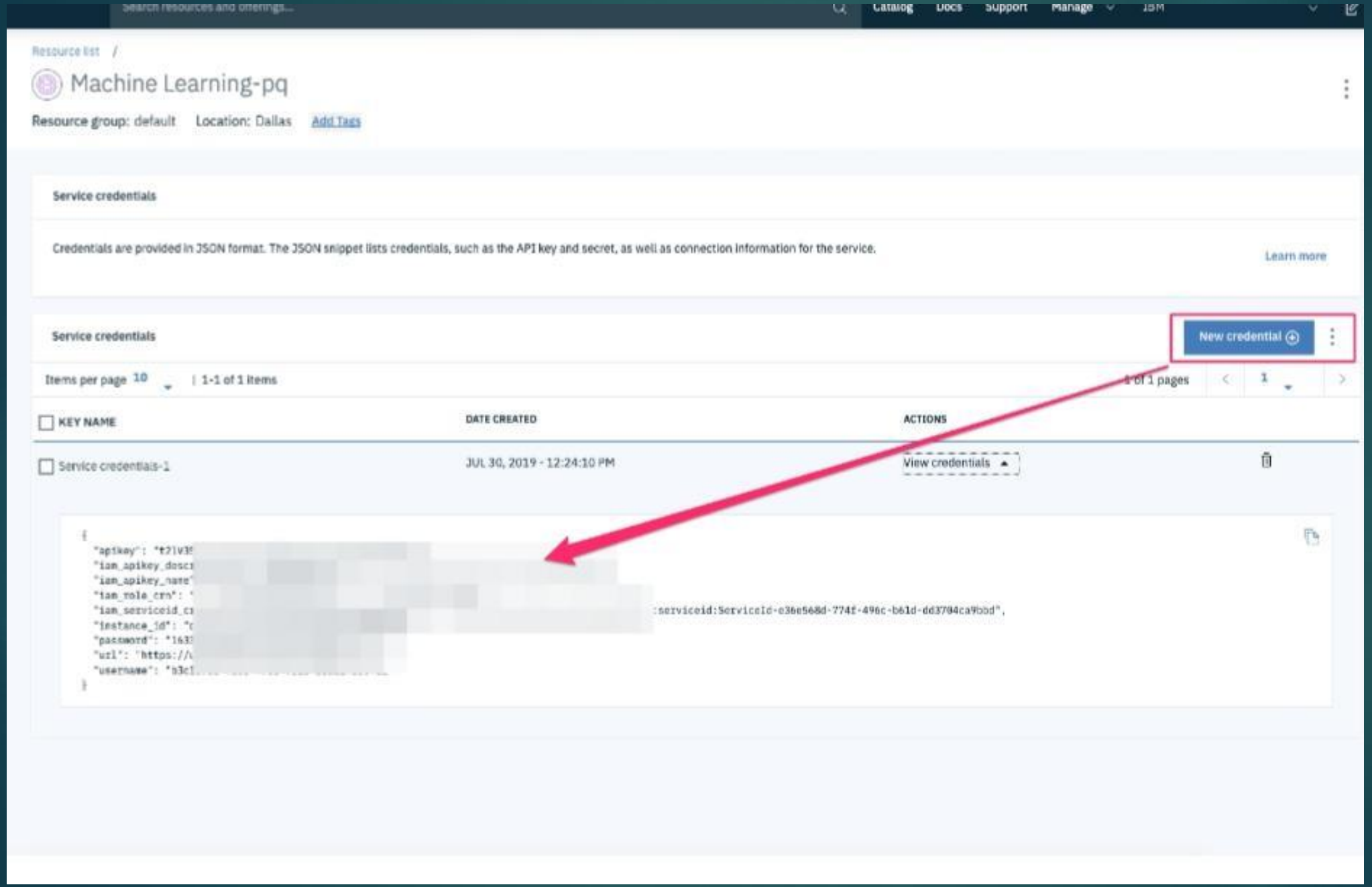
5.CREATING AND DEPLOYING MACHINE LEARNING MODEL

On the top of the project homepage, select Add to project and then click Notebook. Fill out the notebook details

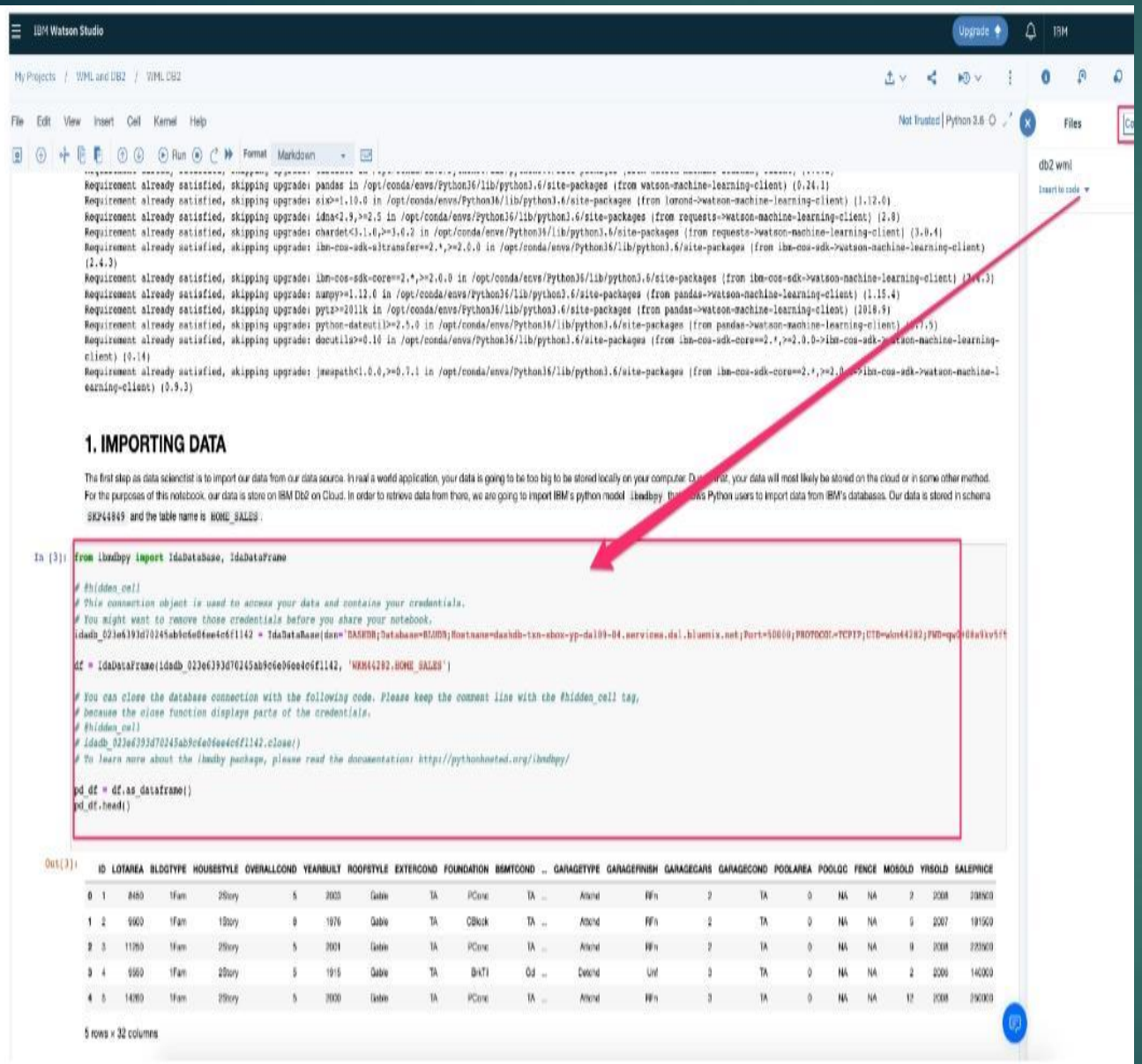


Before we run the notebook, we need to create Watson Machine Learning instance so that we can deploy the model to Watson Machine Learning on IBM Cloud. Here are the steps:

Go to IBM cloud dashboard and click Create Resource
Search for machine learning and select Machine Learning service
Fill out the details, select Lite plan and click Create.



In the notebook, after the import cell, add cell to create connection as shown below.



Gradient Boosting R squared": 0.7539

In [37]:
```
y_pred = model.predict(x_test)
model_mse = mean_squared_error(y_pred, y_test)
model_rmse = np.sqrt(model_mse)
print('Gradient Boosting RMSE: %.4f' % model_rmse)
```

```
Gradient Boosting RMSE: 39648.7992
```

We notice that the metrics are significantly better than the Linear Regression model, however not as good as the Random Forest model.

5. Deploying Model

From our evalution, we can see that our Random Forest Model performed best out of the models we trained. For this reason we are going to use the that model for deploy. Below are the instructions to deploy our model.

In [38]:
```
from watson_machine_learning_client import WatsonMachineLearningAPIClient
wml_credentials = {
    "apikey": "lTTmI[redacted]re8E",
    "username": "298[redacted]",
    "password": "3f4[redacted]",
    "instance_id": "[redacted]38",
    "url": "https://[redacted]"
}
client = WatsonMachineLearningAPIClient(wml_credentials)
```

In [39]:
```
runtimes_meta = {
    client.runtimes.ConfigurationMetaNames.NAME: "Home_Sale_Model",
    client.runtimes.ConfigurationMetaNames.DESCRIPTION: "Home Sale Model hype",
    client.runtimes.ConfigurationMetaNames.PLATFORM: { "name": "python", "version": "3.6" },
}
runtime_details = client.runtimes.store(runtimes_meta)
runtime_details
runtime_url = client.runtimes.get_url(runtime_details)
runtime_uid = client.runtimes.get_uid(runtime_details)
print("Runtimes URL: " + runtime_url)
print("Runtimes UID: " + runtime_uid)
```

```
Runtimes URL: https://us-south.ml.cloud.ibm.com/v4/runtimes/96084e00-42e5-49c3-8fc2-f378171f8016
Runtimes UID: 96084e00-42e5-49c3-8fc2-f378171f8016
```

In [40]:
```
model_props = {client.repository.ModelMetaNames.NAME: "Home Sale Model hype",
               client.repository.ModelMetaNames.RUNTIME_UID: runtime_uid
              }
published_model = client.repository.store_model(model=forest_reg, meta_props=model_props)
import json
published_model_uid = client.repository.get_model_uid(published_model)
model_details = client.repository.get_details(published_model_uid)
print(json.dumps(model_details, indent=2))
```

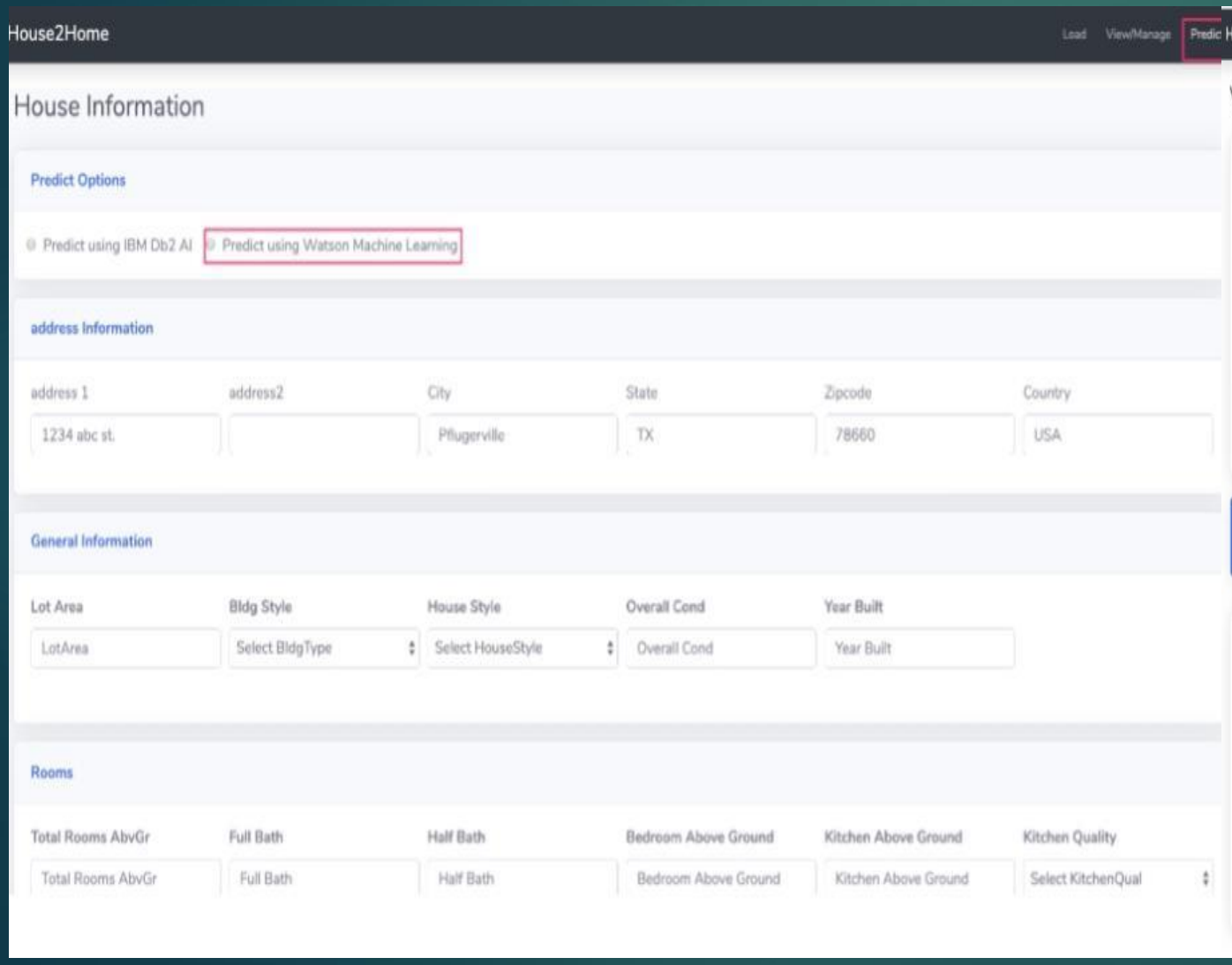
```
{
  "metadata": {
    "guid": "f5052e1f-32ca-4f56-9e71-09f2fb1047f6",
    "url": "https://us-south.ml.cloud.ibm.com/v3/wml_instances/1f171325-6a6f-4e5b-978c-0954f87d218
8/published_models/f5052e1f-32ca-4f56-9e71-09f2fb1047f6",
    "created_at": "2019-07-29T18:36:55.269Z",
```

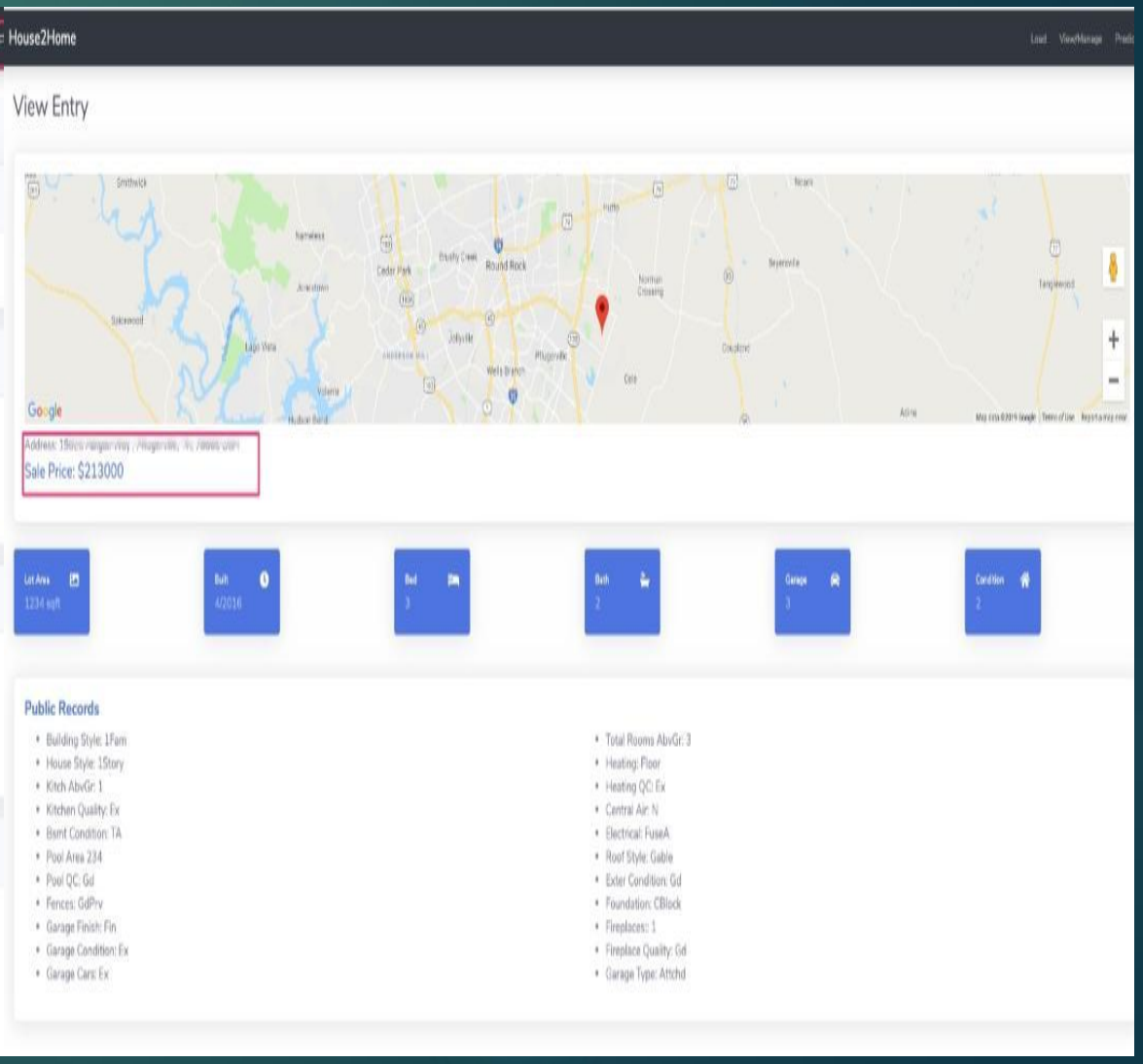
- Then, run all the cells. At the end of the run the model will be deployed using Watson Machine Learning on IBM Cloud so that you could use the same model to predict home value using an API exposed through Watson Machine Learning service.

5.TESTING USING UI

- Run the code from the github URL:
- https://github.com/IBM/crud-using-nodejs-and-db2.
- Replace the value of GO_DB2_API: 'https://<url>', in src/enviornments/enviornment.ts with the API URL of your go server which would be http://localhost:8080/predict
- Click Predict from the navigation bar on top right.
- Fill out the details, Choose Predict using Watson Machine Learning in Predict Options and click Submit.

Analyze the prediction result.






Thank you