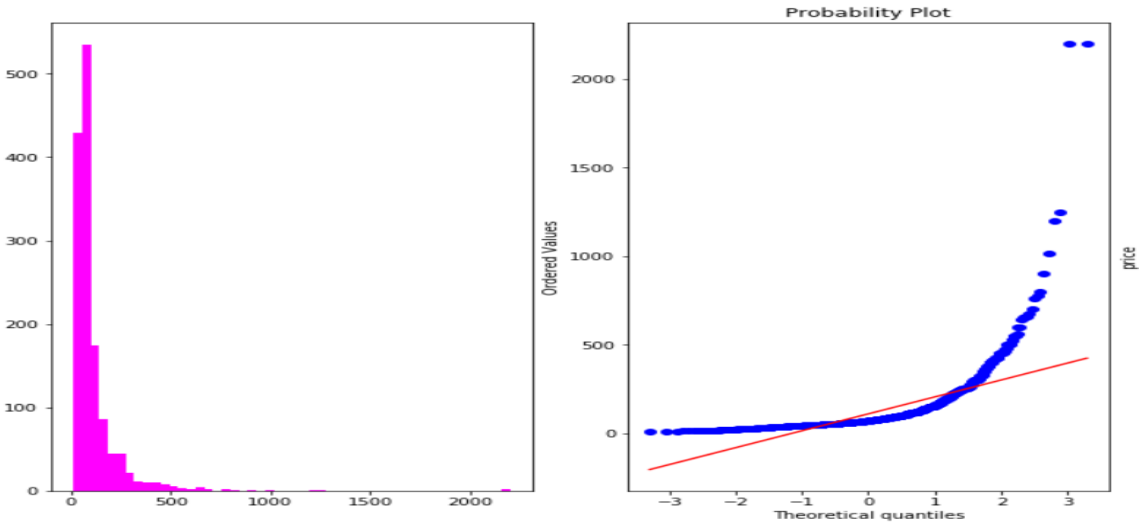
Hyderabad House Price Prediction

Here in this project our team has focused on predicting the price of the Houses present in different locations,here the parameters/columns which we have used are areatype,location,number of rooms,total square feet area,total number of bathrooms,total number of balconies,based on these parameters the Machine Learning Model is going to predict the Price of the Particular House,here is a quick glimpse of the dataset

```
---   ------       --------------  -----
 0    area_type    1402 non-null   object
 1    location     1402 non-null   object
 2    size         1401 non-null   object
 3    total_sqft   1402 non-null   object
 4    bath         1391 non-null   float64
 5    balcony      1331 non-null   float64
 6    price        1402 non-null   float64
```

As we can observe from the dataset,the area_type is of Object type,which is a Categorical Feature,location,size,total square feet,price are all Continous variables,and balcony is an Ordinal Variable,even though it's datatype is mentioned as float,it is not necessary that variables having int/float datatype be always continous,they may be ordinal as well as we can observe in this case,any how as we as are using the AUTOAI feature of IBM Watson,this is automatically handled by them,on other hand let us try to visualise some statistical trends of the continous variables,as shown ↓

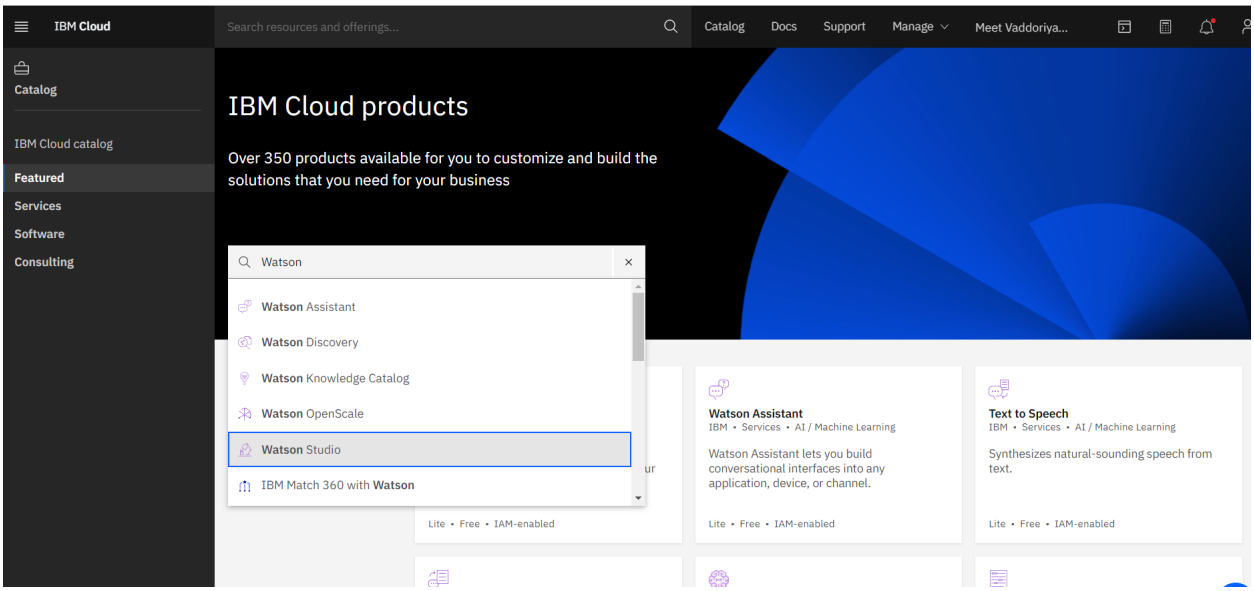


So these are the histogram plot and the Quantile-Quantile Plots relating to the Price variable which is continous,now from the above Distribution we can observe that the distribution is skewed towards the left,and also the Quantile-Quantile plot indicates that the line is not perfectly fitted on the dataset,if the line is fitting that dataset,then we can say that the data is normalised,or the data follows "Gaussian Distribution",here a lot of statistical transformations are required to make such a skwed data into a Gaussian Distributed,like Boxcox Transformation,Chi Square transformation etc,one can refer these links which will clearly explain about the Q-Q plots and the Gaussian Distribution Gaussian Distribution ,as we are working on "AUTO AI" model of IBM Watson,this will automatically set the best distribution for all the features.

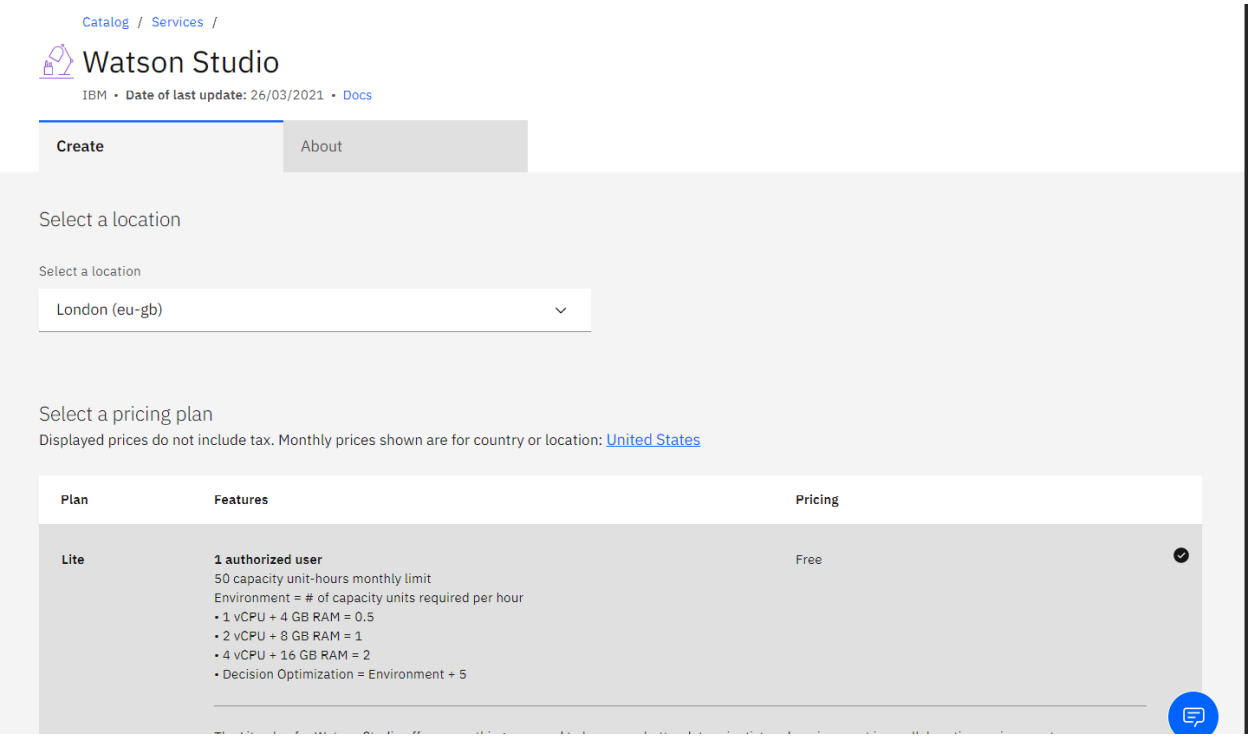
Another important step invloved is about handling the categorical features,as the Machine Learning Model only knows about how to learn numerical data,it has no idea about a category,so we have to encode the categorical variables into numeric form,as we have done on IBM Watsons' AUTOAI,this will automatically handle the terms

Now lets discuss about how to start of with AUTO AI

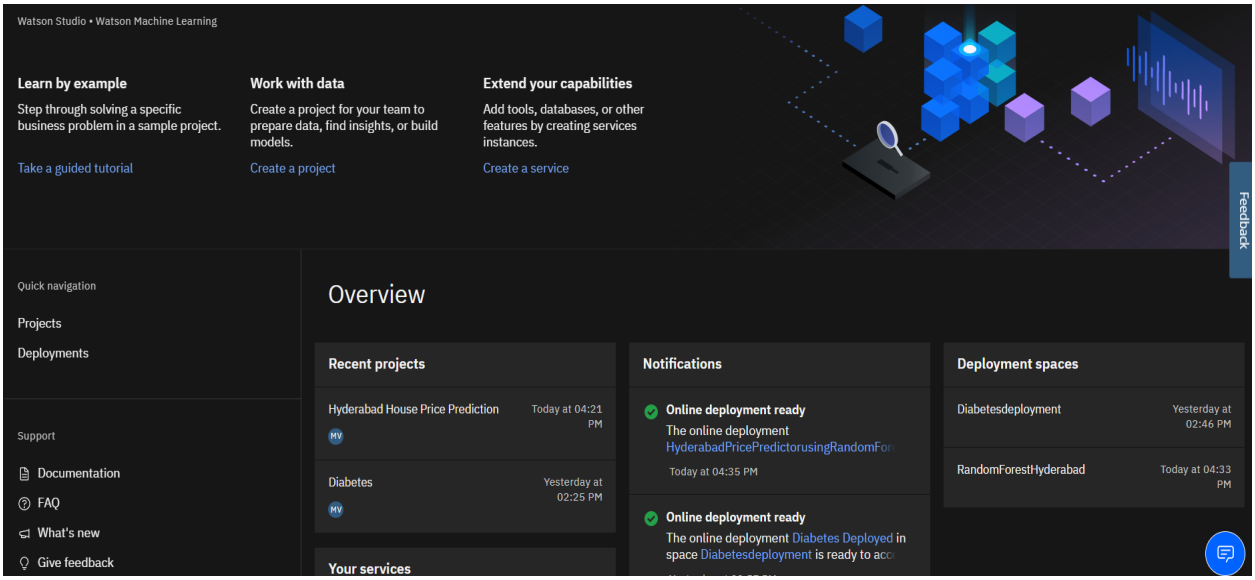
First we need to create an IBM Watson Instance which we can create by logging in on IBM Cloud,then after logging in,we have to create an resource,the icon will be present on the top-left,of the dashboard,so after selecting "Create Resource" we will be getting an interface as follows ↓



Then we have to type in "Watson Studio" and the select the Watson Studio,after that the IBM Watsons' Interfae will be visible,it will look something like ↓

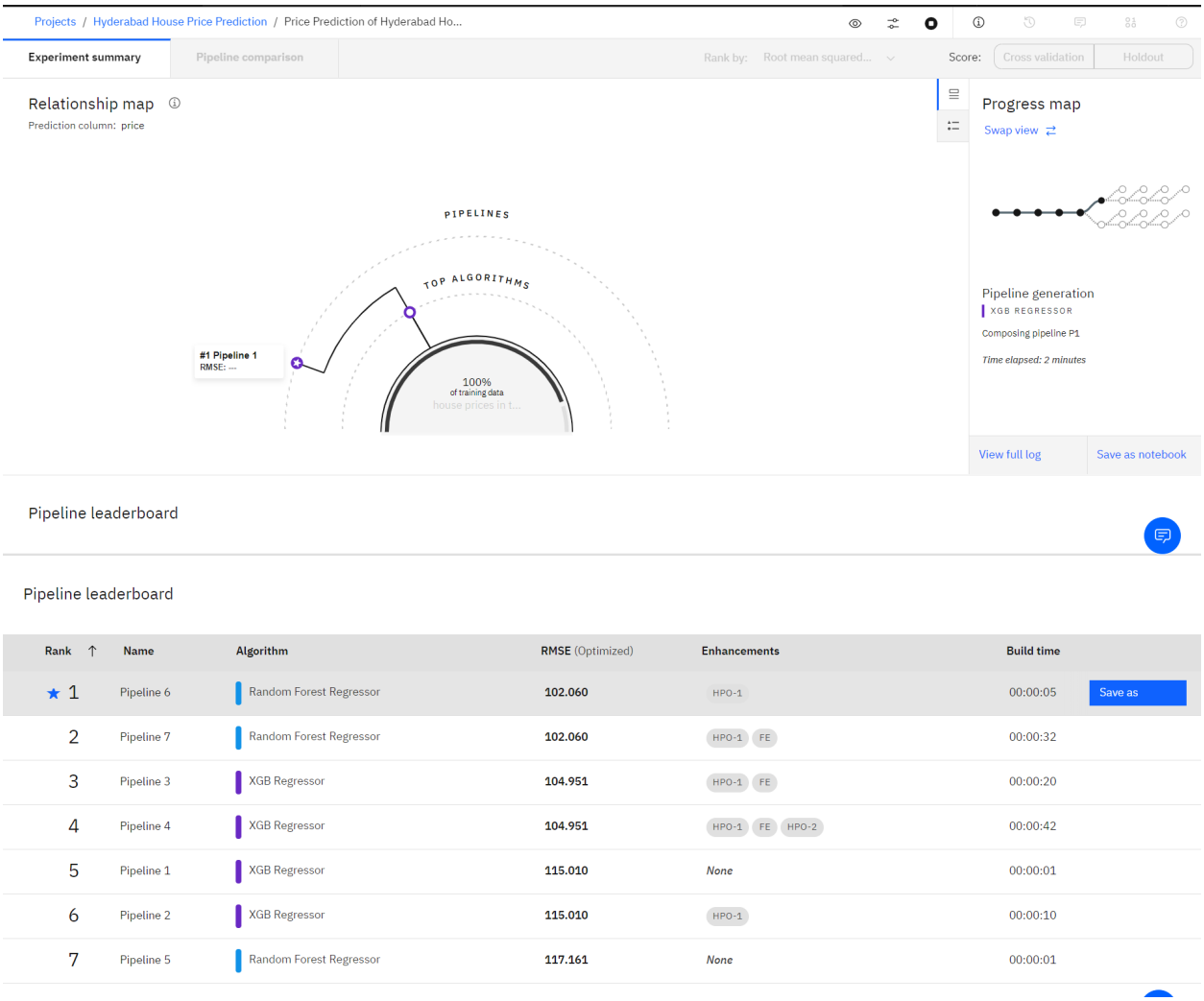


There we will be having a "CREATE" button,we have to simply click on that and our watson studio will be created successfully!,then once we're done with that we have to switch ourselves from "ibmcloud" to "IBM WATSON STUDIO",there we have to enter our details and then we will be looking at an interface as shown ↓

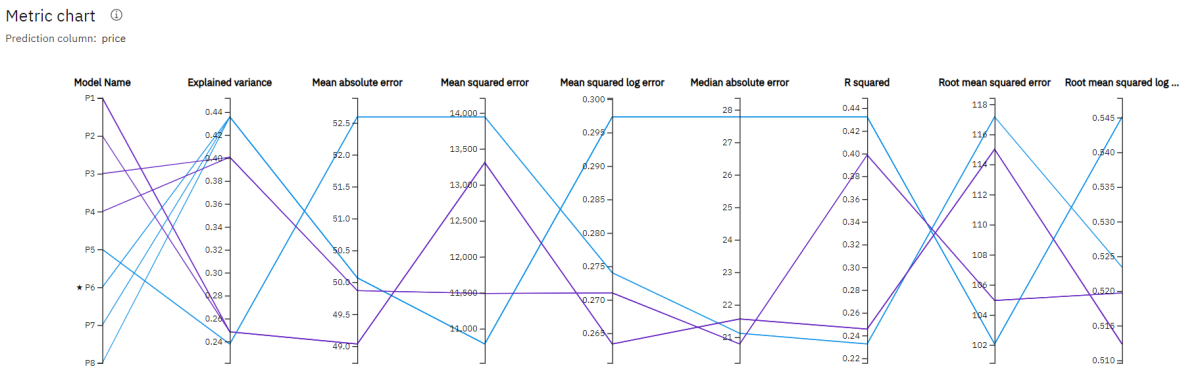


then once done,we have to know start making our project,for this you can follow the steps disscused by IBM Developer

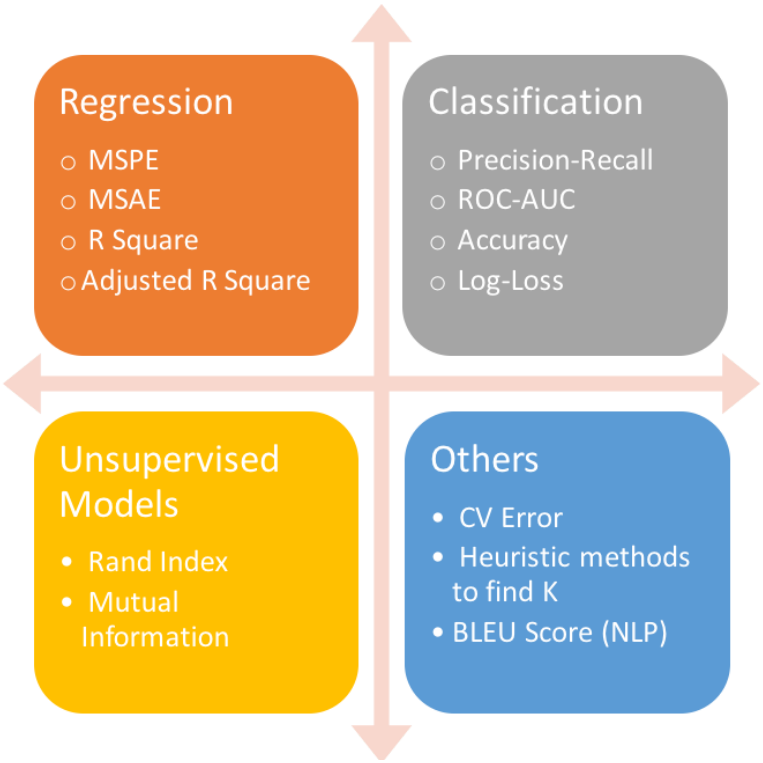
Now here is the Model Predictions Made by AUTO AI in case of predicting the "Price"



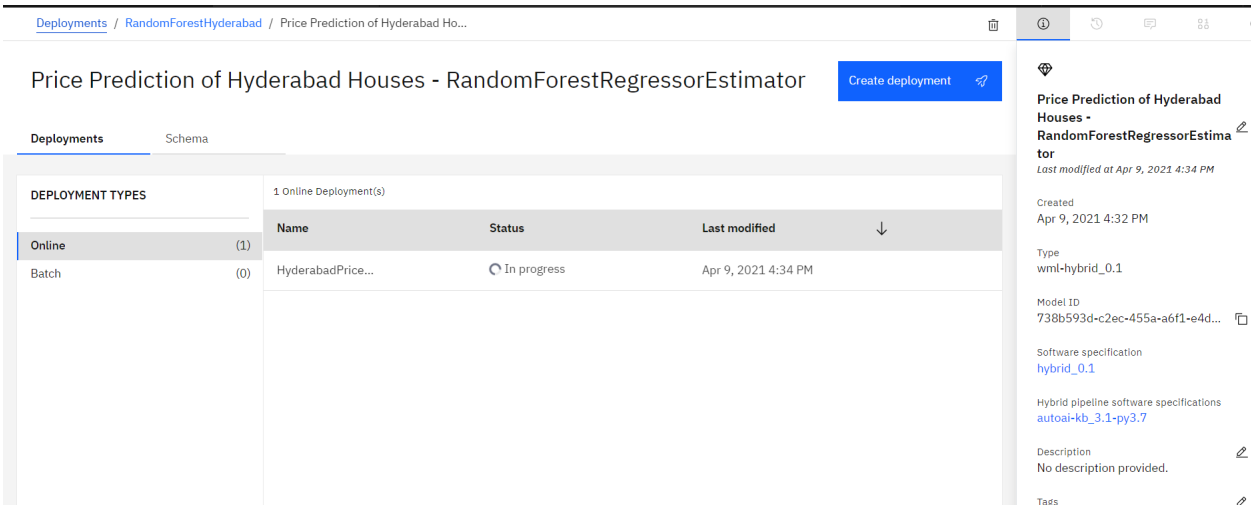
Here we can see that AUTO AI has created almost 6 pipelines for predicting the price and the one which gave the best result has been choosen,we can see that after hyperaparameter tuning,K Fold Cross Validation and other stuff,Random Forest Regressor Gave us the best Result,well the metric which we had choosen was "Root Mean Squared Error",so based on this metric Random Forest Regressor gave us the best reults we can also check out other metrics as well,by clicking on the metric chart,



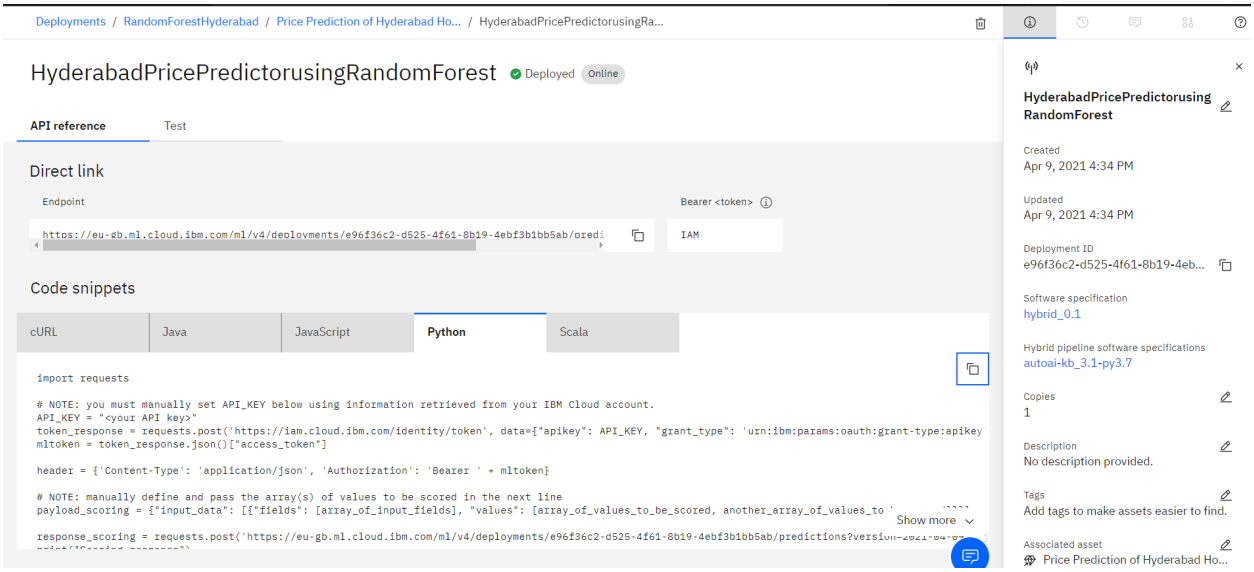
we can analyse various metrics as per our need here are few commonly used metrics in case of Regression and Classification,



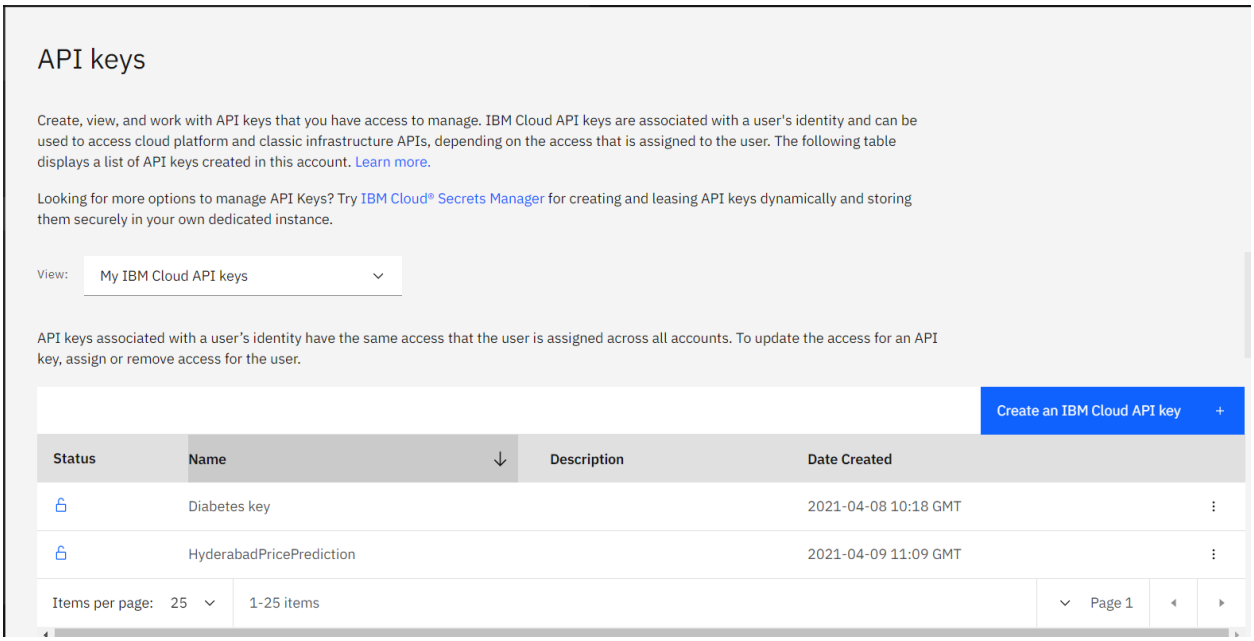
After analysing the model and its metrics,now its time for deploying the model,so for that we have to follow the given steps ↓



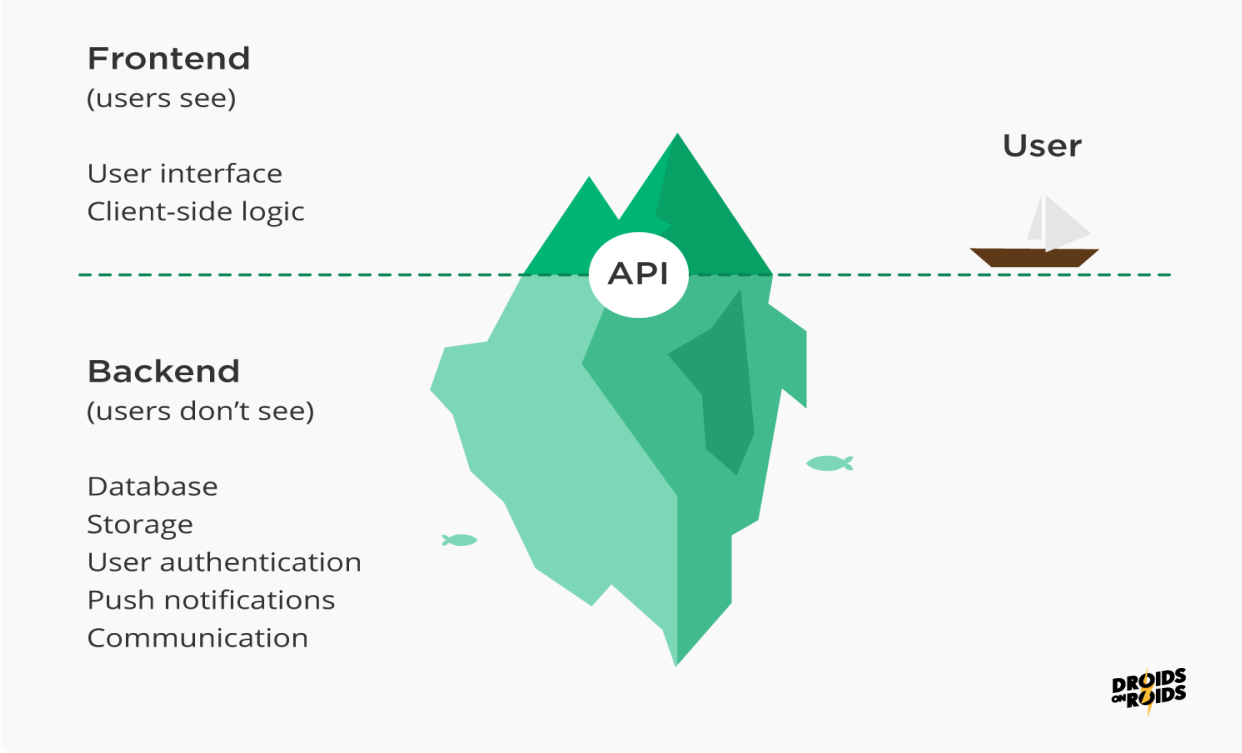
After clicking on "Create Deployment",the steps are easy you have to just click on create create etc..and once all of this is done,we have to select the "ONLINE" mode for deployment,as we are gonna use the "Flask" which is a Webframework supported in python,so after selecting the "Online" Mode,we will be getting an interface as shown ↓



as we can observe there is some code given by default by AUTOAI,so we have to copy that code and in the "app.py" file which is the python file we have to paste this following code,before that inorder to acess the services of the IBM services we need to have an "API" key,so for this we have to login back to IBM cloud and from their we have to find our API key,every user has an unique API key for every project which is using cloud services,so the interface of API keys will look something like this ↓



Then we have to click on the "Create IBM Cloud API key" and we will be getting the API key,which we have to use it in the flask app,here is an image which will make it clear



So here the User will only be able to see the "User Interface",which is nothing but "Front-end" of the project,and what eva the user interacts with the UI,like filling in a form and etc,all those are sent as a request to the "Backend!",now what's this API,here its like a connection of the frontend and the backend,here in this case in backend I have used "Flask" which is a web framework based on python,and its through this backend the UI will interact with the user,so as we have used "IBM Watson Studio",and our project is hosted or deployed on "IBM cloud",so this is kind of backend,now whenever the user fills in a form,hits enter,the data of the form is first reached at the flask server,which is POST request,then once the server fetches the data,it passes that data to the cloud,where in our Machine Learning Model is hosted,this model makes a prediction and returns the result back to the Flask server which in turn will return the result to the UI,here is the step by step procedure for that.

```
def predict():
    if request.method == 'POST':
        my_dict = request.form

        area_type = str(my_dict['areatype'])
        location = float(my_dict['location'])
        roomsize = float(my_dict['roomsize'])
        sqftarea = float(my_dict['sqftarea'])
        washrooms = float(my_dict['washrooms'])
        balcony = float(my_dict['balcony'])

        input_features = [[area_type, location, roomsize,
                           sqftarea, washrooms, balcony]]

        # input = ["area_type","location","size","total_sqft","bath","balcony"]

        payload_scoring = {"input_data": [{"fields": [
            ["area_type", "location", "size", "total_sqft", "bath", "balcony"]], "values":
            input_features}]}

        response_scoring = requests.post('https://eu-gb.ml.cloud.ibm.com/ml/v4/deployments/
        e96f36c2-d525-4f61-8b19-4ebf3b1bb5ab/predictions?version=2021-04-09',
                                         json=payload_scoring, headers={'Authorization': 'Bearer ' +
```

so as I said after the user has interacted with the UI i.e by filling the form,we send the details filled by the user to the backend,we collect all the data from the form and store it in a list,which is "input_features",now the main part of the whole project!,we pass in this list to the cloud so that we can get the predicted price,so as we had copied the code which "AUTO AI" had given us,its time to use it now,so we pass in that list to that payload scoring and this ensures that it gets all the parameters of the form,now the next step is to send the data to the model which is deployed on IBM Cloud,so we send a POST request to the API,which we had taken from the API keys,so once we pass the data through API to the Machine Learning Model which we have created on the IBM cloud,then we try to fetch out the results which the Machine Learing Model had sent

```
response_scoring = requests.post('https://eu-gb.ml.cloud.ibm.com/ml/v4/deployments/
e96f36c2-d525-4f61-8b19-4ebf3b1bb5ab/predictions?version=2021-04-09',
                                 json=payload_scoring, headers={'Authorization': 'Bearer ' +
                                 mltoken})

print("Scoring response")
predictions = response_scoring.json()
print(predictions)
# return render_template('predict.html')

# {'predictions': [{'fields': ['prediction'], 'values': [[73.1356229374655]]}]}
final_price = predictions['predictions'][0]['values'][0][0]

final_price = round(final_price, 2)
# print(f' The value is : {final_price}')
```

we get the response from the Cloud,we do some small modifiations,as the data which is returned by cloud is in form of "json" format which we have to convert in python list,and then acsess the items from the list,after fetching the result we have to return it to the UI,and that will show the result as ↓