Prerequisites for IBM Watson Deep Learning as a Service (DLaaS)

This tutorial outlines the steps needed to setup the required services to run deep learning experiments using Watson Machine Learning via Jupyter notebooks in Watson studio.

Overview

Leveraging the IBM Watson Deep Learning capabilities requires the following IBM Cloud services.

1- IBM Watson Studio
2- IBM Watson Machine Learning (WML)
3- IBM Cloud Object Storage (COS)

Figure 1 illustrates how these services interact to deliver the capability for data scientists to run machine learning and deep learning training jobs. Typically, in an enterprise environment, the account admin manages the cloud object storage instances including creation of buckets and assigning the correct permissions to enterprise users including data scientists. In a personal environment, the data scientist would be the account admin as well and he/she will manage the access permissions to cloud object storage instances and buckets.

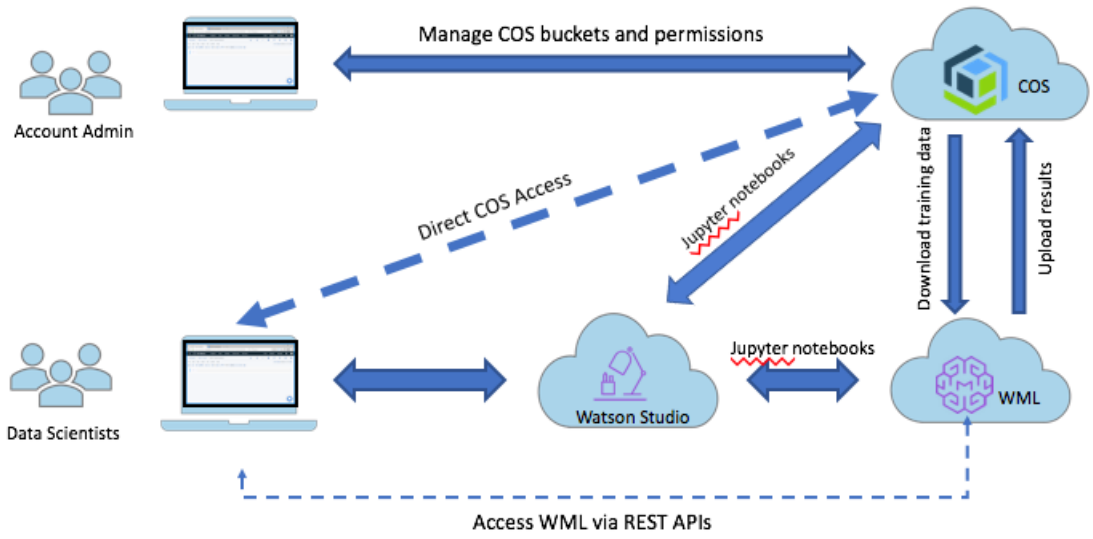

Figure 1: Interaction across IBM Cloud Services required for DLaaS

Once cloud object storage (COS) and the associated buckets are created with the correct permissions, data scientists can run deep learning experiments as follows:

1- Upload training data directly to their COS buckets.
In a personal environment, or for experimentation, data scientists would typically upload training data to their COS buckets. However, in a team environment, it is typical

for data scientists to run different deep learning experiments against the same data. In that scenario, one team member can upload the training data to a COS bucket which all team members have read access to.
For more details on access permissions, check the IBM Cloud Object Storage documentation page.

2- Setup the COS buckets to store experiment training results.
As the deep learning experiment is run, training results get generated and they need to be saved to a cloud object storage (COS) bucket. It is important to set the permissions for the buckets correctly. While it is sufficient to get read access to the COS buckets that hold the training data, it is necessary to get read/write access to the COS buckets that hold the training results.

3- Setup deep learning (DL) experiments.
Jupyter notebooks are popular for data scientists to write code for loading, evaluating, and shaping data as well as training machine learning models. Jupyter notebooks are fully supported in Watson Studio and enable data scientists to work as a team by being collaborators in the same project.
Additionally, Watson Studio supports Neural Network Modeler which offers a user interface (UI) with drag-and-drop functionality to design deep neural networks.
Once deep learning network is defined, a training definition is created in Watson Machine Learning service.

Creating training definitions is a critical step for running deep learning experts whether those are created using Neural Network modeler or via python scripts.

4- Run and monitor DL experiments using Watson Machine Learning service.
Once the training definition is created, use the WML Python client to run and monitor the DL experiments.

5- Visualize experiment results.
Once the training is complete, it is important to be able to visualize the results so data scientists can get a better appreciation on what worked, what didn't and also inspire next steps.

6- Deploy ML/DL models.
Once a machine learning or deep learning model is trained with good performance results, it is important to deploy those models to a REST api so developers can leverage in their applications.

The rest of this tutorial outlines the steps required to setup your account and get it ready for running Deep Learning experiments via Jupyter notebooks in Watson Studio.

After completing the setup, you can run the Deep Learning Experiments notebook in Watson Studio to run a sample experiment for recognizing handwritten digits using the MNIST data set as training data. The notebook leverages Tensorflow as the deep learning framework.

The same notebook can be modified to run deep learning experiments for other use cases using different data sets.

Setup

To start, there are some setup activities required to have access to the components and services needed to be able to train a deep learning network using IBM Watson DLaaS.

Setup IBM Cloud Account

IBM Watson DLaaS is offered on the IBM Cloud and to access its capabilities, users need to have an IBM Cloud account. To setup an IBM Cloud Account, follow these steps:

1- Sign In or Sign up to your IBM Cloud account.
In your browser, paste the following url: https://ibm.com/cloud
For a list of supported web browsers, check the prerequisites.

If you don't have an IBM Cloud account, the click on the **Sign up** link as shown in Figure 2. Then follow the instruction to sign up for an account.

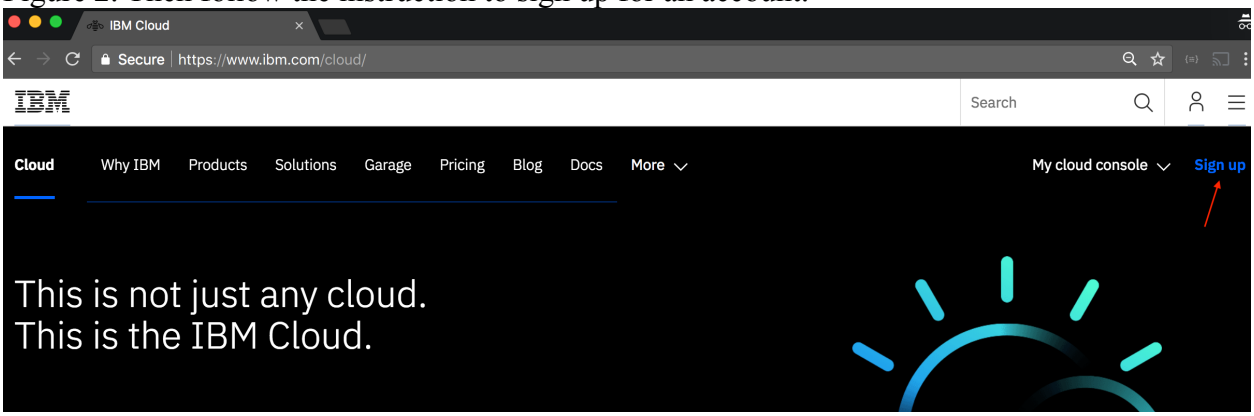

Figure 2: IBM Cloud Sign up

If you do have an IBM Cloud account, click on the avatar and select **Sign in** as shown in Figure 3.

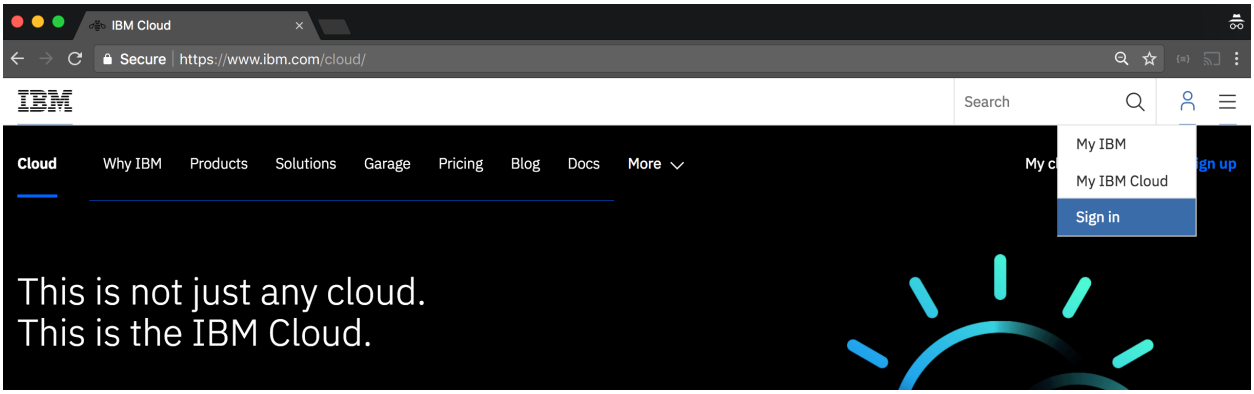

Figure 3: IBM Cloud Sign in

Authenticate by providing your IBM Cloud account credentials (username and password).

Create Required Services

As explained earlier, training deep learning networks using IBM Watson DLaaS requires the following services to be created:

1- IBM Cloud Object Storage (COS)
2- IBM Watson Machine Learning (WML)
3- IBM Watson Studio

Once you've authenticated to your IBM Cloud account, click on **My cloud console** link and select **Catalog** as shown in Figure 4.

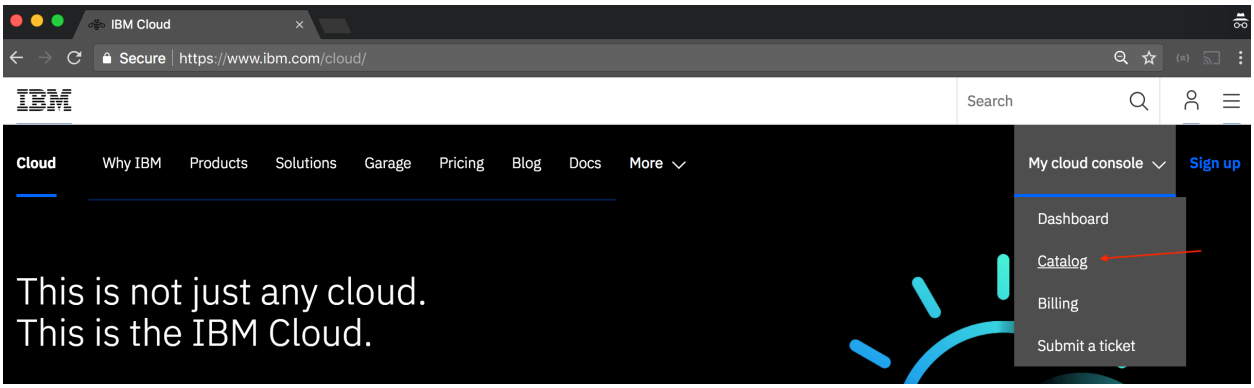

Figure 4: IBM Cloud Catalog

Cloud Object Storage

On the page that loads, click on Storage in the left navigation column and then click on **Object Storage** as shown in Figure 5.

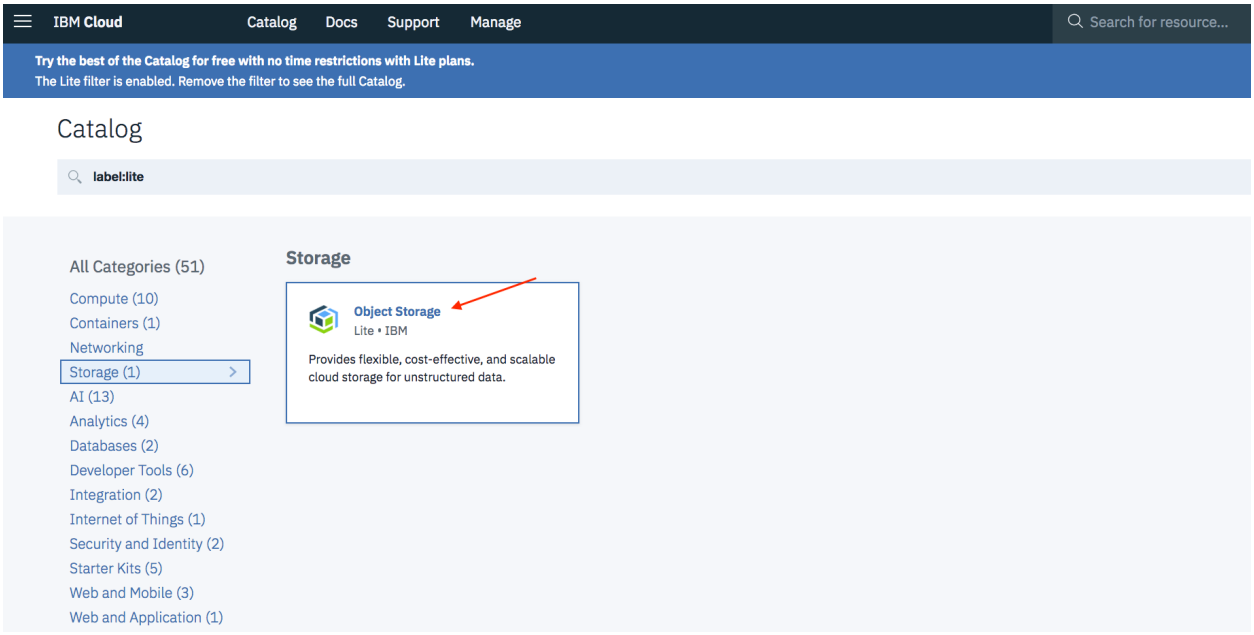

Figure 5: IBM Cloud Object Storage

On Cloud Object Storage (COS) service page, select a unique name for your service, choose the **Lite** plan and click **Create** button.
The **Lite** plan is a free plan which allows you to experiment and evaluate the offerings on the IBM Cloud.
Please note that Lite plan services are deleted after 30 days of inactivity.

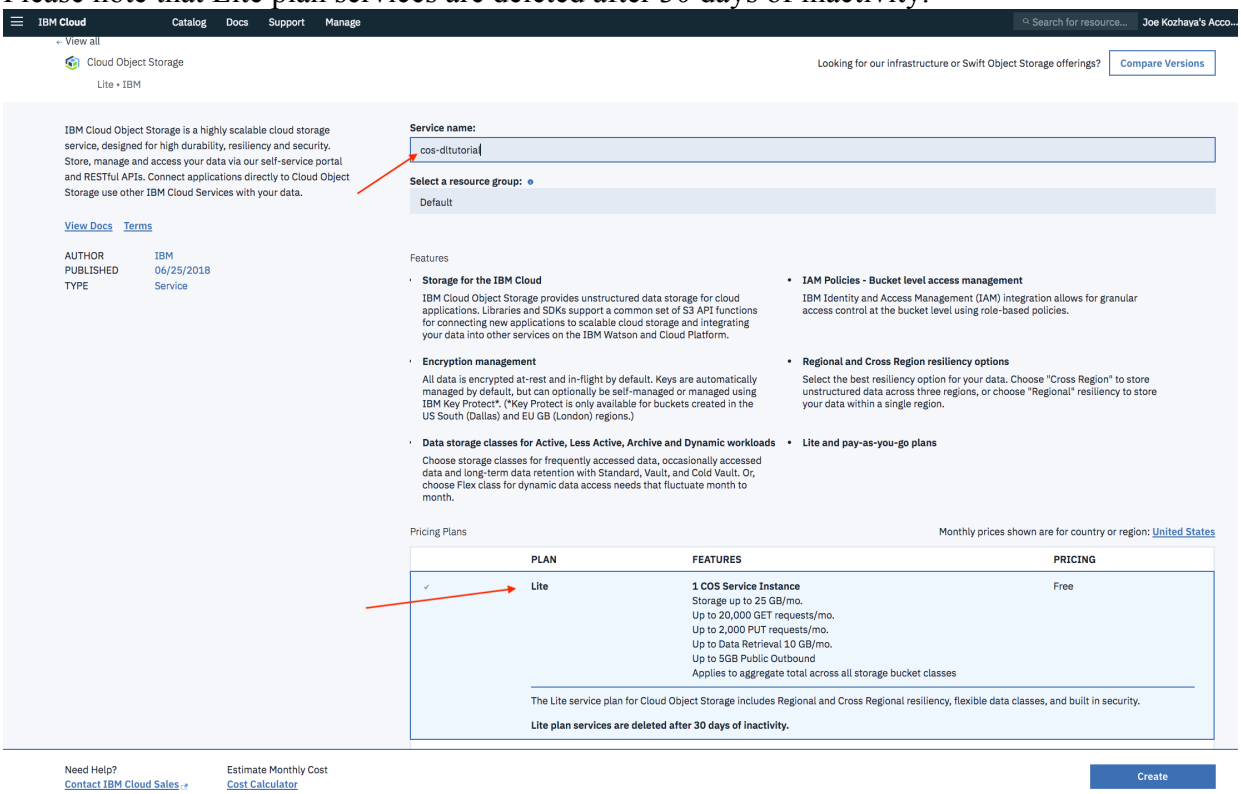

Figure 6: Cloud Object Storage instance creation

Once the COS service is created, we need to record the credentials needed to access COS through APIs.
Click on Endpoint in the left navigation column and copy the us-geo public endpoint. This is the value you specify for the service endpoint in the notebook.

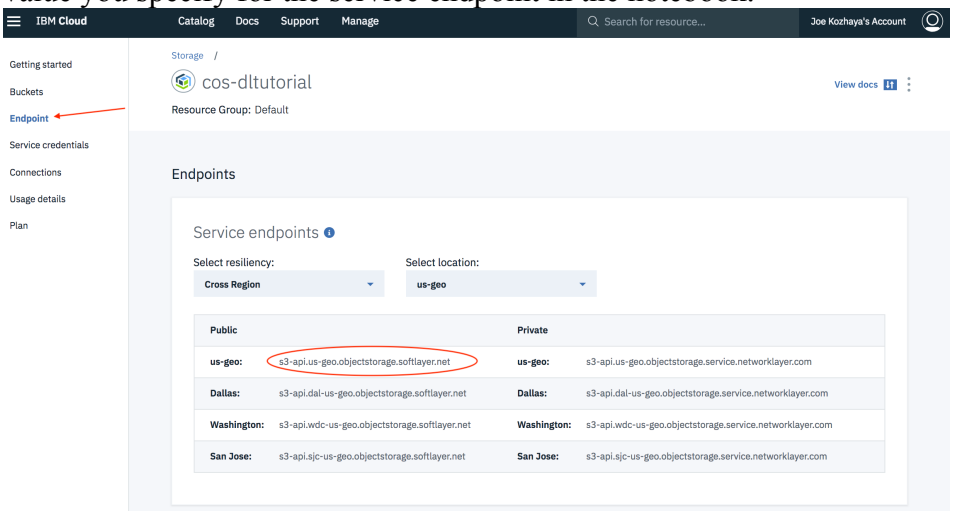

Figure 7:Cloud Object Storage Endpoint

Figure 8 illustrates how to get the cos_hmac_keys. Specifically:

- Click on the **Service credentials** in the left navigation column
- Then press **New credential** button
- In the ***Add new credential*** window, type *{"HMAC":true}* in the ***Add Inline Configuration Parameters*** box.
- Press **Add** button.

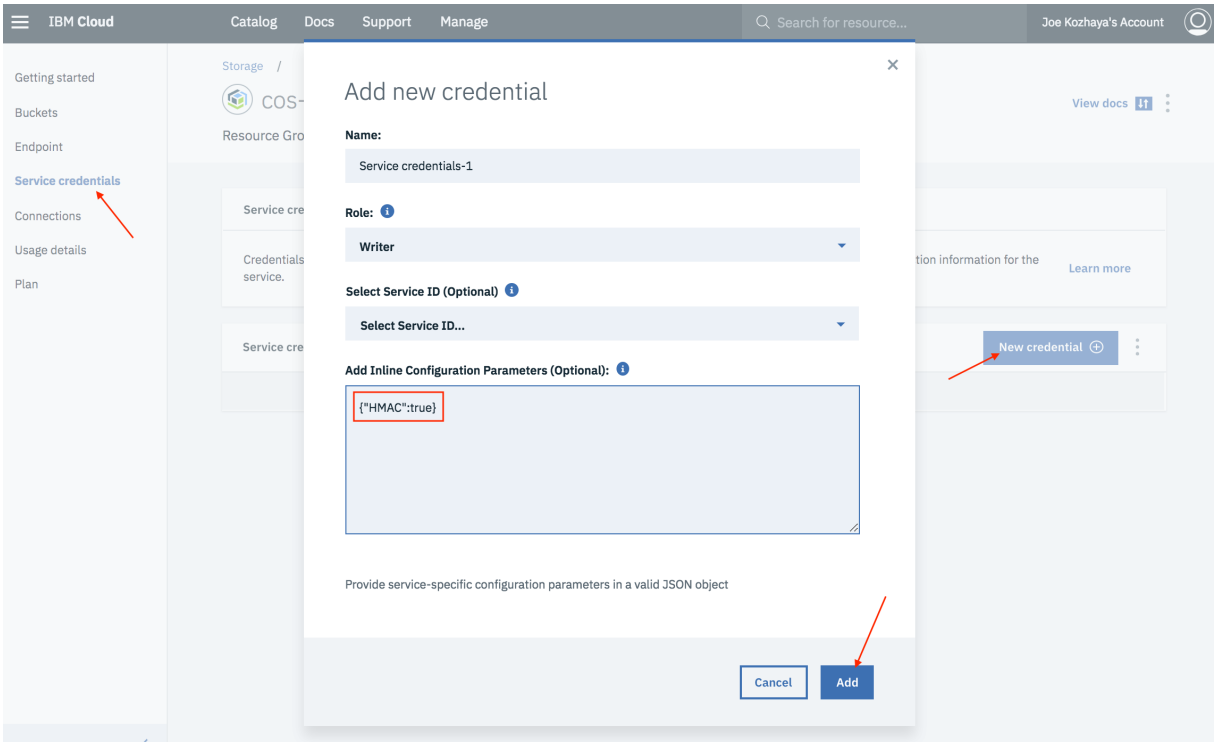

Figure 8: Creating COS HMAC Credentials

Click on **View Credentials** and copy the COS credentials as shown in Figure 9. Copy these credentials as you'll need them in the Jupyter notebook to access your COS instance.
For more details, check the [Using HMAC credentials] page.

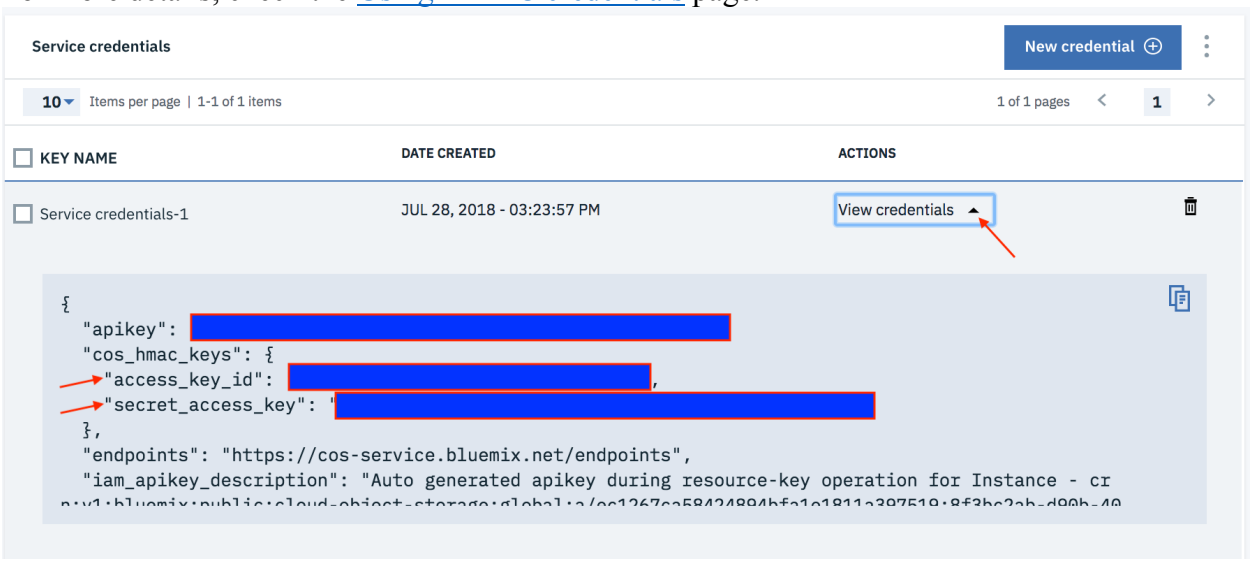

Figure 9: COS HMAC Keys

Watson Machine Learning

To create a Watson Machine Learning (WML) service, click on Catalog tab in the top navigation bar, then click on the AI category in the left navigation column and then select the Machine Learning service as shown in Figure 10.

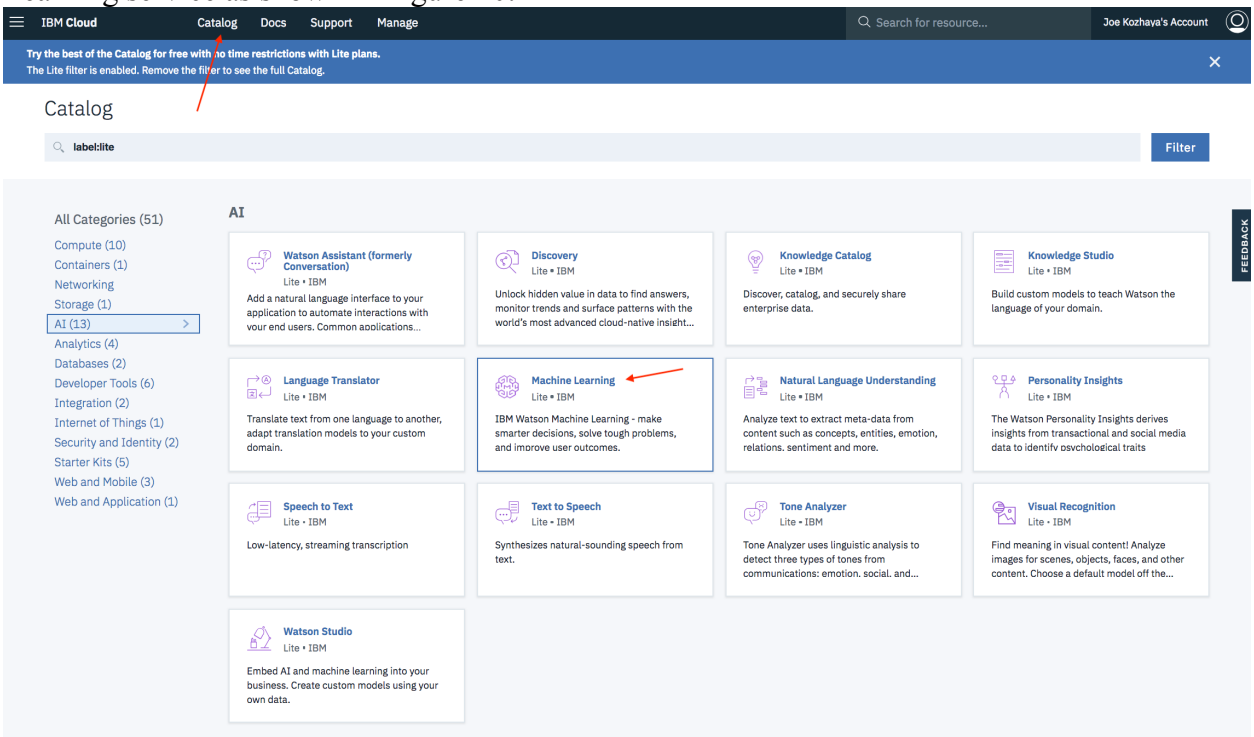

Figure 10: IBM Cloud AI Services

On the Watson Machine Learning service page, select a unique name for your service, choose the **Lite** plan and click **Create** button as shown in Figure 11.

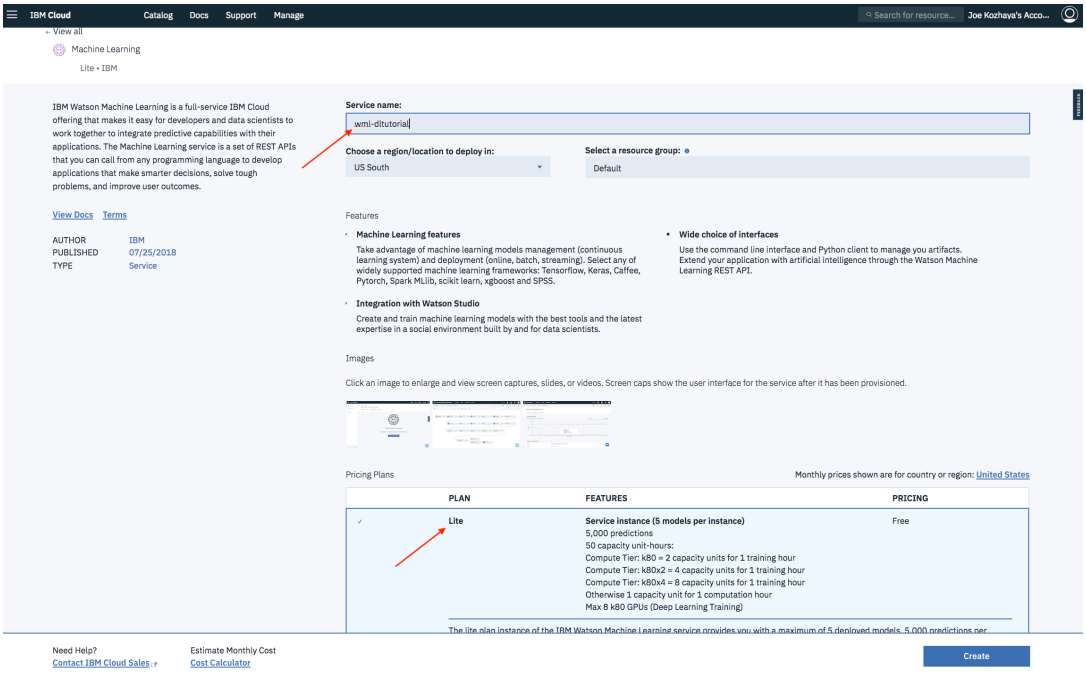

Figure 11: Watson Machine Learning Service Page

Once the WML service is created, create credentials for the service by clicking on the **Service credentials** link in the left navigation column and pressing the **New credential** button.
To view the generated credentials, click the **View credentials** button and copy the credentials for use in the notebook.

Watson Studio

To create a Watson Machine Learning (WML) service, click on Catalog tab in the top navigation bar, then click on the AI category in the left navigation column and then select the **Watson Studio** service as shown in Figure 12.

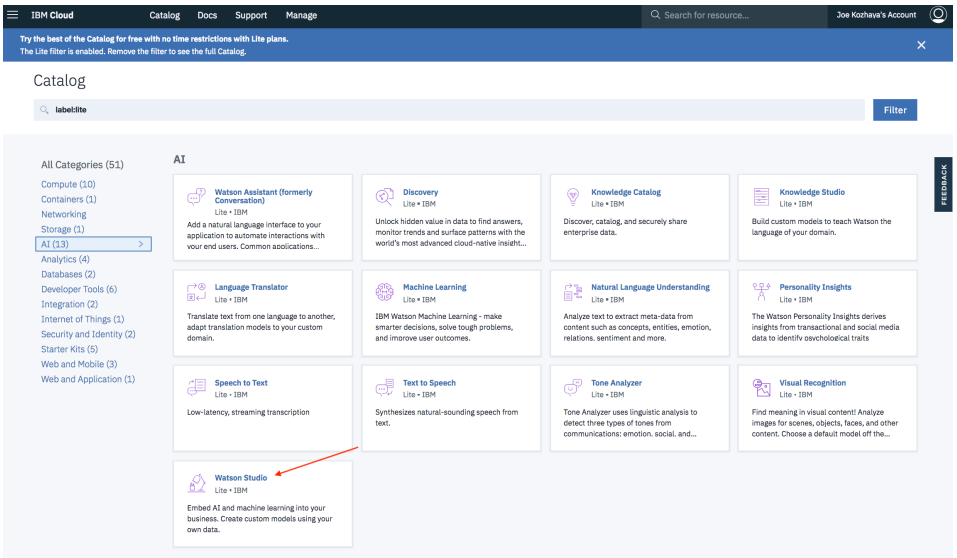

Figure 12: IBM Cloud AI Services

On Watson Studio service page, select a unique name for your Watson Studio service, choose the **Lite** plan and click **Create** button.

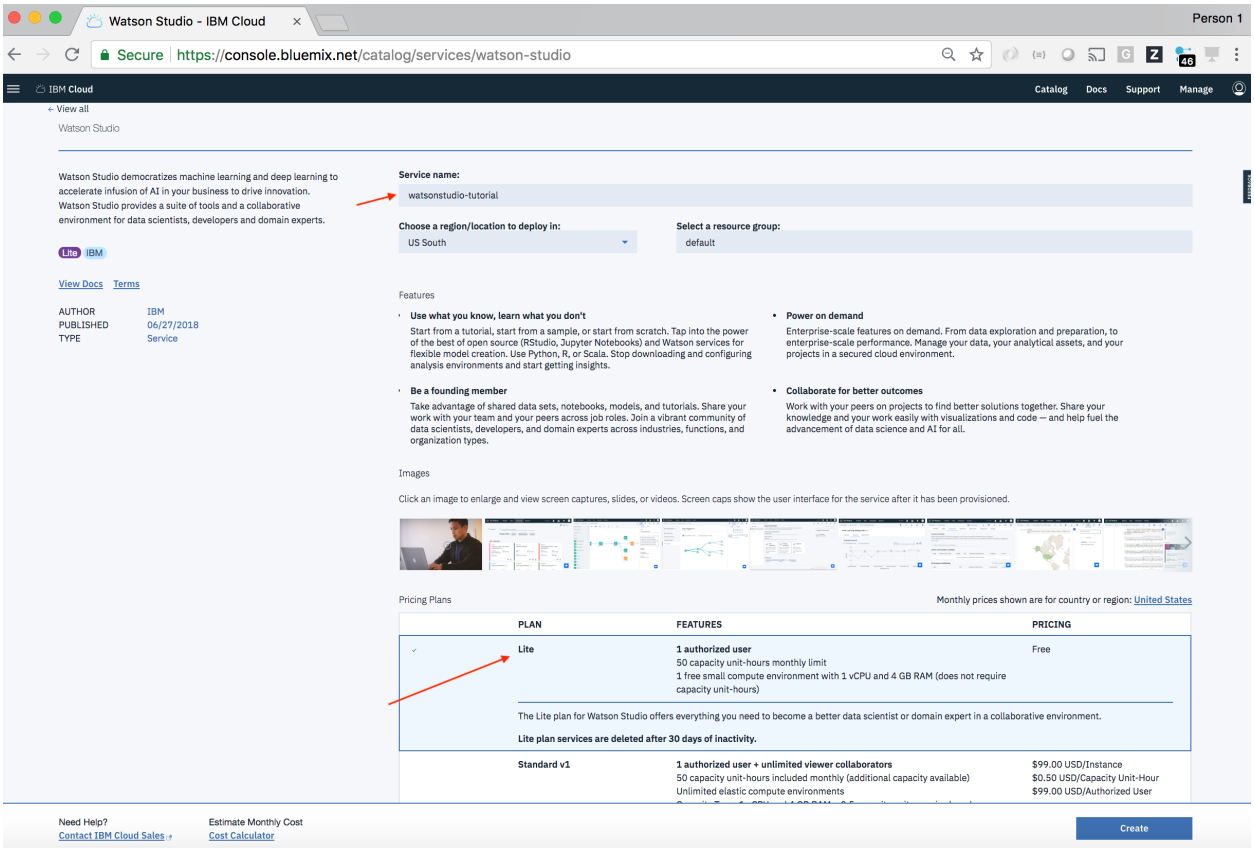

Figure 13: Watson Studio Instance Creation

On the page that loads, click Get Started button to launch Watson Studio as shown in Figure 7.

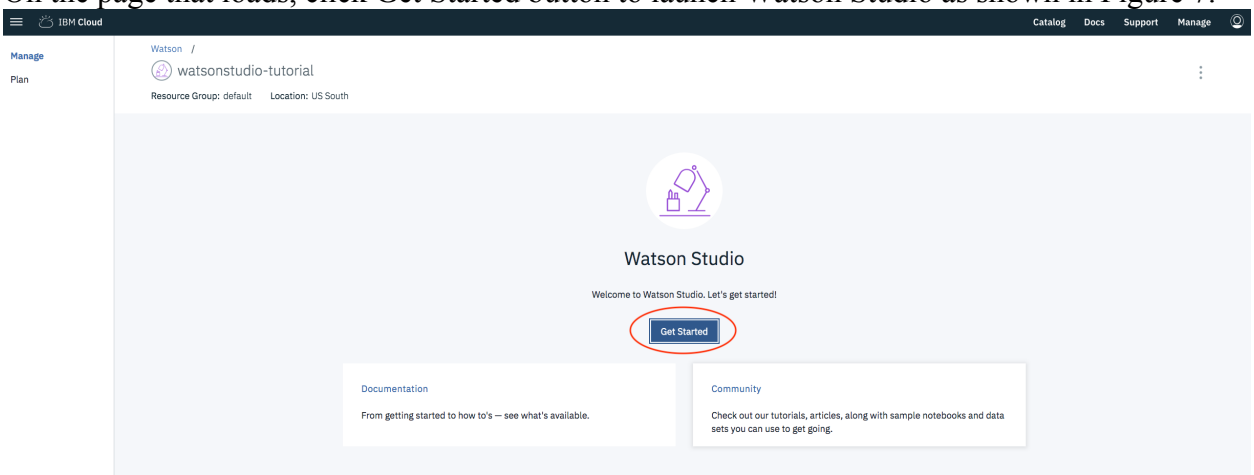

Figure 7: Launch Watson Studio

After this initial setup, for future logging into Watson Studio, you can paste the following url into your browser, provide your credentials and you're logged into IBM Watson landing page: https://dataplatform.ibm.com/

Deep Learning Experiments in Jupyter notebooks

Now that you have setup the required services, you can setup and run deep learning experiments by following the instructions in the Deep Learning Experiments notebook.