

Using AutoAI to forecast electricity consumption!

Objective for Exercise:

- Learn how to utilize Watson AutoAI to forecast electricity consumption based on input data.
- Creating and training a model using sample data.

You are a part of an AI team and you have been given a project to forecast electricity consumption for the clients. You have been provided with time series data from the Electricity department and with the help of this data, you can leverage the power of AI to build a model that predicts future electricity consumption values based on trends in the past.

You will build the model using IBM Watson Studio. The Watson Studio Auto AI is a service that allows us to interactively create, train, and deploy machine learning models. Follow the steps below to complete this exercise.

NOTE: For learners working to get a certificate for this course (i.e. not auditing), please go through this exercise carefully and thoroughly

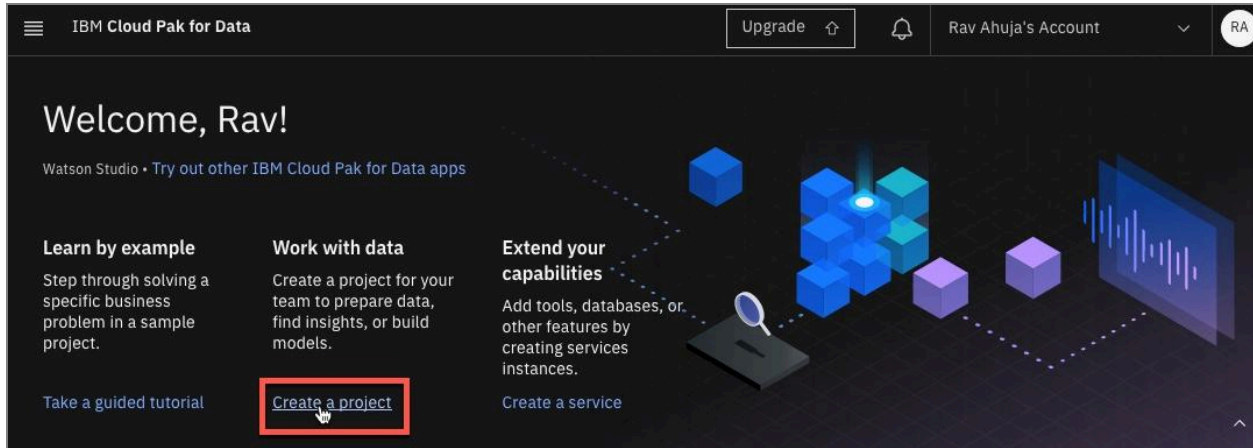
it will be used for the graded assignment that follows.

Pre-requisite

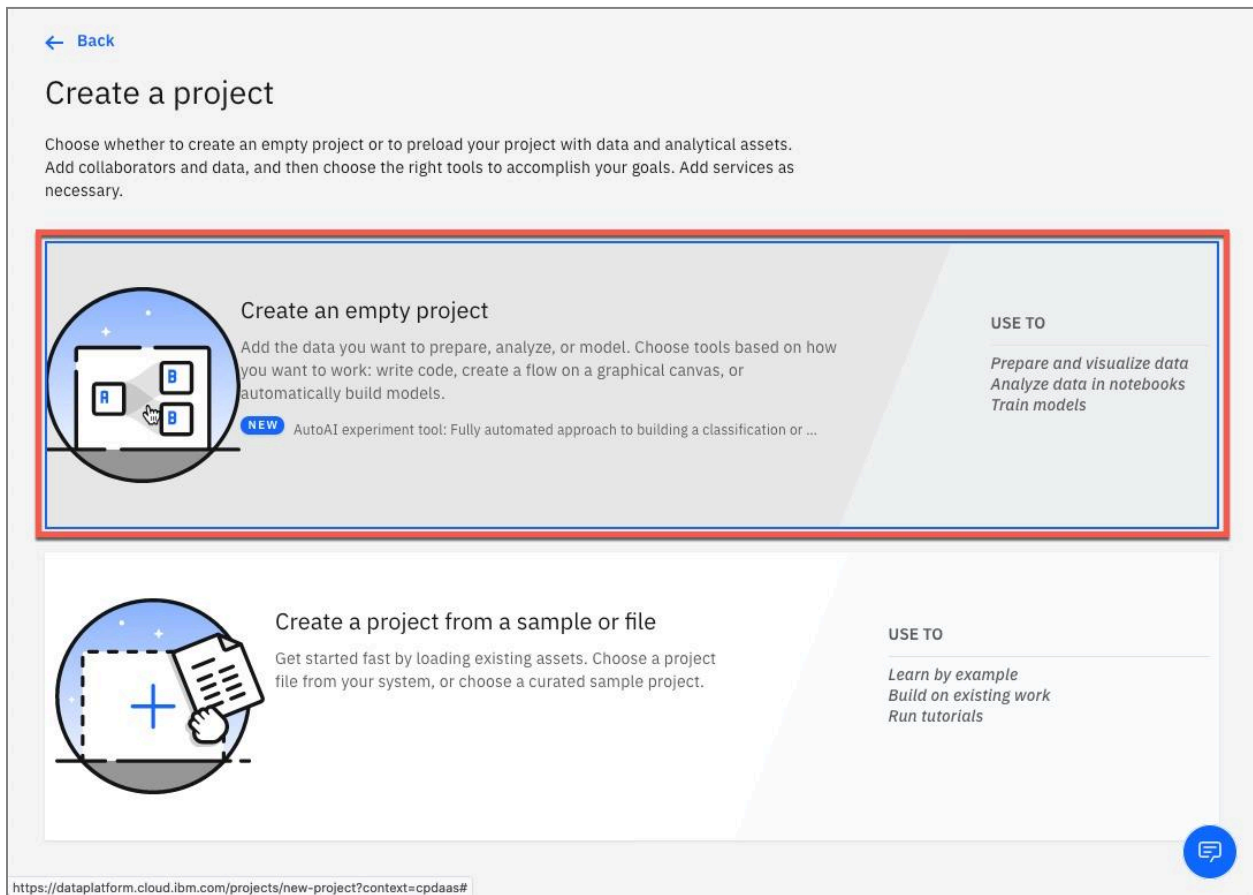
To complete this lab, you must have created an IBM Cloud account, Machine Learning and Watson Studio service which is instructed in previous lab: [Hands-on Assignment 1: IBM Cloud Service Creation](#)

Task 1: Create a Project on Watson Studio

1. Log in to your IBM Cloud account: <https://cloud.ibm.com/login>
2. Now, open the IBM Watson Studio service in your web browser: <https://dataplatform.cloud.ibm.com/home>
3. On the Watson Studio Welcome page, click Create a project.



4. On the Create a project page, click Create an empty project.



5. On the New Project page, enter a name for your project (we suggest using "Auto AI Exercise" or something similar) and, if you'd like, a description.

New project

Define details

Name

Description

Project description

Choose project options

☐ Restrict who can be a collaborator ⓘ

Project includes integration with [Cloud Object Storage](#) for storing project assets.

Define storage

① Select storage service

[Add](#)

Add an object storage instance, and then return to this page and click Refresh.

② Refresh

[Cancel](#)
[Create](#)

<https://dataplatform.cloud.ibm.com/projects/create-project?context=cpdaas#>

6. You must define storage for your project before you can create it. If you already have an instance of Cloud Object Storage, you can select it, otherwise under Select storage service, click Add. Now on the Cloud Object Storage page, verify that Lite plan is selected, and then click Create.

Services catalog /

Cloud Object Storage

Author: IBM • Date of last update: Mar 26, 2021 • [Docs](#) • [API Docs](#)

[Create](#) [About](#)

Pricing plan

Displayed prices do not include tax. Monthly prices shown are for country or region: United States

Plan	Features	Pricing
Lite	1 COS Service Instance Storage up to 25 GB/month Up to 2,000 Class A (PUT, COPY, POST, and LIST) requests per month Up to 20,000 Class B (GET and all others) requests per month Up to 10 GB/month of Data Retrieval Up to 5GB of egress (Public Outbound) Applies to aggregate total across all storage bucket classes The Lite service plan for Cloud Object Storage includes Regional and Cross Regional resiliency, flexible data classes, and built in security. Lite plan services are deleted after 30 days of inactivity.	Free

Summary

Cloud Object Storage

Region: Global
 Plan: Lite
 Service name: Cloud Object Storage-It
 Resource group: Default

[Create](#)

8. Now on the Create Project page, under Define storage, you may need to click Refresh to see the newly created instance of Cloud Object Storage (COS).

New project

Define details
Name
Auto AI Exercise
Description
Project description

Define storage
① Select storage service
Add
Add an object storage instance, and then return to this page and click Refresh.
② **Refresh**

9. Once an instance of Cloud Object Storage (COS) is listed, click Create to create the Project.

New project

Define details
Name
Auto AI Exercise
Description
Project description

Storage
cloud-object-storage-eo

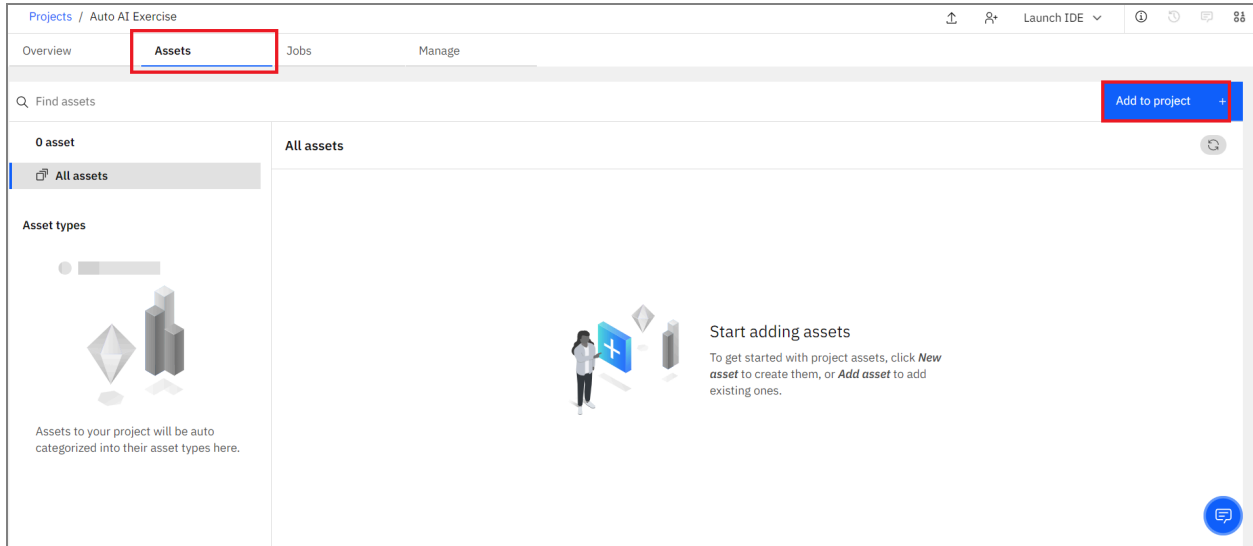
Choose project options
☐ Restrict who can be a collaborator ⓘ
Project includes integration with [Cloud Object Storage](#) for storing project assets.

<https://datapatform.cloud.ibm.com/projects/create-project?context=cpdaas#>

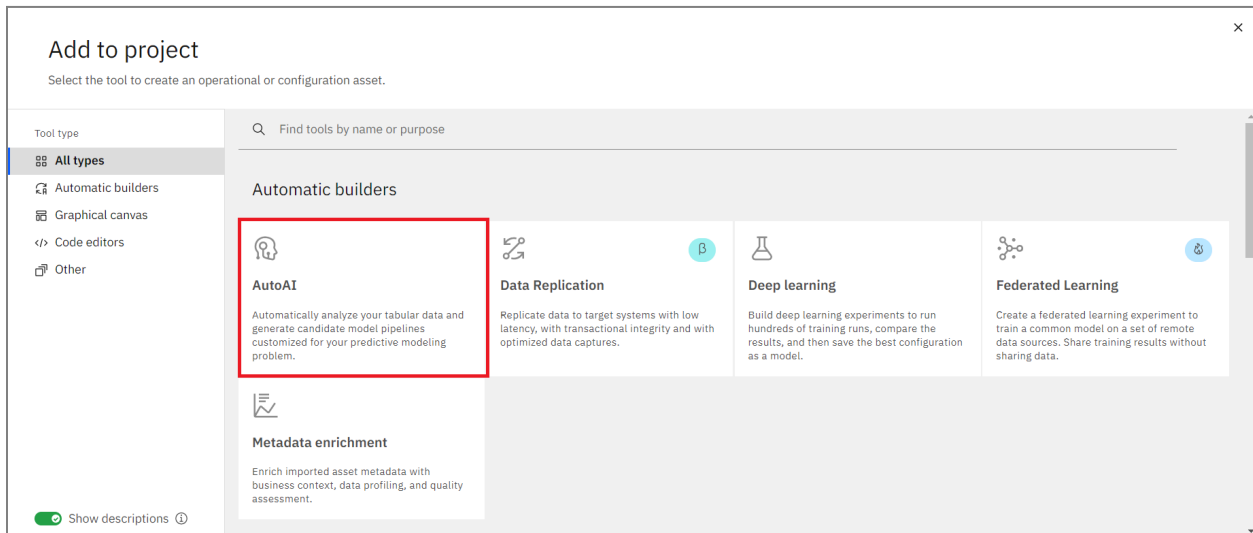
Cancel Create

Task 2: Add Auto AI Asset to Your Project

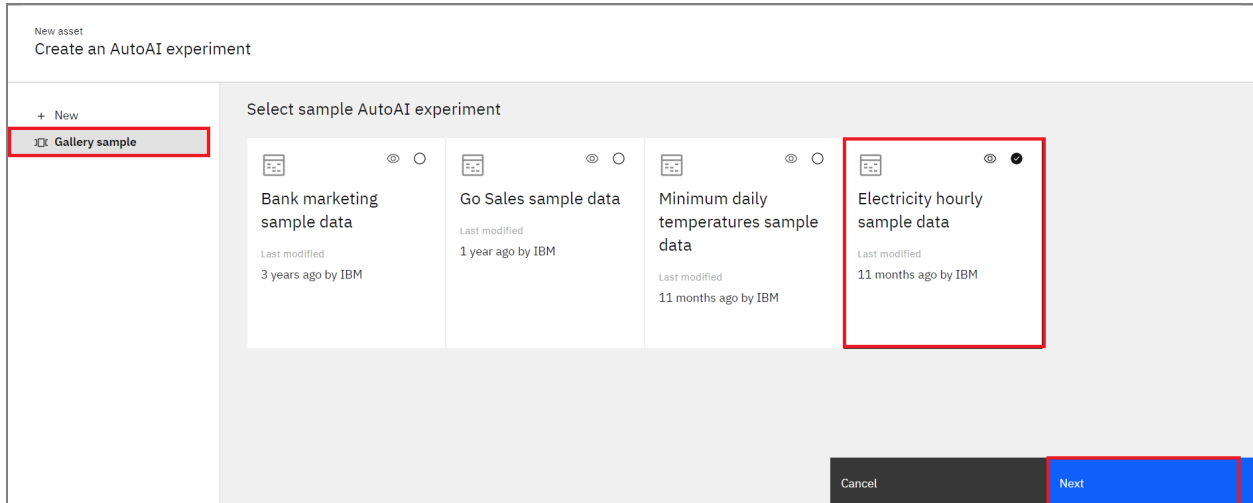
1. On the project page, go to the "Assets" and click on Add to project button to add a new tool to your project.



2. Now, select the AutoAI tool to add this to your project.

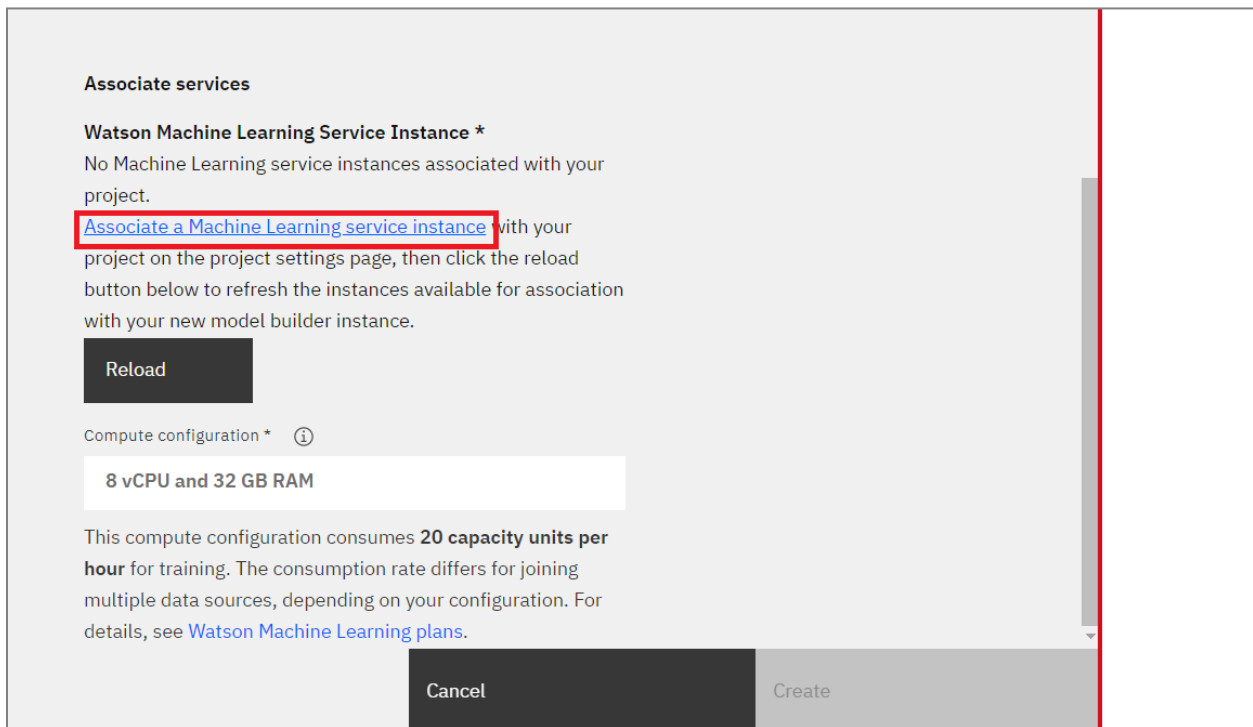


3. On the Create an AutoAI experiment page, there are multiple samples provided under the Gallery sample, please select the Electricity Hourly Sample Data for this lab and click on Next.



4. In order to use AutoAI, you will need to associate a machine learning

service with your project. If a machine learning service is not associated with your project, you can associate one under the Associate services section on this page. Click the link, Associate a Machine Learning service instance to start the association flow.



5. Associate the Machine Learning service you created in

an earlier step in this exercise. select a machine learning service and click Associate Service.

Associate service
Choose an existing or add a new service to associate with your project.

Filter by: 1 x Default 7 x Locations 1 x shubhamy@skillup.tech (eu-gb)

1 item selected

Name	Type	Plan	Location	Status	Group
☐ Watson Assistant-y0	Watson Assistant	Lite	London	Not associated	Default
☐ Watson Discovery-0d	Watson Discovery	Lite	London	Not associated	Default
☐ Language Translator-eg	Language Translator	Lite	Dallas	Not associated	Default
☐ Natural Language Understanding-76	Natural Language Understanding	Lite	Dallas	Not associated	Default
☒ Machine Learning-yx ⓘ	Machine Learning	Lite	Dallas	Not associated	Default
☐ Speech to Text-pj	Speech to Text	Lite	London	Not associated	Default
☐ Text to Speech-i8	Text to Speech	Lite	London	Not associated	Default
☐ Visual Recognition-i9 ⓘ	Visual Recognition	Lite	Dallas	Not associated	Default

Associate service | Cancel

6. After the service is associated, you will be taken back to the experiment details page. Click or tap the Reload button to refresh the machine learning association. Your machine learning instance should now show under the "Associate services" section.

7. Now click the Create button and your AutoAI asset will be created in your project.

Define details

Name *

Electricity hourly sample data

Description

Train an experiment with this sample data to predict electricity consumption for several clients at hourly intervals using multivariate time series forecasting.

Associate services

Watson Machine Learning Service Instance*

Machine Learning-yx

Compute configuration * ⓘ

8 vCPU and 32 GB RAM

This compute configuration consumes **20 capacity units per hour** for training. The consumption rate differs for joining multiple data sources, depending on your configuration. For details, see [Watson Machine Learning plans](#).

Cancel Create

Task 3: Run the Experiment

1. When the experiment page loads, you can click next on all the wizard buttons to close out the wizard. For this experiment, the Electricity hourly sample data is selected for you.
2. In this dataset, The first column presents the date and time as a string with the following format 'dd-mm-yyyy hh:mm'. Other columns MT_002, MT_004, and MT_007 present float values with consumption in kW, each of these columns represents one client.

timestamp	MT_002	MT_004	MT_007
01-10-2014 00:00	92.46088	451.2195	15.26286
01-10-2014 01:00	79.65861	416.6667	12.4364
01-10-2014 02:00	77.52489	373.9837	14.13228
01-10-2014 03:00	75.39118	347.561	12.4364
01-10-2014 04:00	76.81366	341.4634	12.4364
01-10-2014 05:00	84.63727	349.5935	13.56699
01-10-2014 06:00	97.43954	331.3008	16.95873
01-10-2014 07:00	133.7127	341.4634	9.609949
01-10-2014 08:00	128.734	359.7561	7.914076
01-10-2014 09:00	118.7767	355.6911	7.348785
01-10-2014 10:00	115.2205	357.7236	7.914076
01-10-2014 11:00	115.9317	351.626	7.348785
01-10-2014 12:00	115.2205	343.4959	11.87111
01-10-2014 13:00	120.1991	313.0081	13.0017
01-10-2014 14:00	108.8193	329.2683	7.914076
01-10-2014 15:00	103.8407	367.8862	8.479367

3. For this experiment, your goal is to predict future values based on trends in the past so forecasting is enabled for you already. And under the Prediction columns, you have to choose what the experiment will predict. For this sample, MT_002, MT_004, and MT_007 are selected. Each of these columns represents the amount of electricity consumed hourly by three different clients.



Create a time series forecast? BETA

Enable this option to predict future activity over a specified date/time range. Data must be structured and sequential. [Learn more](#)

Yes

No

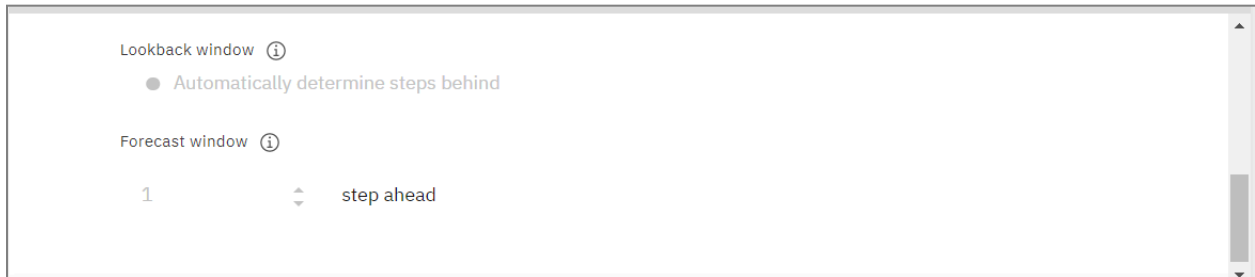


What do you want to predict?

Prediction columns ⓘ

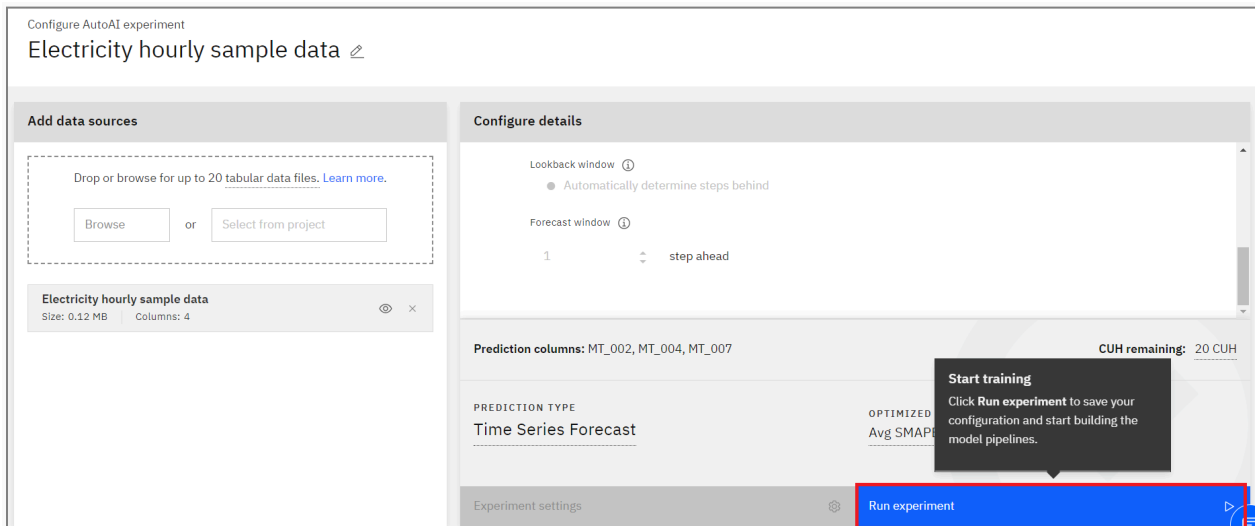
MT_002, MT_004, MT_007

- Now, adjust the windows settings and these settings specify how many steps in the past should be considered when predicting the future (lookback window), and how many steps in the future to predict at once (forecast window). By default, the lookback window is set to automatic and the forecast window is set to 1.

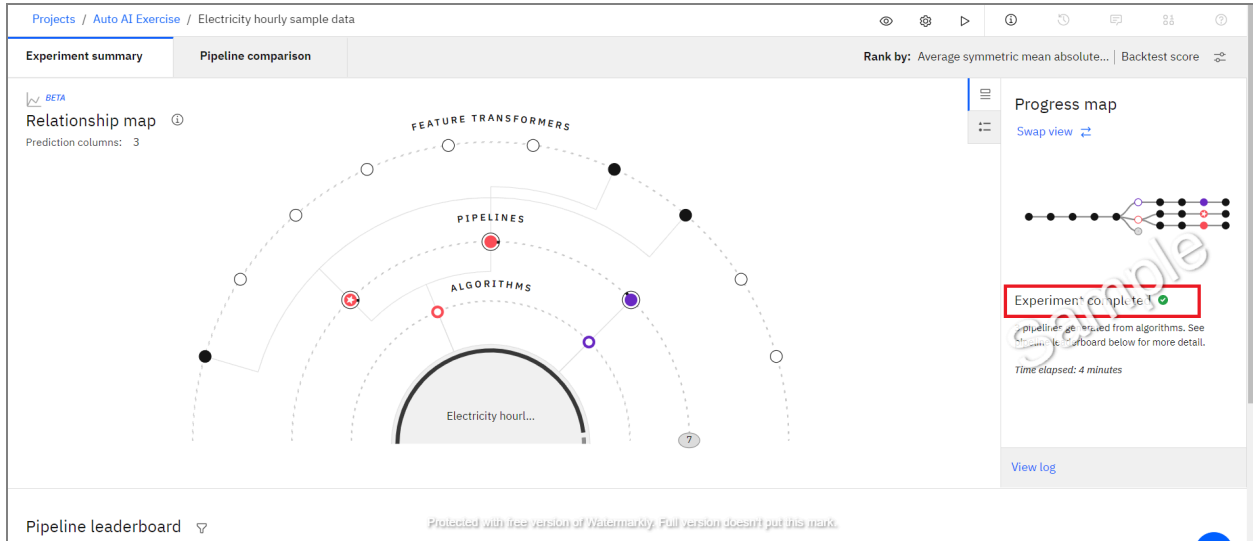


- Now you are ready to analyze the sample data. Click the Run experiment button and let the classifier run until it's complete.

Note: It will take approximately 4 minutes to complete.



- Now, You will see a visual representation of the work being done. You see a message on the right-hand side of the page when the experiment is complete. In the diagram on the left of the page, you'll see various pipelines that represent the experiments that were run. One pipeline will be starred. This shows the most effective experiment.



Save a screenshot of this page in your account and save it as 'experimentcompleted' in .jpg or .png format for the assignment.

Task 4: Save the Model

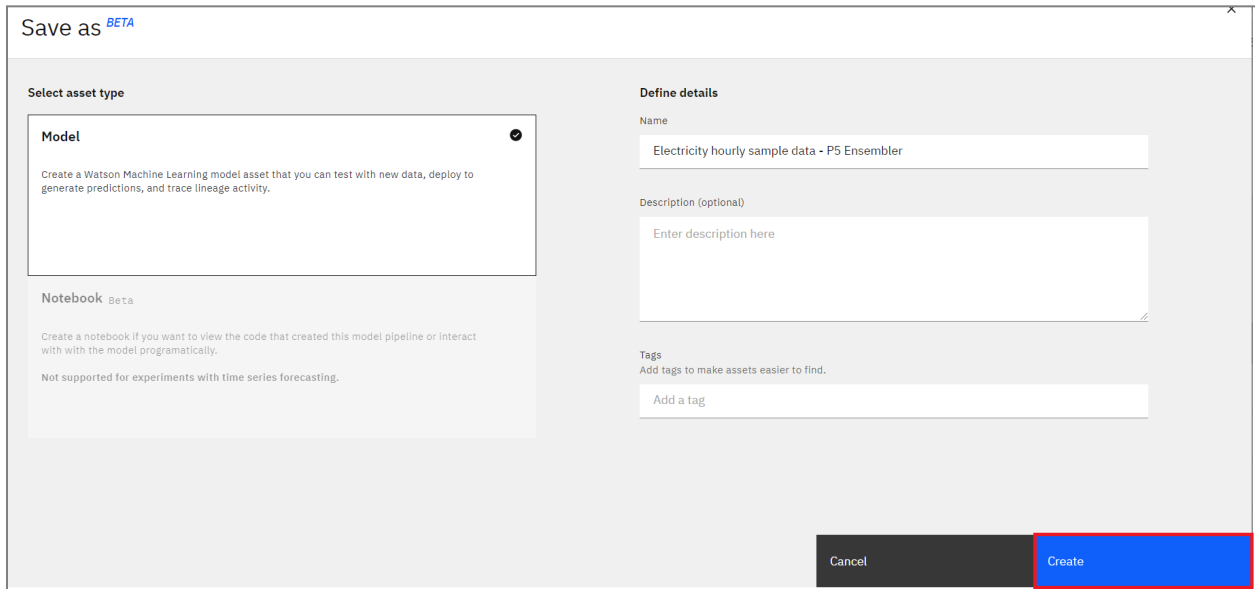
1. On the experiment summary page, scroll down to the Pipeline leaderboard. Hover over the pipeline that has the first ranking in the list until the Save as Model button appears and then click the button.

The screenshot shows the 'Pipeline leaderboard' section of the 'Auto AI Exercise' interface. It displays a table with 3 pipelines. The first pipeline, 'Pipeline 5', is highlighted with a red box around the 'Save as' button. The table columns are Rank, Name, Algorithm, SMAPE (Optimized) Validation, Avg SMAPE (Optimized) Holdout, Avg SMAPE (Optimized) Backtest, Enhancements, and Build time.

Rank	Name	Algorithm	SMAPE (Optimized) Validation	Avg SMAPE (Optimized) Holdout	Avg SMAPE (Optimized) Backtest	Enhancements	Build time
1	Pipeline 5	Ensembler	7.094	8.401	7.311	HPO FE	00:00:02
2	Pipeline 6	Ensembler	7.315	8.465	7.548	HPO FE	00:00:01
3	Pipeline 10	BATS	7.449	8.499	7.588	HPO FE	00:01:24

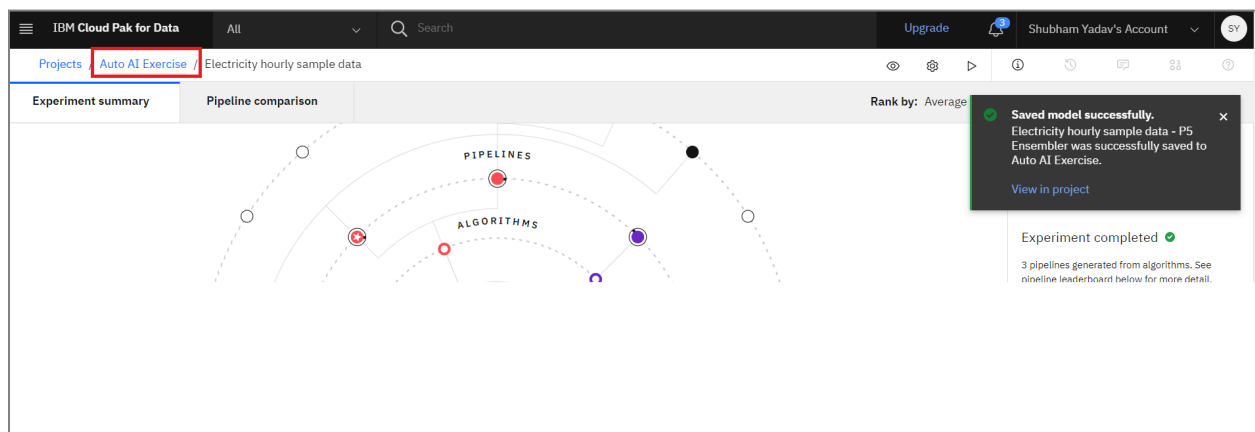
View discarded pipelines (7)

2. You can keep the default name or create your own and add a description if you want to. When you're ready, click the Create button to save your model.



Task 5: View the Model

1. To view the model you just created, navigate back to the project by clicking project name in the "breadcrumb" menu at the top as shown in the screenshot > Note: Your project name may be different than the one shown.



2. Once on the project page, scroll down to the models section and find the model you saved and click the link (the name of the model) to open it.

You don't have any Data assets yet.

AutoAI experiments [New AutoAI experiment +](#)

Name	Status	Model type	Last modified
Electricity hourly sample data	Completed	Time Series Forecast	Jun 01, 2021, 03:16 PM

Deep learning experiments [New Deep learning experiment +](#)

Name	Status	Last modified
You don't have any Deep learning experiments yet		

Models [New Model from file +](#)

Watson Machine Learning models

Name	Type	Software specification	Last modified
Electricity hourly sample data - P5 Ensembler	wml-hybrid_0.1	hybrid_0.1	Jun 01, 2021

 Save a screenshot of this page in your account and save it as 'savedmodel' in .jpg or .png format for the assignment.

Task 6: Create a Deployment

1. In this step, you're going to deploy the model you just created to a web service so it can take input data. Under the model section, click on the model you saved:

You don't have any Data assets yet.

AutoAI experiments [New AutoAI experiment +](#)

Name	Status	Model type	Last modified
Electricity hourly sample data	Completed	Time Series Forecast	Jun 01, 2021, 03:16 PM

Deep learning experiments [New Deep learning experiment +](#)

Name	Status	Last modified
You don't have any Deep learning experiments yet		

Models [New Model from file +](#)

Watson Machine Learning models

Name	Type	Software specification	Last modified
Electricity hourly sample data - P5 Ensembler	wml-hybrid_0.1	hybrid_0.1	Jun 01, 2021

2. Go to Promote to deployment space

My Projects / Auto AI Exercise / Electricity hourly sample data - P...

Electricity hourly sample data - P5 Ensembler

[Promote to deployment space](#)

Electricity hourly sample data - P5 Ensembler

Input Schema

Input	
Column	Type
MT_002	"double"
MT_004	"double"
MT_007	"double"

3. Click on dropdown and select Create a new deployment space

IBM Cloud Pak for Data All Search

Promote to space

Target space

Select or create a space

Create a new deployment space

Tags (optional)

Start typing to add

Close menu

4. Now, fill space details, then click on Create

Create a deployment space

Use a space to collect assets in one place to create, run, and manage deployments

Define space details

Name

AutoAI Deployment

Description (Optional)

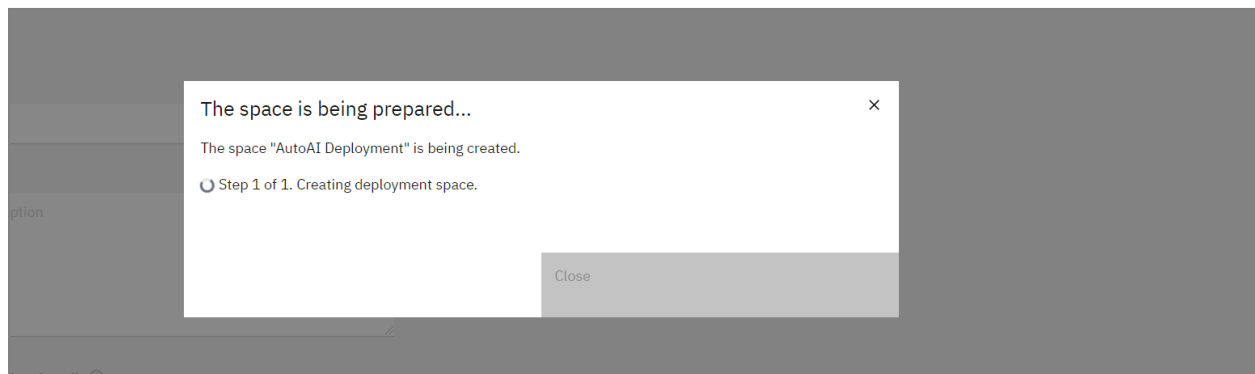
Deployment space description

Deployment space tags (optional) ⓘ

Add a tag

Cancel

Create



5. Once the space is created, click on Promote

Promote to space

Target space

AutoAI Deployment

Tags (optional)

Start typing to add tags

☐ Go to the model in the space after promoting it

Selected assets (1)

Asset name	Format
Electricity hourly sample data - P5 Ensembler	Model

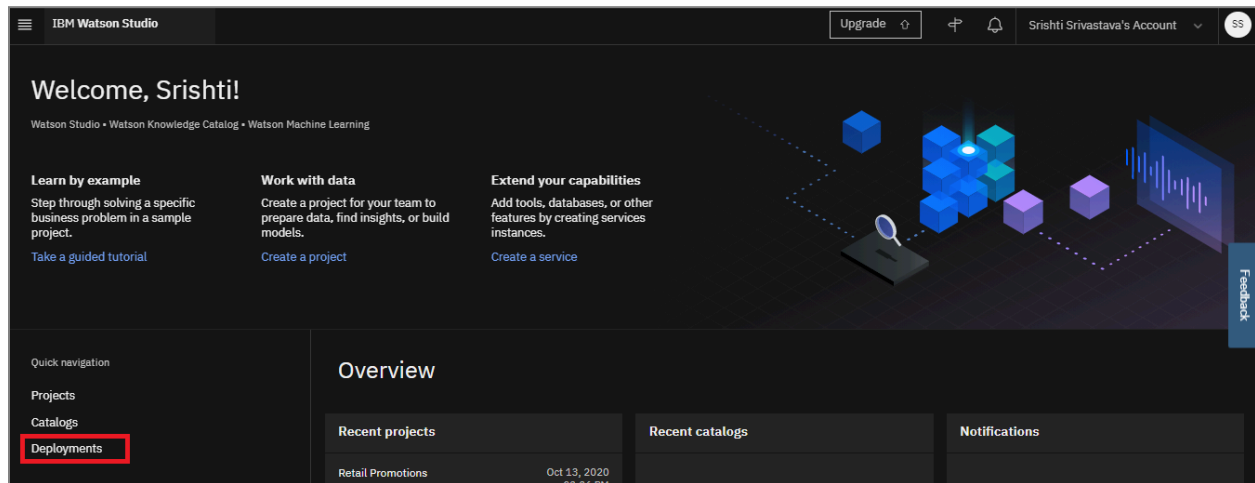
Description (optional)

Description of assets

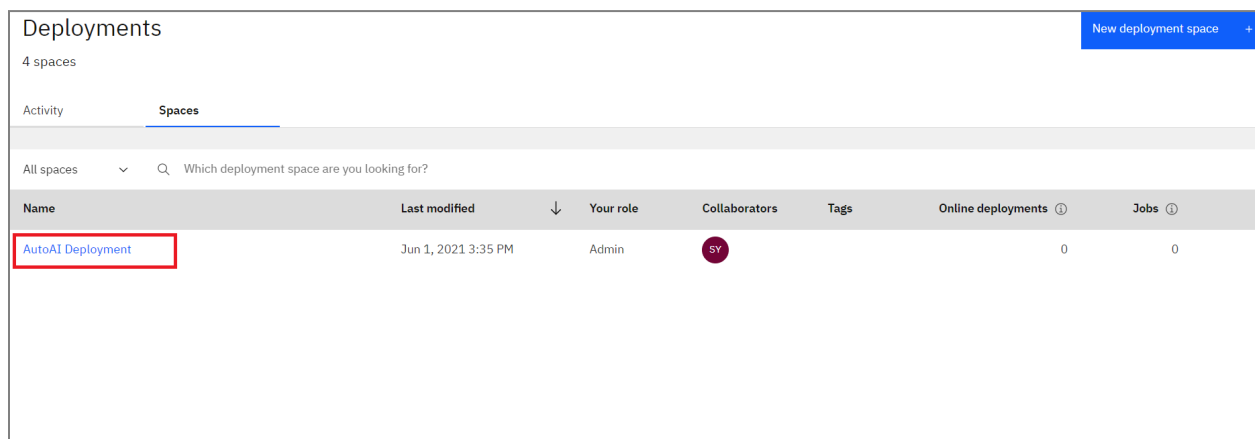
Cancel

Promote

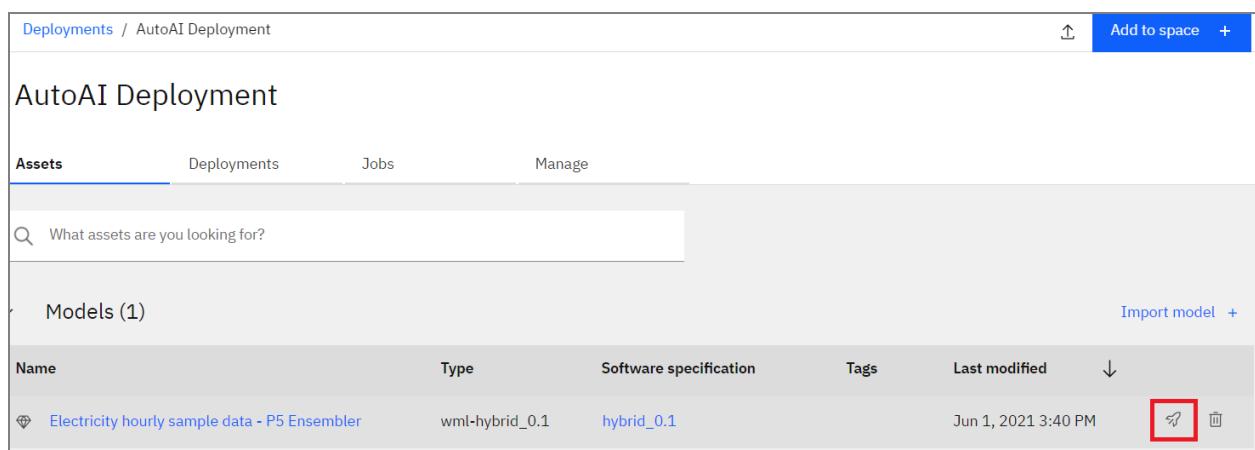
6. Go to the Watson Studio homepage, and click on Deployments



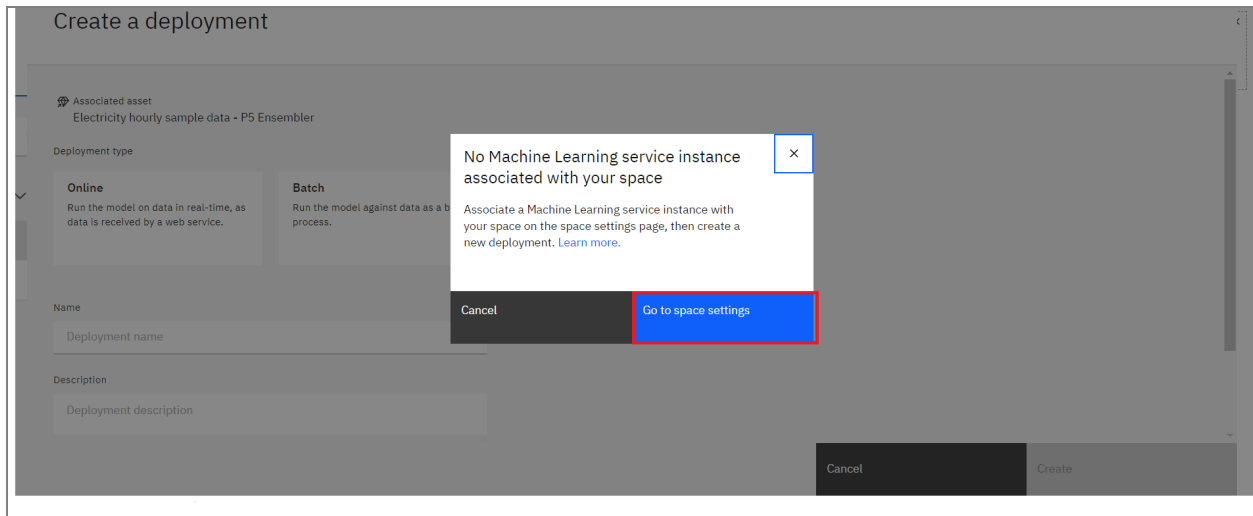
7. Click on the deployment space you created:



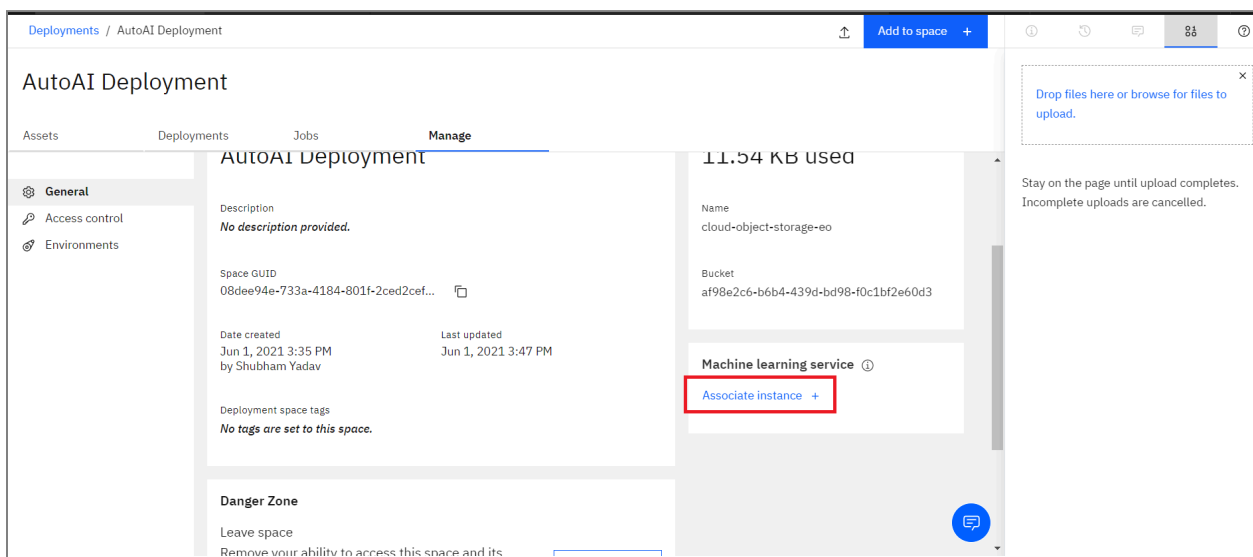
8. Click on the deploy icon:

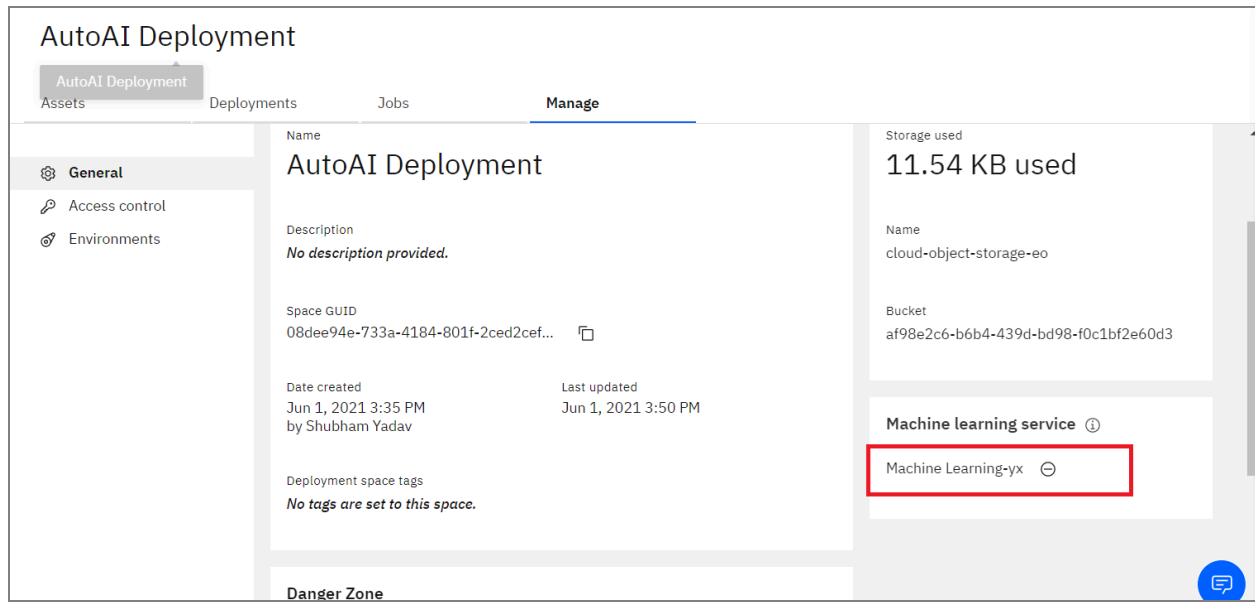


9. On getting the below pop-up window, please click on Go to space settings

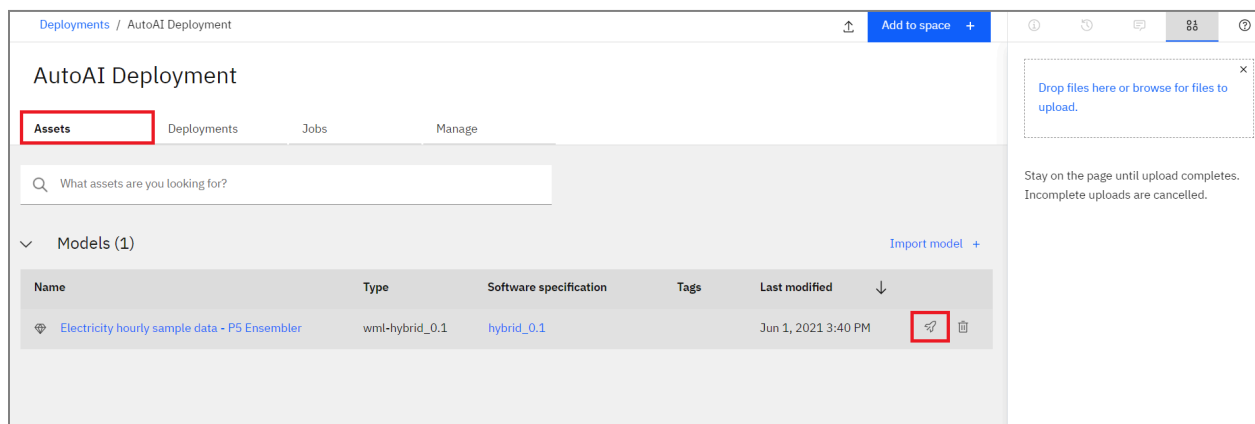


10. Then, click on Associate instance and select the machine learning service instance you created in Step 2





11. Again, click on the deploy icon:



12. Select Deployment type as Online and give the deployment a name and, if

you'd like, add a description. The deployment may go through various stages until it's ready. You may need to refresh your browser to update the status. Once the deployment status states "ready," click on the deployment name to open it.

Note - This step takes few minutes to deploy

Create a deployment

Electricity hourly sample data - P5 Ensembler

Deployment type

Online
Run the model on data in real-time, as data is received by a web service.

Batch
Run the model against data as a batch process.

Name
AutoAI Deployment

Description
Deployment description

Tags

Cancel Create

Deployments / AutoAI Deployment

Add to space +

AutoAI Deployment

Assets Deployments Jobs Manage

What deployments are you looking for?

Deployments (1)

Name	Type	Status	Asset	Tags	Last modified
AutoAI Deployment	Online	Deployed	Electricity hourly sample data - P5 Ensembler		Jun 1, 2021 3:56 PM

Protected with free version of Watermarkly. Full version doesn't put this mark.

 Save a screenshot of this page in your account and save it as 'deployedmodel' in .jpg or .png format for the assignment.

Task 7: Test Your Deployment

1. Now that you have your model deployed, you're ready to test it with some data. On the deployment page you just opened, click the Test tab. Use the form for enter data.

AutoAI Deployment Deployed Online

API reference Test

Enter input data

MT_002

MT_004

MT_007

Add to list +

Input list (0)

The prediction list is empty.

Add **one or more items** to the list to request a prediction.

Add **an empty item** to the list to predict the first steps in the time series forecast.

Predict

Result

Submit a prediction to see scoring results.

2. To test the model, Enter the below given values.

"MT_002" = 92.46088193

"MT_004" = 315.0406504

"MT_007" = 13.566987

And click on Add to list. Now, click the Predict button at the bottom.

The return values highlighted in the screenshot below indicate that based on the input values, the model forecasts the next hour's electricity consumption for its three clients "MT_002", "MT_004", "MT_007". Using this forecasting model you will be able to provide the insights to the clients.

And now you have learned to create a forecasting model and will be able to help your clients for planning their future resources.

AutoAI Deployment Deployed Online

API reference Test

Enter input data

MT_002

MT_004

MT_007

Add to list +

Input list (1)

[92.46088193, 315.0406504, 13.566987]

Predict (1)

Result

```

0 {
1   "predictions": [
2     {
3       "fields": [
4         "prediction"
5       ],
6       "values": [
7         [
8           [
9             82.32092683853598,
10            353.28847658888314,
11            13.64852616622895
12           ]
13         ]
14       ]
15     }
16   ]

```

3. Now, modify the input data with the below values and predict.

"MT_002" = 86.567003

"MT_004" = 255.06428

"MT_007" = 12.224678

4. In the result, the first section of the JSON contains the fields and the second section contains the values for those fields.

 Take a screenshot of your modified input result and save it as 'result' in .jpg and .png format to your local computer (similar to the screenshot in the above step) for the assignment.

We just used AI machine learning to forecast the electricity consumption.

Task 8: Share your results

Follow us on Twitter and send us some of the most interesting results you found with IBM Auto AI Experiment!



[Tweet and share your achievement!](#)

Author(s)

[Shubham Yadav](#)

Contributor(s)

[Srishti Srivastava](#)

Changelog

Date	Version	Changed by	Change Description
2021-06-01	2.0	Shubham	Created Lab Updated steps with present watson Studio UI

2022-02-16	2.1	Shubham	Updated steps with present watson Studio UI
------------	-----	---------	---

© IBM Corporation 2020. All rights reserved.