

Develop Machine Learning Model for crop recommendation using AUTO AI with Watson Machine Learning.

Data set link : <https://www.kaggle.com/datasets/siddharthss/crop-recommendation-dataset?resource=download>

About Dataset

Context

Precision agriculture is in trend nowadays. It helps the farmers to get informed decision about the farming strategy. Here, we present you a dataset which would allow the users to build a predictive model to recommend the most suitable crops to grow in a particular farm based on various parameters.**

Source

This dataset was build by augmenting datasets of rainfall, climate and fertilizer data available for India. Gathered over the period by ICFA, India.

Data fields

N - ratio of Nitrogen content in soil

P - ratio of Phosphorous content in soil

K - ratio of Potassium content in soil

temperature - temperature in degree Celsius

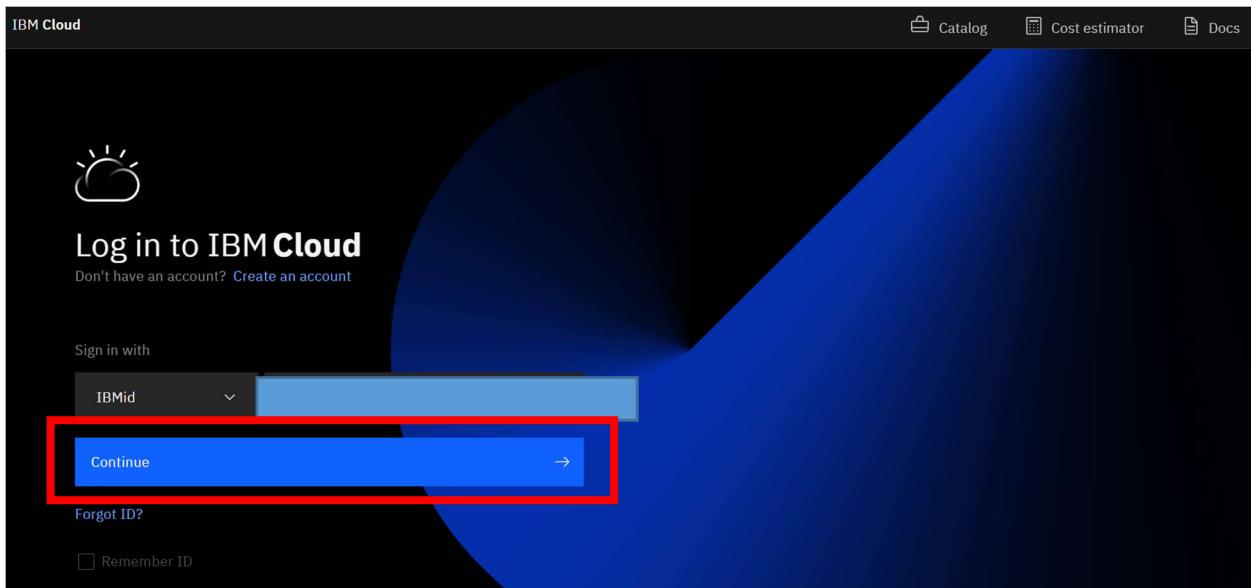
humidity - relative humidity in %

ph - ph value of the soil

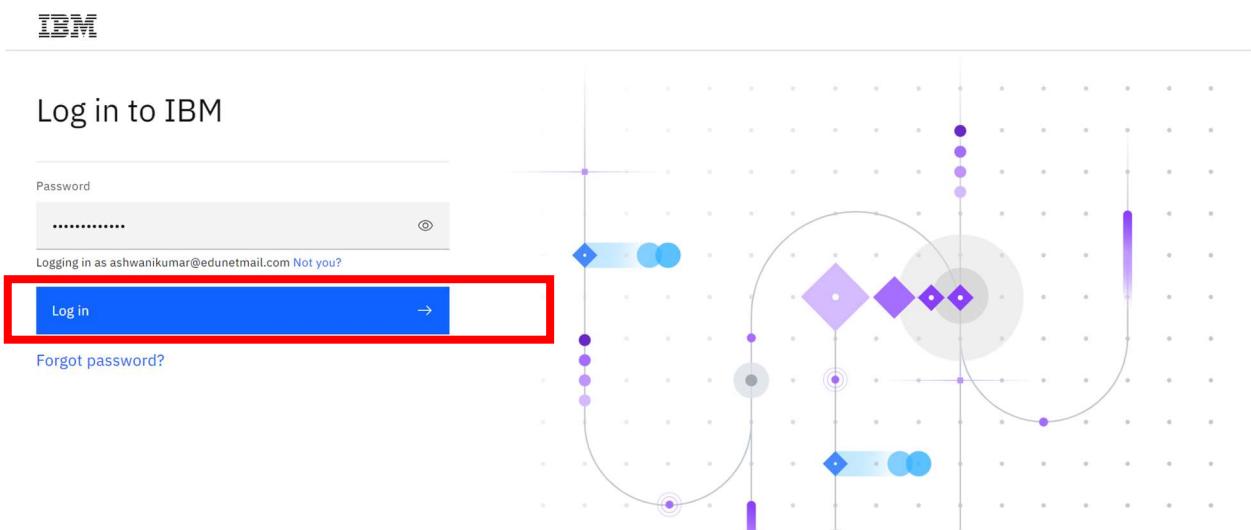
rainfall - rainfall in mm

COPYRIGHT: Indian Chamber of Food and Agriculture <https://www.icfa.org.in/>

Step1 : Open IBM Cloud login page with this link cloud.ibm.com, enter your Gmail and click on Continue



Step2 : Enter your IBM Academic portal password, Click on Login



Step3: This is IBM Cloud Dash board

The screenshot shows the IBM Cloud dashboard titled "Untitled". The top navigation bar includes "IBM Cloud", a search icon, "Catalog", "Manage", and a user account dropdown for "Ashwani Kumar's Acco...". On the right, there are icons for help, refresh, settings, and notifications, along with a "Create resource" button.

The main content area features a sidebar with icons for Build, VM, User access, and others. Below the sidebar, a "For you" section displays five service cards:

- Build**: Explore IBM Cloud with this selection of easy starter tutorials and services. (Recommended, 1 min)
- Track emissions with Carbon Calculator**: View estimated greenhouse gas emissions for your IBM Cloud account and export data for ESG reporting. (Popular, 2 min)
- Use Watson Assistant**: Watson Assistant lets you build conversational interfaces into any application, device, or channel. (Popular, 15 min)
- Get Started with Watson Studio**: Get started with using AI and Cloud Object Storage in 15 minutes. (Popular, 3 m)
- Build with Watson**: Chatbots, insights, recognizers, and more. Explore the AI platform for business. (Popular, 3 m)

At the bottom, there are tabs for "User access", "Manage users", "News" (selected), "View all", "Planned maintenance", and "View all".

Step4 : Click on Navigation menu, go to Resources list and clear all the resources

The screenshot shows the IBM Cloud navigation menu on the left side of the dashboard. A red box highlights the "Resource list" option under the "Pinned" section. Other pinned items include "Dashboard", "Projects", and "DevOps". The main content area shows a table header for "Group", "Location", "Product", "Status", and "Tags". Below the header, there are several rows of data, each starting with a small icon and some text. At the bottom right of the table area is a blue "Create resource" button.

A screenshot of the IBM Cloud catalog search interface. On the left is a sidebar with various icons and categories: Compute (0), Containers (0), Networking (0), Storage (0), Converged infrastructure (0), Enterprise applications (0), AI / Machine Learning (0), Analytics (0), Blockchain (0), Databases (0), and Developer tools (0+). The main area has a search bar at the top with filters for Name, Group, Location, Product, Status, and Tags. Below the search bar is a table with columns for Name, Group, Location, Product, Status, and Tags. A red box highlights the 'Watson studio' entry in the Catalog Results section.

Step5: Click on search icon and type “Watson studio”. Select Watson studio(Service).

A screenshot of the IBM Cloud catalog search interface. The search bar at the top contains the text "Watson studio". The main area shows a table with columns for Name, Group, Location, Product, Status, and Tags. A red box highlights the "Watson Studio Service" entry in the Catalog Results section. Other entries listed include NeuralSeek Service, Watsonx.ai SaaS with Assistant and G..., CrushBank Service, and Converlistics Service.

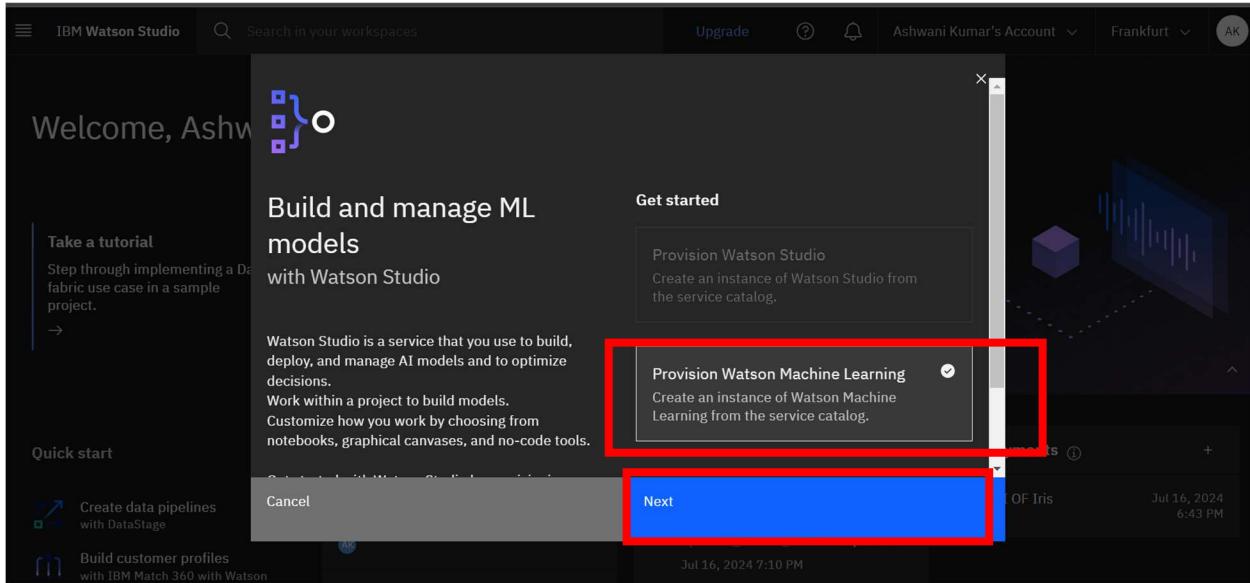
Step6: Click on the check box and Create.

The screenshot shows the IBM Cloud Catalog interface. On the left, there's a sidebar with service details: Type Service, Provider IBM, Last updated 07/04/2024, Category AI / Machine Learning, and Compliance HIPAA Enabled, IAM-enabled. The main area displays 'Watson Studio' with a brief description: 'Develop sophisticated machine learning models using Notebooks and code-free tools to infuse AI throughout your business.' Below this are tabs for 'Create' (which is active) and 'About'. A dropdown for 'Select a location' shows 'Frankfurt (eu-de)'. A table for 'Select a pricing plan' shows a 'Lite' plan with '1 authorized user' and 'Free' pricing. On the right, a 'Summary' panel shows the service name 'Watson Studio' and plan 'Lite', with a note it's 'Free'. At the bottom right is a 'Create' button, which is highlighted with a red box.

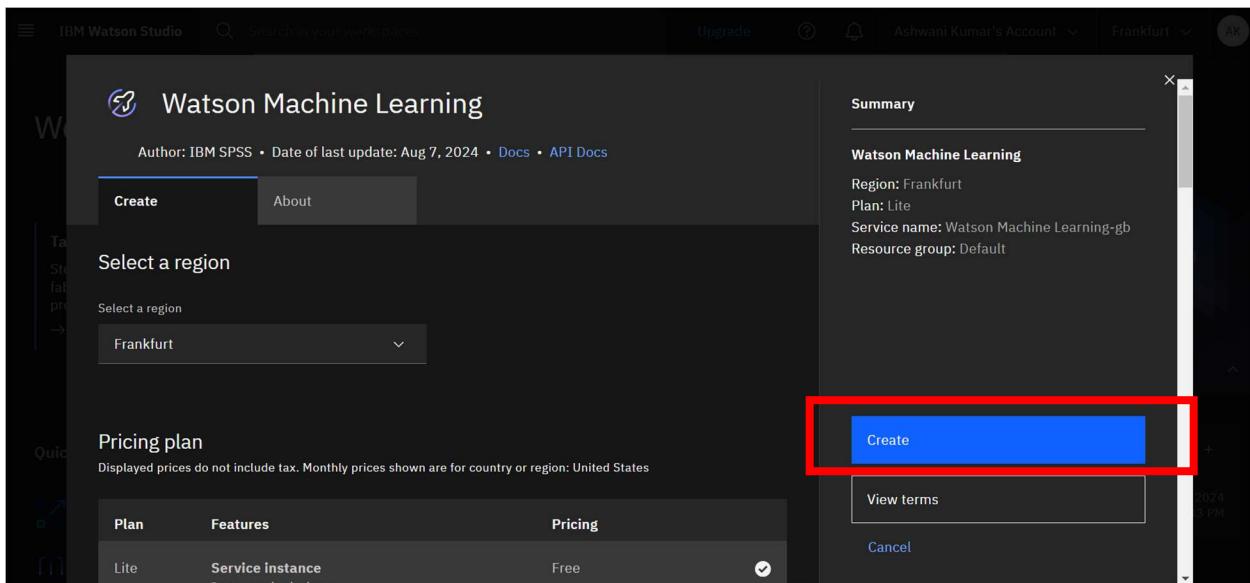
Step7: Click on the Launch in

The screenshot shows the resource details page for 'Watson Studio-us'. It includes a navigation bar with 'Catalog', 'Manage', and 'Ashwani Kumar's Acco...'. Below this, there's a 'Resource list' section for 'Watson Studio-us' with status 'Active' and an 'Add tags' button. A 'Details' button is also present. The main content area features a 'Manage' tab and a 'Plan' section. It displays the 'Watson Studio in Cloud Pak for Data and watsonx' logo and a brief description: 'Build and deploy machine learning models on either platform. Work with foundation models on watsonx as a Service.' To the right, there's a diagram illustrating the architecture: 'IBM Watson Studio in Cloud Pak for Data and watsonx' sits atop 'IBM Cloud Pak for Data, watsonx Unifying platforms', which sits on top of 'IBM Cloud Base cloud infrastructure'. At the bottom, a 'Launch in' button is highlighted with a red box.

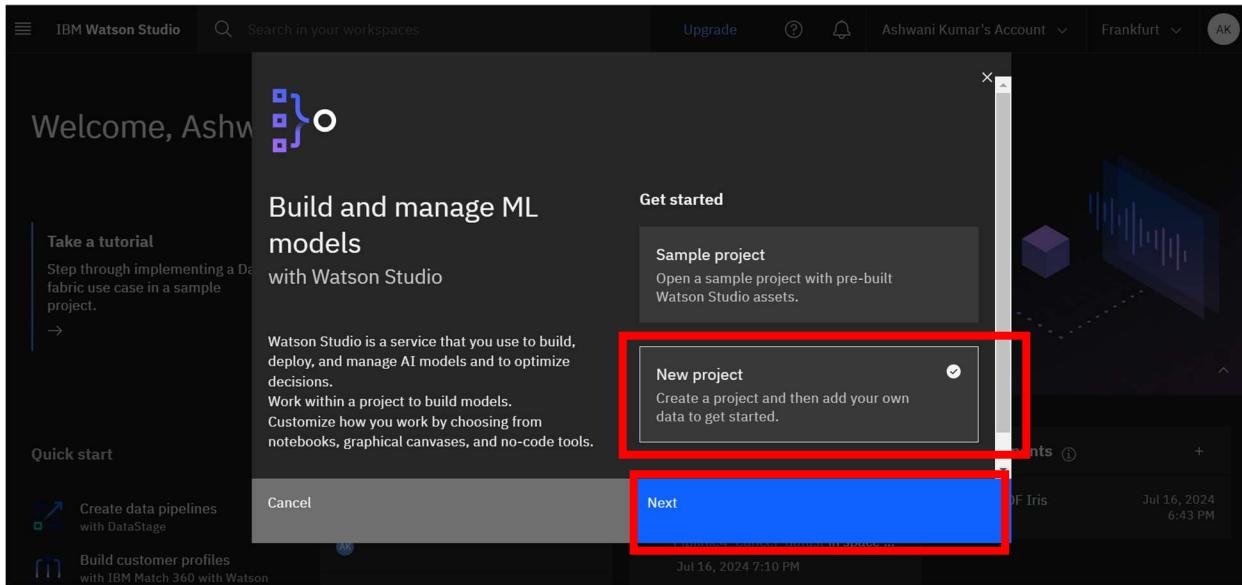
Step8: Select Provision Watson Machine Learning and click on Next.



Step9 : Click on the Create.



Step10: Select New project and click on Next.



Step11: Enter project name and scroll a little.

A screenshot of the 'Create a project' dialog. On the left, there's a sidebar with '+ New' selected, showing 'Local file' and 'Sample' options. The main area is titled 'Define details'. It has fields for 'Name' (with placeholder 'Enter a name' highlighted by a red box), 'Description (optional)', 'What's the purpose of this project?' (a large text input field), and 'Tags (optional)'. The entire dialog is set against a light gray background.

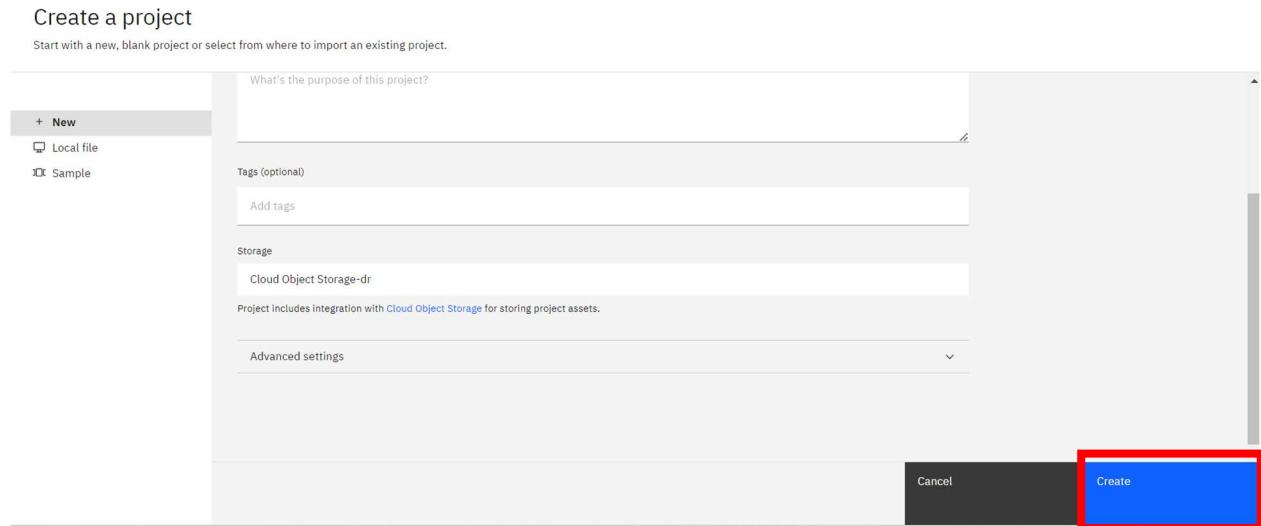
Step12: Click on Add

The screenshot shows a 'Create a project' interface. On the left, there's a sidebar with '+ New' options: 'Local file' and 'Sample'. The main area has a heading 'Define storage' with a red box around it. Inside, step 1 says 'Select storage service' with a red box around the 'Add' button. Step 2 says 'Refresh'. Below that, it says 'Project includes integration with Cloud Object Storage for storing project assets.' At the bottom right are 'Cancel' and 'Create' buttons.

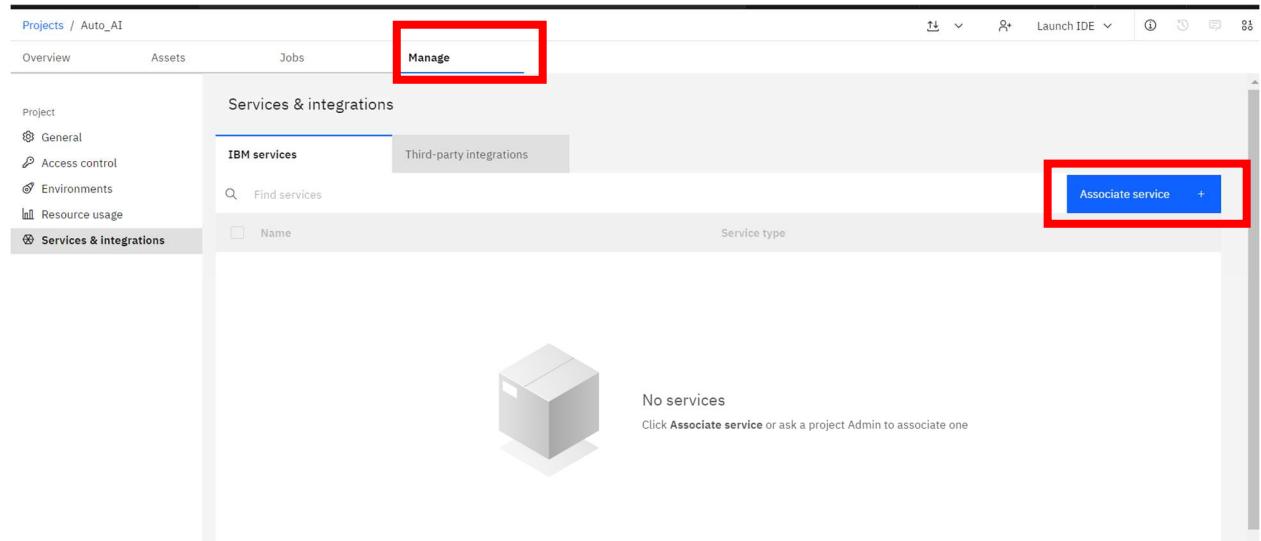
Step13: Select Free plan, Click on Continue

The screenshot shows the 'Cloud Object Storage' service catalog page. It has a 'Summary' section on the right with details like Region: Global, Plan: Lite(deprecated), Service name: Cloud Object Storage-dr, and Resource group: Default. The main area shows a 'Pricing plan' table with two rows: 'One Rate' and 'Lite(deprecated)'. The 'Lite(deprecated)' row is highlighted with a red box. The 'Create' button at the bottom right of the table is also highlighted with a red box.

Step14: Click on the Refresh, click on the Create.



Step15: Click on the Manage and Associate the service.



Step16: Click on the Watson Machine Learning and Associate

Associate service

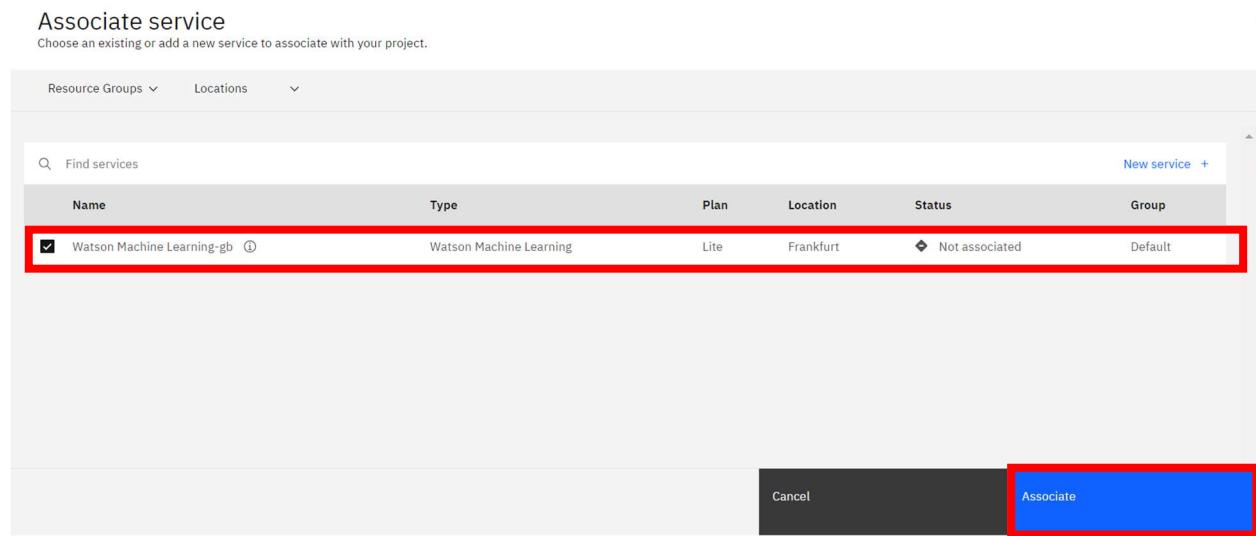
Choose an existing or add a new service to associate with your project.

Resource Groups ▾ Locations ▾

Find services New service +

Name	Type	Plan	Location	Status	Group
<input checked="" type="checkbox"/> Watson Machine Learning-gb ⓘ	Watson Machine Learning	Lite	Frankfurt	Not associated	Default

Cancel Associate



Step17: Machine Learning service associated now click on the Overview.

Projects / Auto_AI

Overview Assets Jobs Manage

Project

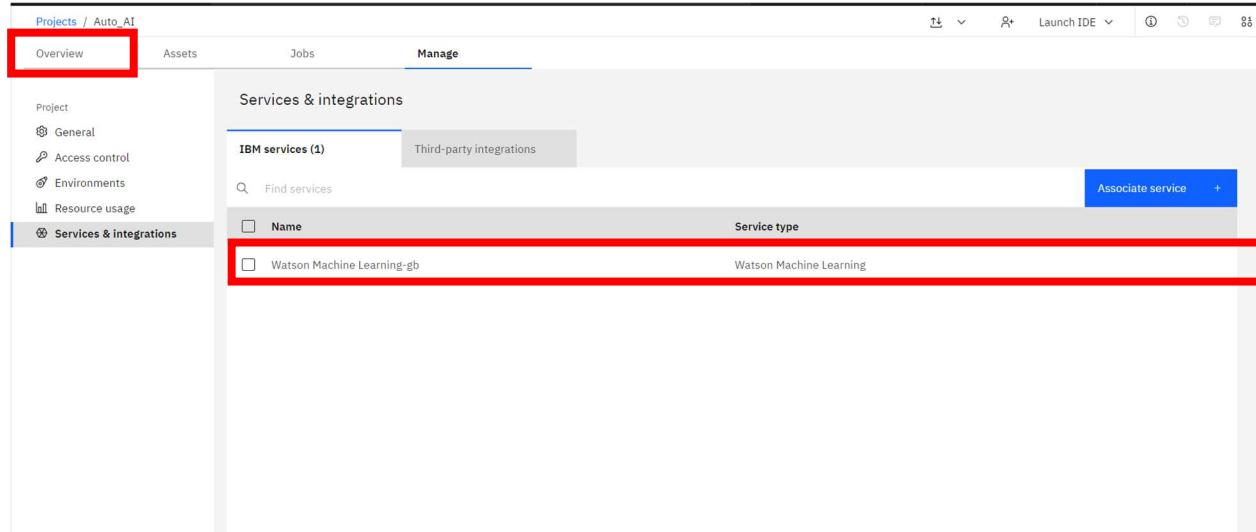
- General
- Access control
- Environments
- Resource usage

Services & integrations

IBM services (1) Third-party integrations

Find services Associate service +

Name	Service type
<input type="checkbox"/> Watson Machine Learning-gb	Watson Machine Learning



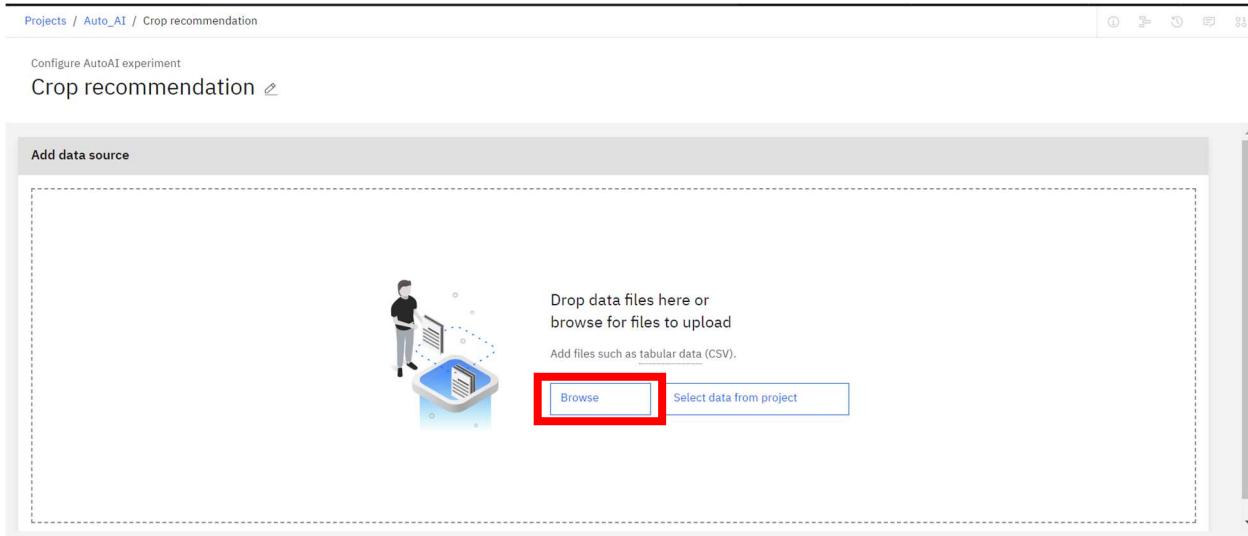
Step18: Click on “Build machine learning models automatically”

The screenshot shows the 'Projects / Auto_AI' page in Watson Studio. At the top, there are tabs for 'Overview', 'Assets', 'Jobs', and 'Manage'. Below these are sections for 'Start working' and 'Recommended' tasks. One task, 'Build machine learning models automatically', is highlighted with a red box. The 'Assets' section shows 0 CUH usage. The 'Project history' section shows a recent creation of the project.

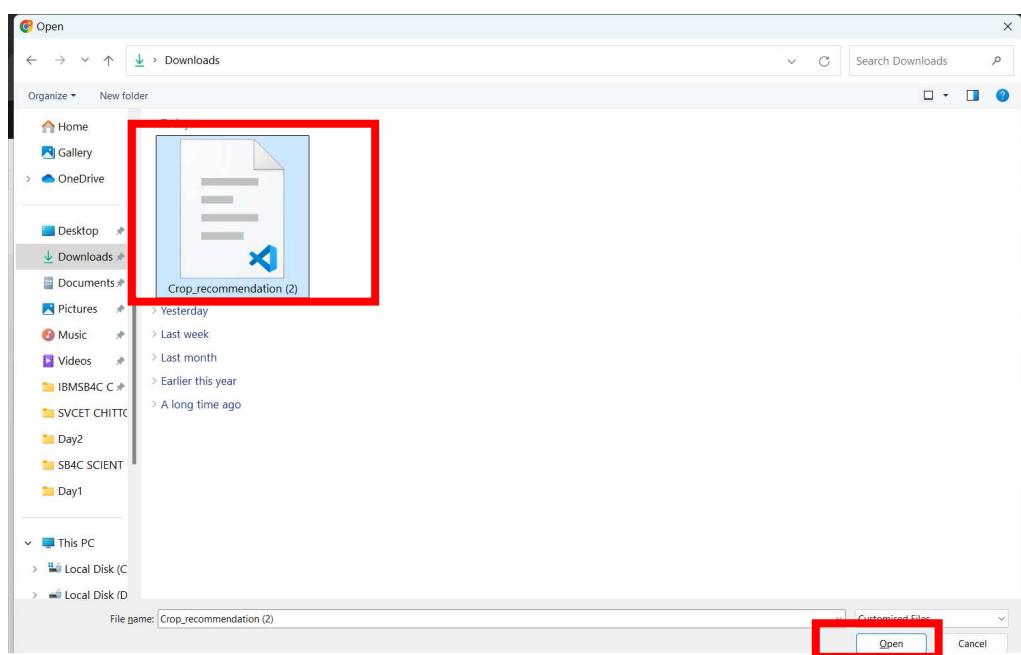
Step19: Enter the experiment name and click on Create

The screenshot shows the 'Define details' and 'Define configuration' sections of the configuration dialog. In the 'Define details' section, the 'Name' field contains 'Crop recommendation' and is highlighted with a red box. In the 'Define configuration' section, the 'Watson Machine Learning Service Instance' dropdown is set to 'Watson Machine Learning-gb'. The 'Create' button at the bottom right is highlighted with a blue box.

Step20: Add the downloaded data set (Crop_recomondation.csv) with the help of Browse option



Step21: Select the data set and click on Open



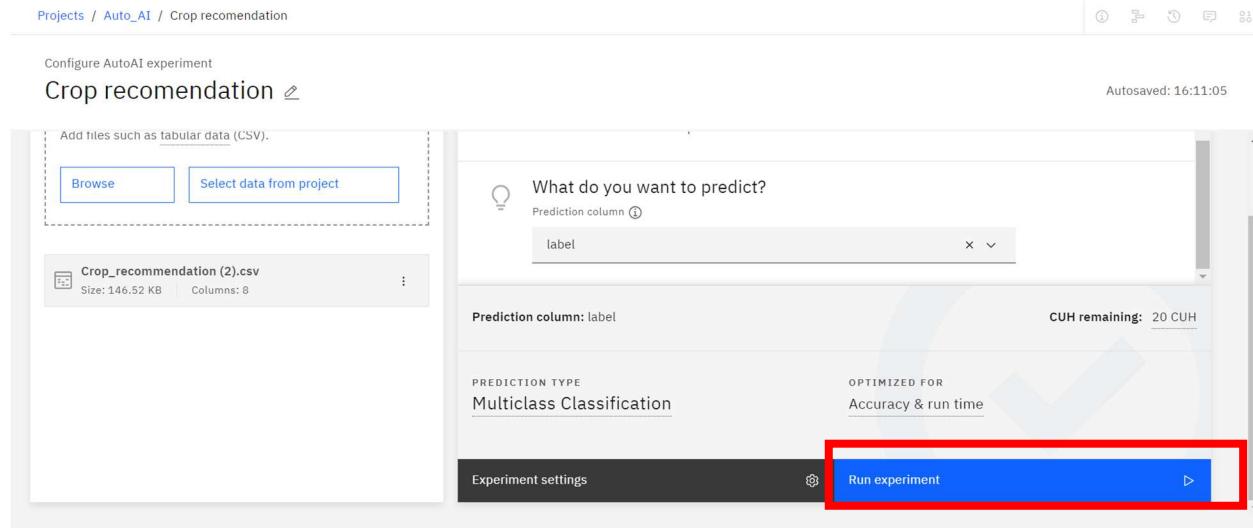
Step22: Data set is loaded. In create a time series analysis? You can choose No option

The screenshot shows the 'Configure AutoAI experiment' interface for a project named 'Crop recommendation'. On the left, there's a file upload section with 'Browse' and 'Select data from project' buttons, and a preview of a CSV file named 'Crop_recommendation (2).csv' (Size: 146.52 KB, Columns: 8). On the right, a section titled 'Create a time series analysis?' is displayed, which includes a description: 'Enable this option to predict future activity over a specified date/time range. Data must be structured and sequential.' Below this are 'Yes' and 'No' buttons, with 'No' being highlighted by a red box.

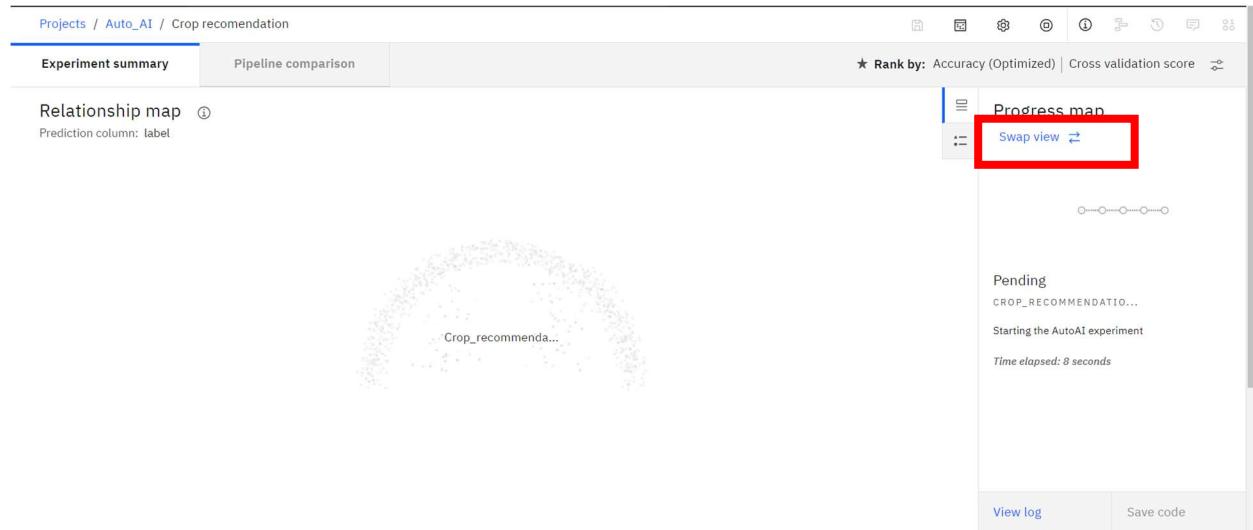
Step23 : Choose prediction column.

The screenshot shows the same 'Configure AutoAI experiment' interface. The 'Create a time series analysis?' section is still present. Below it, a new section titled 'What do you want to predict?' is shown, containing a 'Prediction column' dropdown labeled 'Select prediction column'. This 'What do you want to predict?' section is also highlighted by a red box.

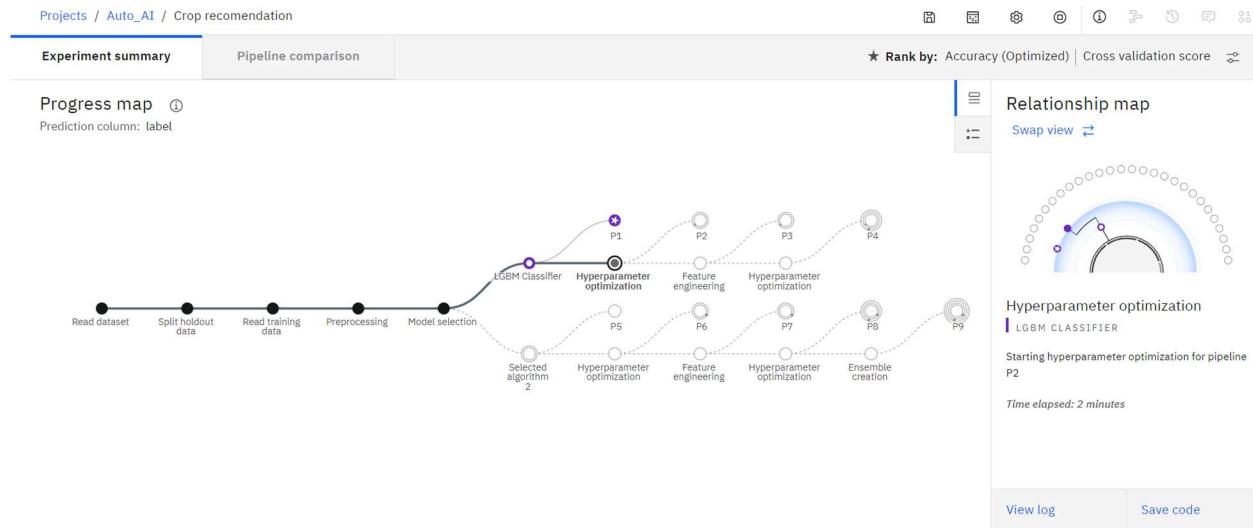
Step24: Now click on the Run experiment



Step25: Auto AI experiment is running. Now click on swap view



Step26: Pipelines are building.



Step27: This is the pipeline leader board. In this Pipeline2 is the top performer.

The screenshot shows the 'Pipeline comparison' tab selected. The 'Pipeline leaderboard' table lists six pipelines based on accuracy and build time. Pipeline 2 is highlighted with a red border and a star icon, indicating it is the top performer.

Rank	Name	Algorithm	Accuracy (Optimized) Cross Validation	Enhancements	Build time
1	Pipeline 2	LGBM Classifier	0.991	HPO-1	00:02:53
2	Pipeline 1	LGBM Classifier	0.989	None	00:00:08
3	Pipeline 4	LGBM Classifier	0.988	HPO-1 FE HPO-2	00:22:58
4	Pipeline 3	LGBM Classifier	0.988	HPO-1 FE	00:18:27
5	Pipeline 8	Logistic Regression	0.988	HPO-1 FE HPO-2	00:02:48
6	Pipeline 7	Logistic Regression	0.983	HPO-1 FE	00:01:23

Step28: Now we can save this model. Click on the Save as

The screenshot shows the IBM Watson Studio interface. In the top navigation bar, there are links for 'IBM Watson Studio', 'Search in your workspaces', 'Upgrade', 'Help', 'Bell', 'Ashwani Kumar's Account', 'Frankfurt', and a user icon. Below the navigation is a breadcrumb trail: 'Projects / Auto_AI / Crop recommendation'. Underneath, there are two tabs: 'Experiment summary' and 'Pipeline comparison'. A status bar indicates '★ Rank by: Accuracy (Optimized) | Cross validation score'. The main area is titled 'Pipeline leaderboard' with a dropdown arrow. It displays a table with the following data:

	Rank	Name	Algorithm	Accuracy (Optimized) Cross Validation	Enhancements	Build time	
★	1	Pipeline 2	LGBM Classifier	0.991	HPO-1	00:02:53	Save as
	2	Pipeline 1	LGBM Classifier	0.989	None	00:00:08	
	3	Pipeline 4	LGBM Classifier	0.988	HPO-1, FE, HPO-2	00:22:58	
	4	Pipeline 3	LGBM Classifier	0.988	HPO-1, FE	00:18:27	
	5	Pipeline 8	Logistic Regression	0.988	HPO-1, FE, HPO-2	00:02:48	
	6	Pipeline 7	Logistic Regression	0.983	HPO-1, FE	00:01:23	

Step29: Choose Model asset and click on Create

The screenshot shows a 'Save as' dialog box. On the left, under 'Select asset type', the 'Model' option is selected, highlighted with a red box. Below it is the 'Notebook' option. On the right, under 'Define details', there are fields for 'Name' (set to 'Crop recommendation - P2 LGBM Classifier - Model') and 'Description (optional)' (set to 'Model description'). There is also a 'Tags' section with a placeholder 'Add tags to make assets easier to find.' At the bottom, there are 'Cancel' and 'Create' buttons, with the 'Create' button also highlighted with a red box.

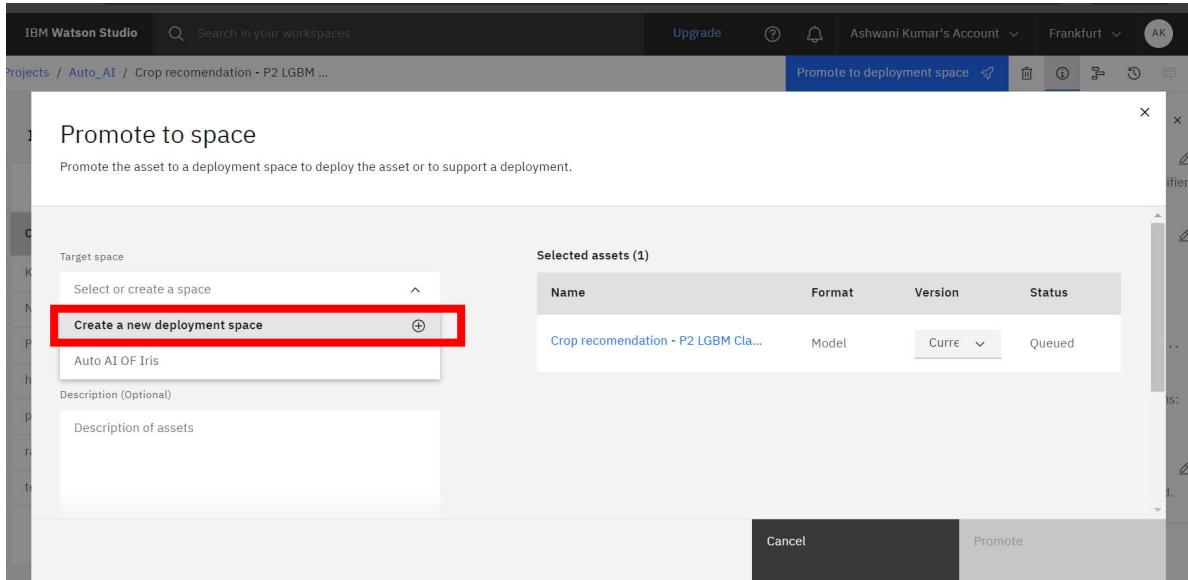
Step30: The mode saved successfully and click on view in project

The screenshot shows the IBM Watson Studio interface. At the top, there's a navigation bar with 'IBM Watson Studio', a search bar, and account information for 'Ashwani Kumar's Account'. Below the navigation bar is a breadcrumb path 'Projects / Auto_AI / Crop recomendation'. Underneath, there are tabs for 'Experiment summary' and 'Pipeline comparison', with 'Experiment summary' being active. A 'Pipeline leaderboard' section follows, showing a table of pipelines. The table columns include Rank, Name, Algorithm, Accuracy (Optimized), Enhancements, and Build time. Pipeline 2 is at the top with an accuracy of 0.991. A green success message box is overlaid on the right side, stating 'Saved model successfully. Crop recomendation - P2 LGBM Classifier - Model was successfully saved to Auto AI.' A red box highlights the 'View in project' button in the message box.

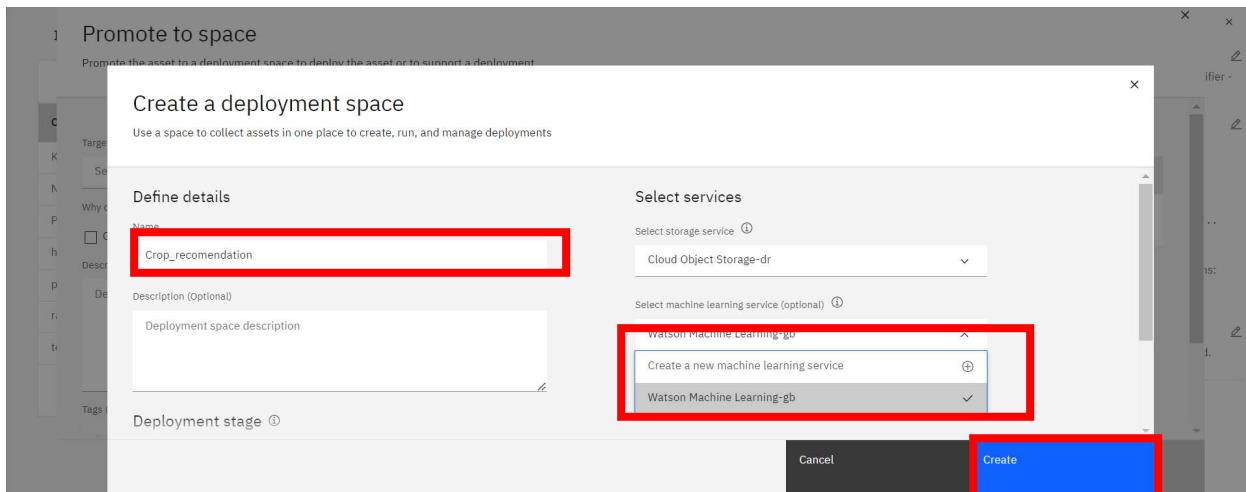
Step31: Click on promote in deployment space

The screenshot shows the 'About this asset' panel for a saved model. The left side displays the 'Input Schema' with columns for 'Column' and 'Type'. The right side contains sections for 'About this asset', 'Asset Details', and 'Tags'. The 'About this asset' section includes fields for 'Name' (Crop recomendation - P2 LGBM Classifier - Model) and 'Description' (No description provided). The 'Asset Details' section provides technical details like Type: wml-hybrid_0.1 and Model ID: 554a7d56-f222-4ce3-817... The 'Promote to deployment space' button is highlighted with a red box. The 'Tags' section allows adding tags for easier finding.

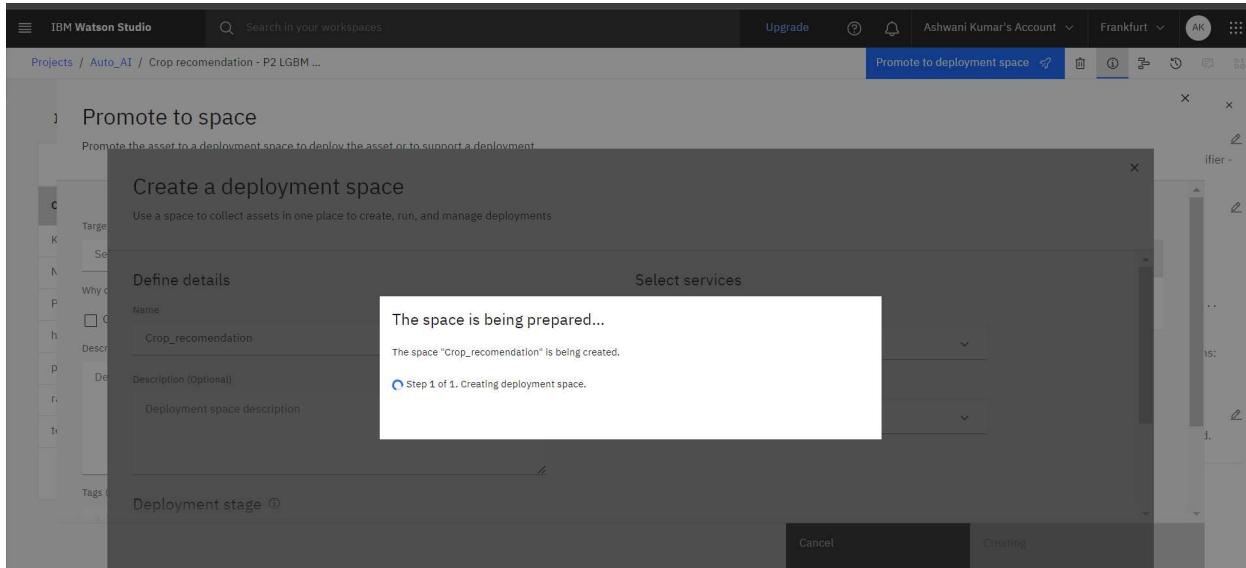
Step32: Create the new deployment space.



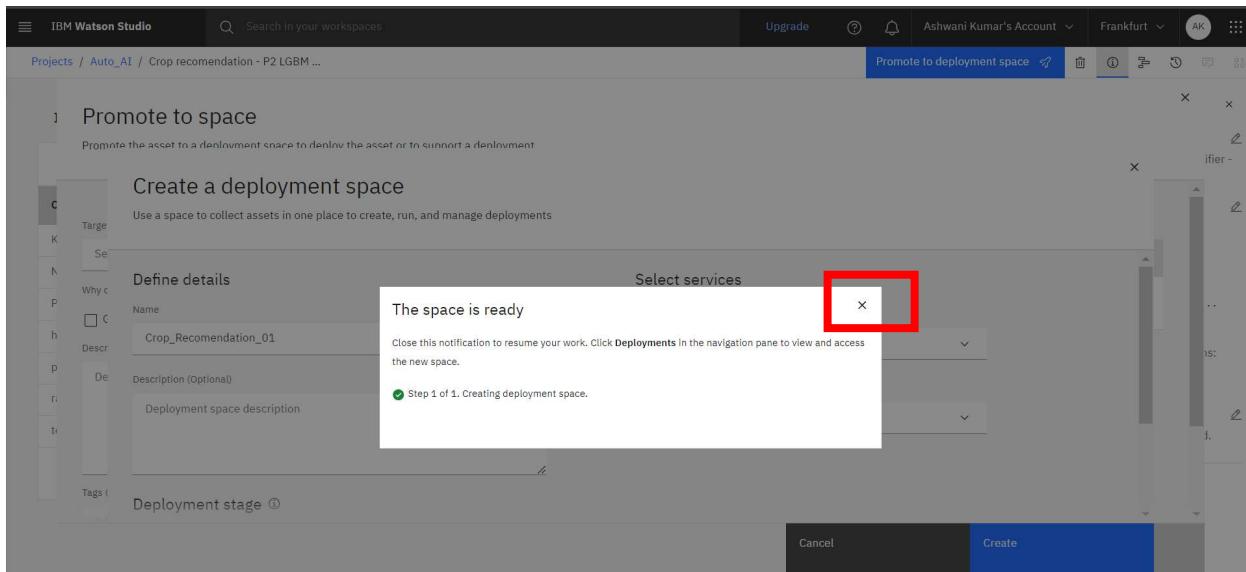
Step33: Give the deployment space name and select machine learning service , click on Create



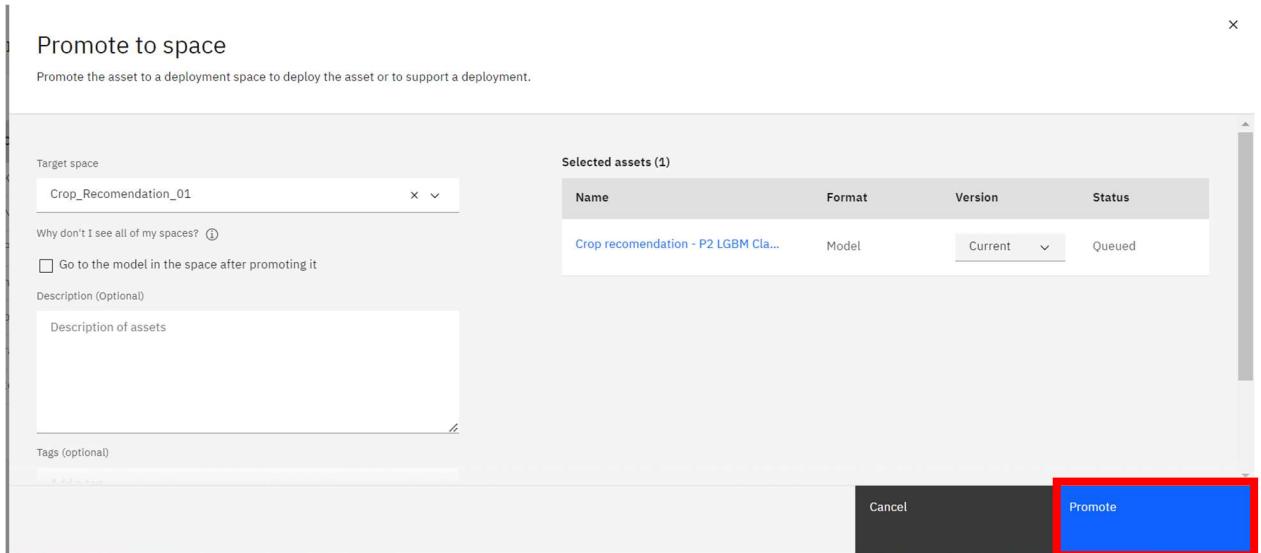
Step34: it's preparing the deployment space.



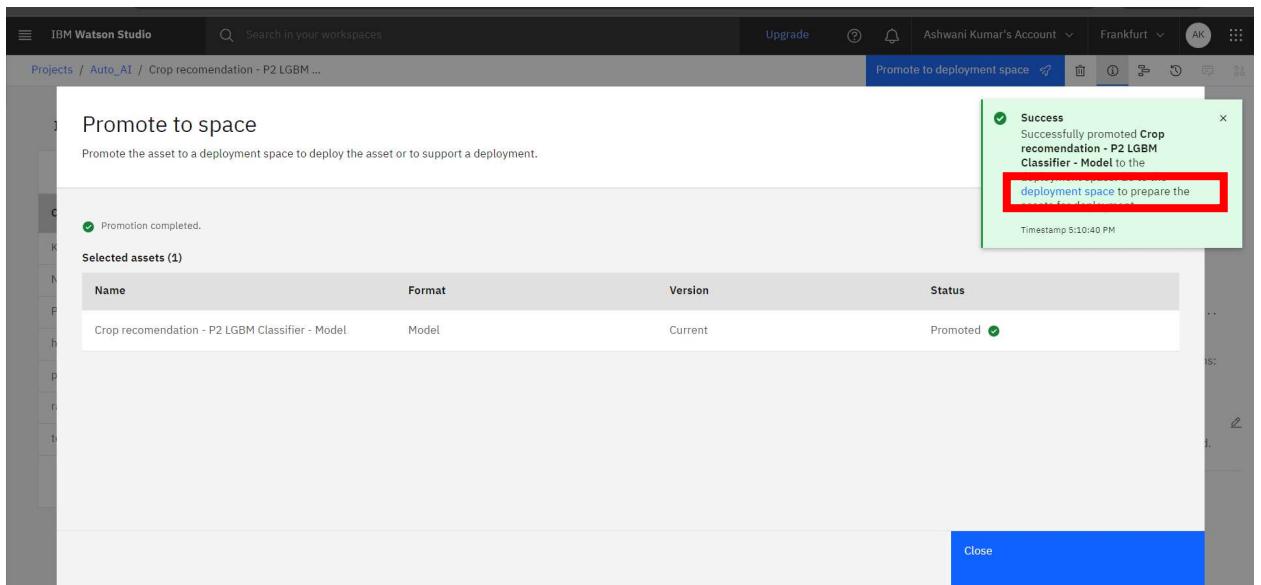
Step35: Now the space is ready , close the dialog box



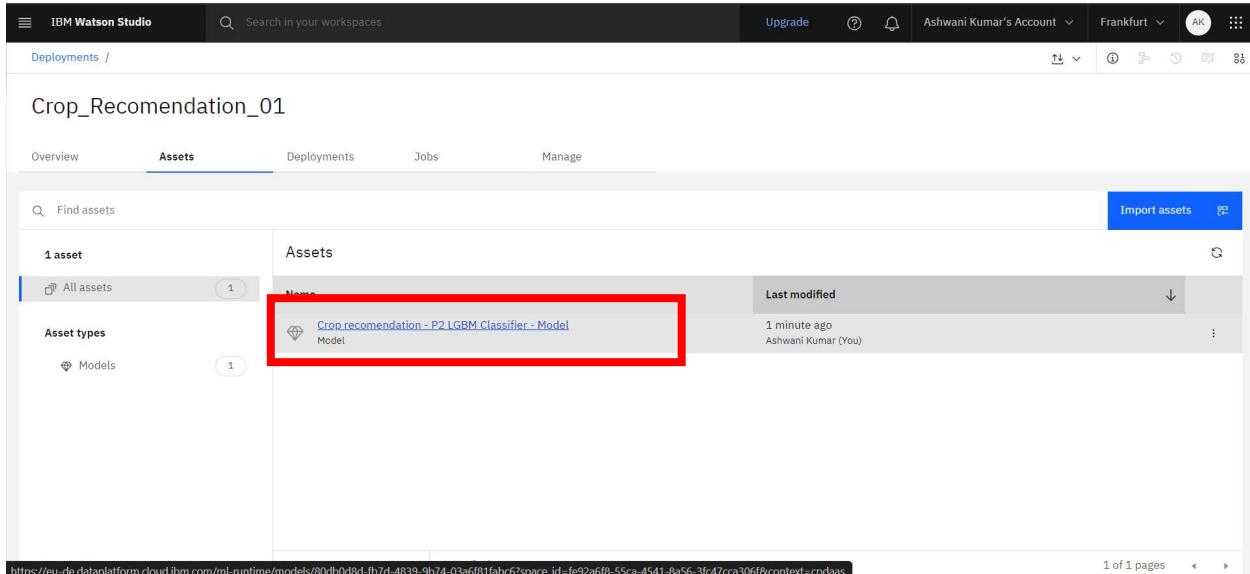
Step36: Click on the promote.



Step37: it's promoted and click on deployment space.

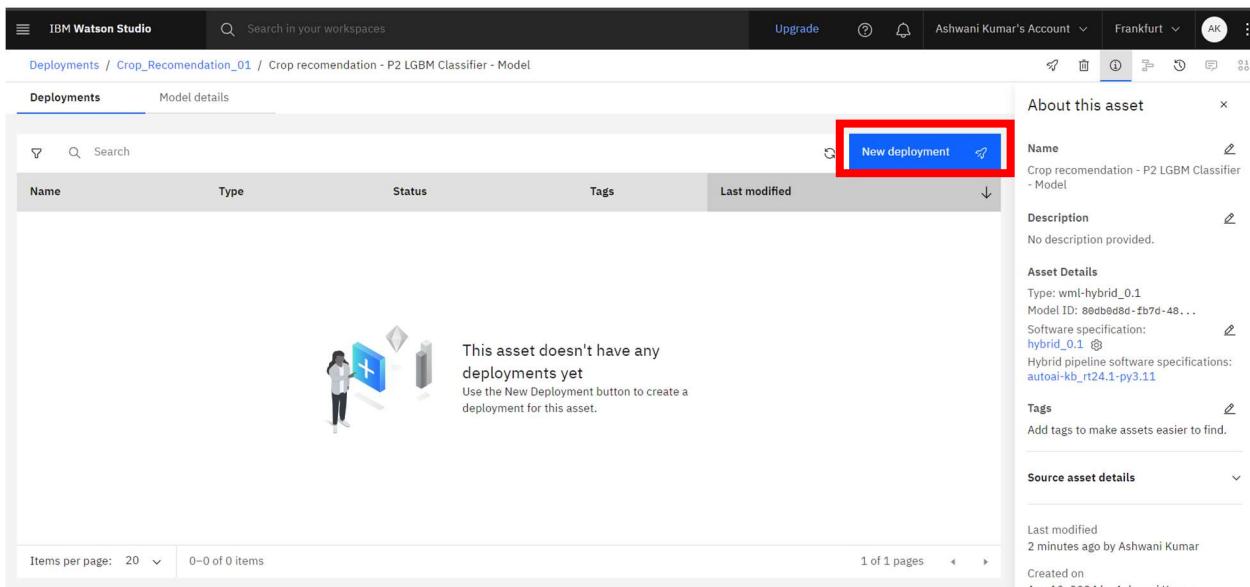


Step38: Click on the Asset name.



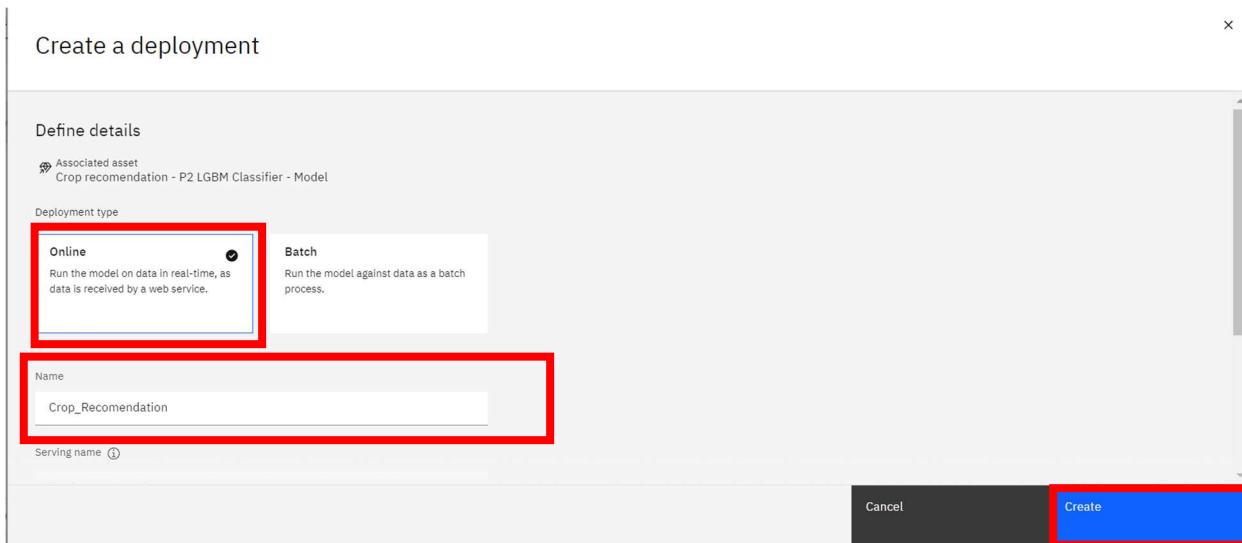
The screenshot shows the IBM Watson Studio interface. At the top, there's a navigation bar with 'IBM Watson Studio', a search bar, and account information for 'Ashwani Kumar's Account' and 'Frankfurt'. Below the navigation is a toolbar with various icons. The main area is titled 'Crop_Recomendation_01' and has tabs for 'Overview', 'Assets' (which is selected), 'Deployments', 'Jobs', and 'Manage'. On the left, there's a sidebar with 'Find assets' and sections for 'Asset types' (with 'Models' selected) and 'All assets' (showing 1 item). The main content area is titled 'Assets' and lists one item: 'Crop recommendation - P2 LGBM Classifier - Model' (Type: Model, Last modified: 1 minute ago by Ashwani Kumar). A red box highlights the asset name.

Step39: Click on the New deployment



This screenshot shows the 'Deployment details' page for the asset 'Crop recommendation - P2 LGBM Classifier - Model'. The top navigation bar includes 'IBM Watson Studio', a search bar, and account information. The main content area shows the asset details: Name (Crop recommendation - P2 LGBM Classifier - Model), Description (No description provided), Asset Details (Type: wml-hybrid_0.1, Model ID: 80dbd8dd-fb7d-4839-9b74-07a6f81fabc6), and Source asset details (Last modified: 2 minutes ago by Ashwani Kumar, Created on: Aug 10, 2024 by Ashwani Kumar). On the left, there's a sidebar with 'Deployments' selected and a 'Model details' tab. The main table lists deployments by Name, Type, Status, Tags, and Last modified. A red box highlights the 'New deployment' button at the top right of the table area.

Step40: select deployment type and give the deployment name. Click on the Create.



Step41: Model is deployed.

IBM Watson Studio

Search in your workspaces

Upgrades

Ashwani Kumar's Account

Frankfurt

Deployments / Crop_Recomendation_01 / Crop recommendation - P2 LGBM Classifier - Model

Deployments Model details

Name	Type	Status	Last modified
(i) Crop_Recomendation	Online	Deployed	26 seconds ago Ashwani Kumar (You)

New deployment

About this asset

Name: Crop recommendation - P2 LGBM Classifier - Model

Description: No description provided.

Asset Details

Type: wml-hybrid_0.1

Model ID: 80db0e8d-fb7d-48...
Software specification:
hybrid_0.1 ⓘ
Hybrid pipeline software specifications:
autoai-kb_r124.1-py3.11

Tags

Add tags to make assets easier to find.

Source asset details

Last modified: 6 minutes ago by Ashwani Kumar

Created on: Aug 10, 2024 by Ashwani Kumar

Step42: Now click on Test to predict with new values.

Deployments / Crop_Recomendation_01 / Crop recommendation - P2 LGBM ... /

Crop_Recomendation • Deployed Online

API reference Test

Enter input data

Text JSON

Enter data manually or use a CSV file to populate the spreadsheet. Max file size is 50 MB.

Download CSV template ↴ Browse local files ↵ Search in space ↶

Clear all x

	N (double)	P (double)	K (double)	temperature (double)	humidity (double)	ph (double)	rainfall (double)
1	Start typing or drag and drop a CSV file...						
2							
3							
4							
5							

0 rows, 7 columns

Predict

Step43: Enter the new values and click on predict

IBM Watson Studio Search in your workspaces Upgrade Ashwani Kumar's Account Frankfurt AK

Deployments / Crop_Recomendation_01 / Crop recommendation - P2 LGBM ... /

Crop_Recomendation • Deployed Online

API reference Test

Enter input data

Text JSON

Enter data manually or use a CSV file to populate the spreadsheet. Max file size is 50 MB.

Download CSV template ↴ Browse local files ↵ Search in space ↶

Clear all x

	N (double)	P (double)	K (double)	temperature (double)	humidity (double)	ph (double)	rainfall (double)
1	30	79	75	18.820	16.10748	8.204862	89.73119
2							
3							
4							
5							

1 row, 7 columns

Predict

Step44: It's predicted label name with 99% confidence.

The screenshot shows the IBM Watson Studio interface with a deployment named "Crop_Recommendation_01". The main view displays "Prediction results" for a "Multiclass classification" task. A large purple circle indicates "1 Record". The prediction table shows one entry: "chickpea" with a confidence of "99%". A blue button at the bottom right says "Download JSON file".

Prediction	Confidence
1 chickpea	99%
2	
3	
4	
5	
6	
7	
8	
9	
10	