

Machine Fault Prediction

Introduction

Machine failures in industrial settings can lead to significant downtime, costly repairs, and safety hazards. Predicting machine failures in advance allows for preventive maintenance, reducing unexpected breakdowns and improving overall operational efficiency. The goal of this project is to develop a predictive model that can forecast machine failures using sensor data.

About the Dataset

The dataset used in this project comprises sensor data collected from various machines. Each record in the dataset includes several sensor readings taken at different time points, along with a binary indicator of whether a machine failure occurred. By analyzing this data, we aim to identify patterns and correlations that can help predict future machine failures.

Dataset Overview

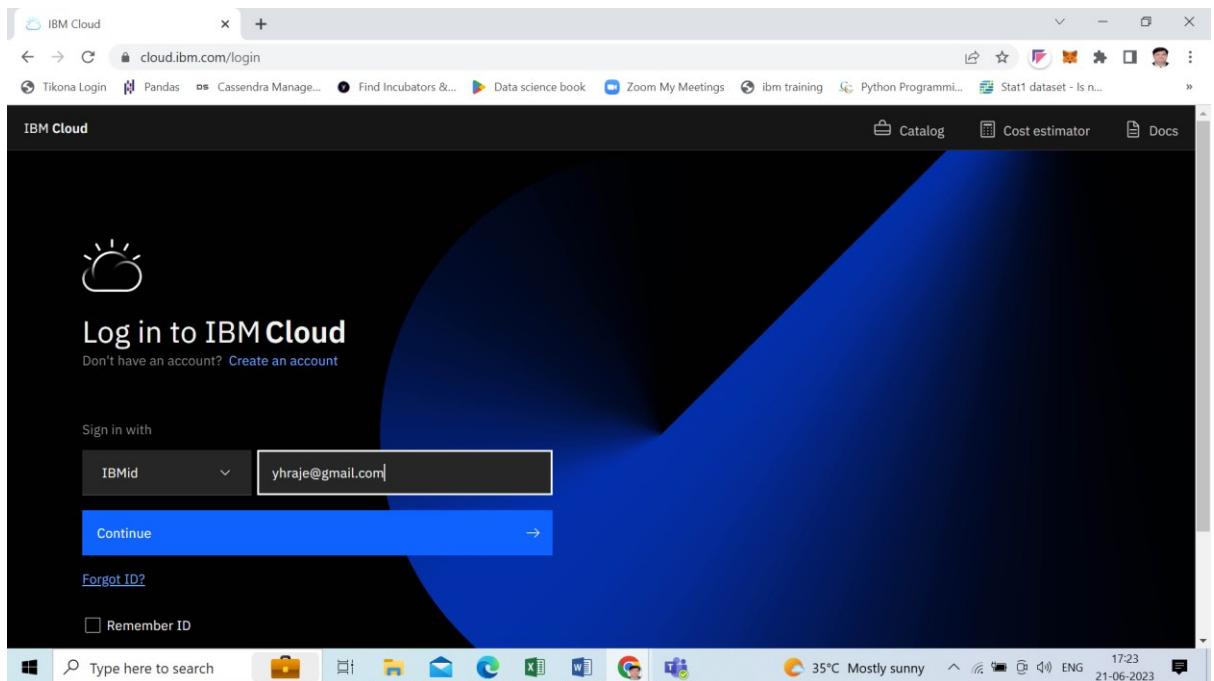
The dataset includes the following columns:

- **footfall:** The number of people or objects passing by the machine. This could affect the machine's performance due to increased usage or environmental changes.
- **tempMode:** The temperature mode or setting of the machine, which can influence the machine's operational state and susceptibility to failure.
- **AQ:** Air quality index near the machine. Poor air quality might contribute to faster wear and tear of machine components.
- **USS:** Ultrasonic sensor data, indicating proximity measurements. This can help detect objects or barriers that might interfere with the machine's operation.
- **CS:** Current sensor readings, indicating the electrical current usage of the machine. Unusual current usage patterns can signal potential issues or malfunctions.
- **VOC:** Volatile organic compounds level detected near the machine. High levels of VOCs can be harmful and may degrade machine performance.
- **RP:** Rotational position or RPM (revolutions per minute) of the machine parts. Variations in RPM can indicate mechanical problems.
- **Temperature:** The operating temperature of the machine. Excessive temperatures can cause overheating and damage to machine components.
- **Fail:** Binary indicator of machine failure (1 for failure, 0 for no failure). We aim to predict this target variable using the other sensor readings.

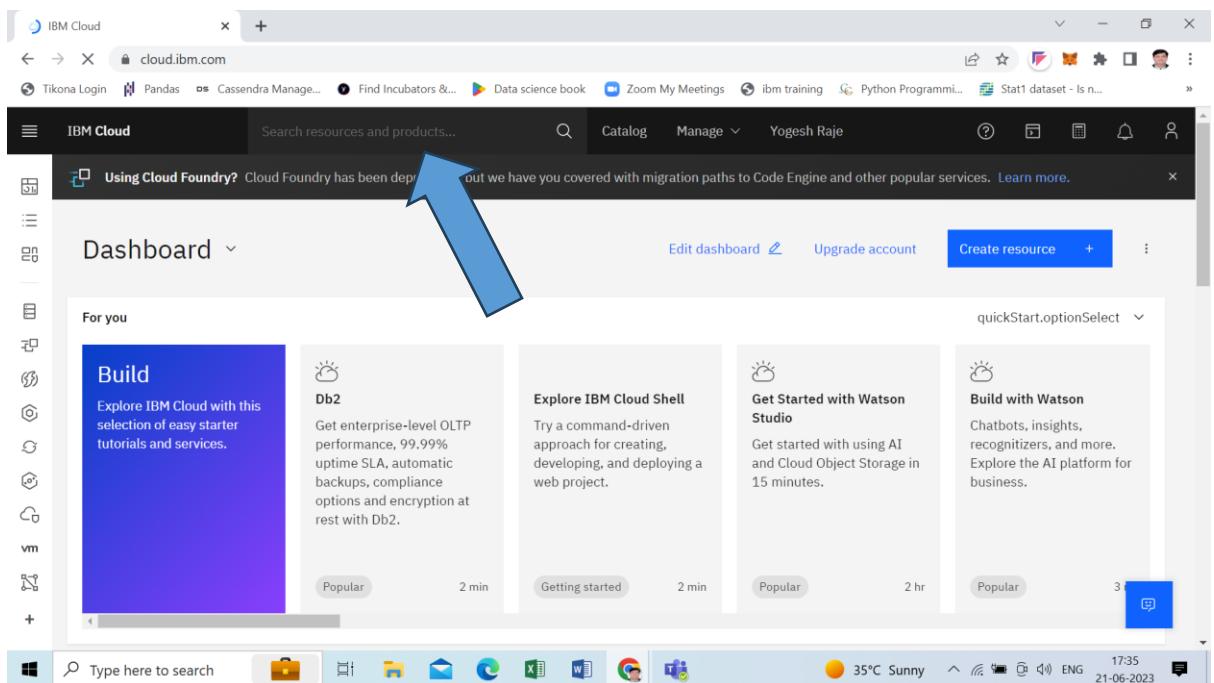
Step-by-Step Guide for IBM Cloud Platform for Machine Fault Prediction

Step 1: Login to IBM Cloud

1. Open your browser and go to [IBM Cloud](#).
2. Login with your IBM Cloud credentials.



1. Search for “Watson Studio” and select it from the list of services.



The screenshot shows the IBM Cloud Watson studio service catalog results. On the left, there's a sidebar with various icons and a 'Dashboard' section. In the center, under 'Catalog Results', there's a list of services: Watson Studio, NeuralSeek, Conversitics, Knowledge Studio, and Watson Assistant. To the right, there are two cards: 'Get Started with Watson Studio' and 'Build with Watson'. The status bar at the bottom indicates it's 35°C Sunny, 17:37, and the date is 21-06-2023.

Step 2: Create a Watson Studio Service

1. Select Location= Dallas(us-south) and click on Create Button
2. Click on the “Create” button.
3. Configure the service by selecting the appropriate pricing plan (you can start with the Lite plan if available) and then click “Create”.

The screenshot shows the Watson Studio creation wizard. It has tabs for 'Create' (selected) and 'About'. Under 'Create', there's a 'Type Service' dropdown set to 'IBM' with an arrow pointing to the 'Dallas (us-south)' location dropdown. Below that, there's a 'Select a pricing plan' section with a table showing the 'Lite' plan. The table includes columns for 'Plan', 'Features and capabilities', and 'Pricing'. The 'Features and capabilities' column lists: 1 authorized user, 10 capacity unit-hours monthly limit, Environment = # of capacity units required per hour, and specific RAM requirements for different vCPU counts. The 'Pricing' column shows 'Free'. On the right, there's a 'Summary' panel with details: Watson Studio, Location: Dallas, Plan: Lite, Service name: Watson Studio-dig, and Resource group: Default. At the bottom, there's a checkbox for 'I have read and agree to the following license agreements:' followed by a 'Create' button and an 'Add to estimate' button.

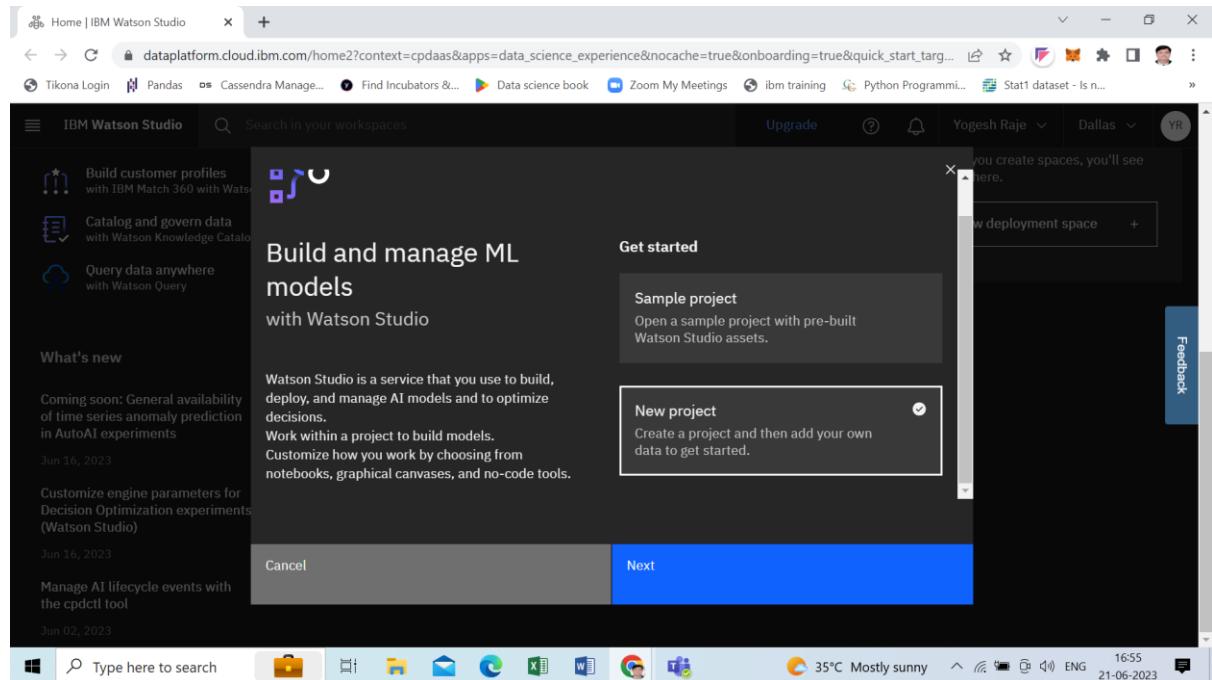
Step 3: Launch Watson Studio

The screenshot shows the IBM Cloud interface with the 'Watson Studio-wq' resource selected. A large blue arrow points from the 'Launch in' button to the main content area. The content area features a diagram of the Watson Studio architecture, showing it integrated with Cloud Pak for Data and WatsonX, which are built on top of the IBM Cloud Base cloud infrastructure.

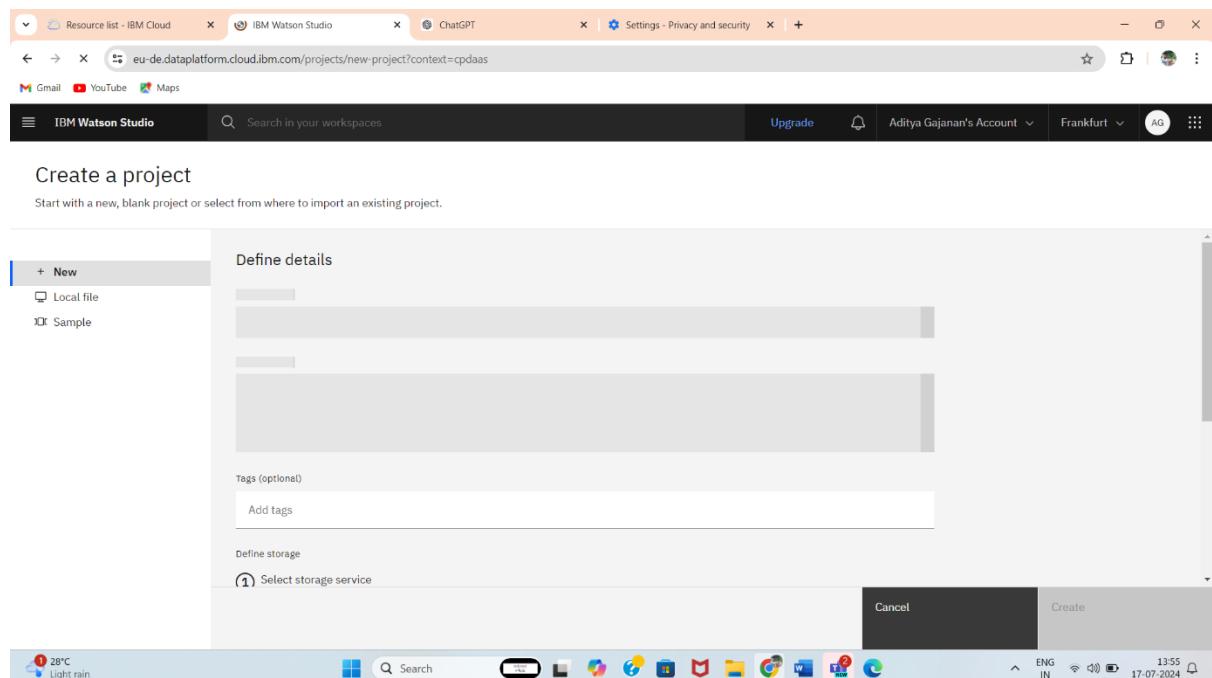
Step 4: Select Provision Watson ML Click on Next

The screenshot shows the IBM Watson Studio interface. On the left, there's a sidebar with options like 'Catalog and govern data with Watson Knowledge Catalog', 'Build and manage ML models with Watson Studio', and 'Query data anywhere with Watson Query'. The main area displays a section titled 'Build and manage ML models with Watson Studio'. A modal window titled 'Get started' is open, showing two options: 'Provision Watson Studio' and 'Provision Watson Machine Learning'. A large blue arrow points from the 'Next' button at the bottom of the modal to the 'Provision Watson Studio' option.

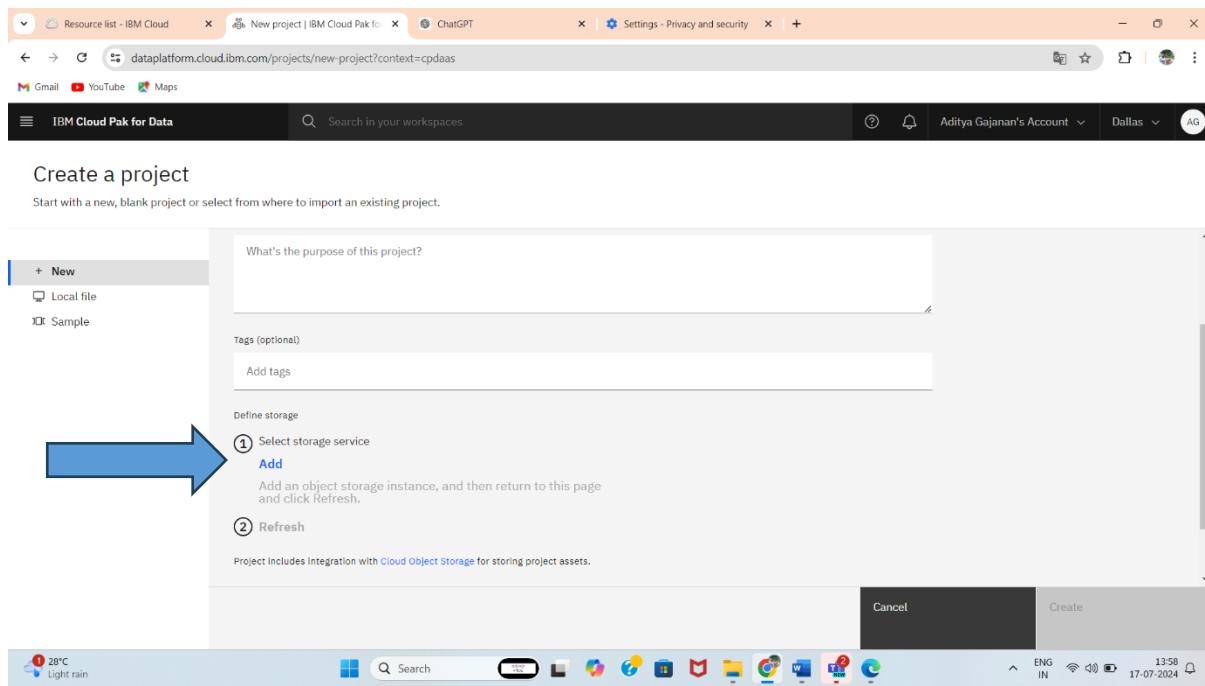
Step 5 : Select a new Project & click on next



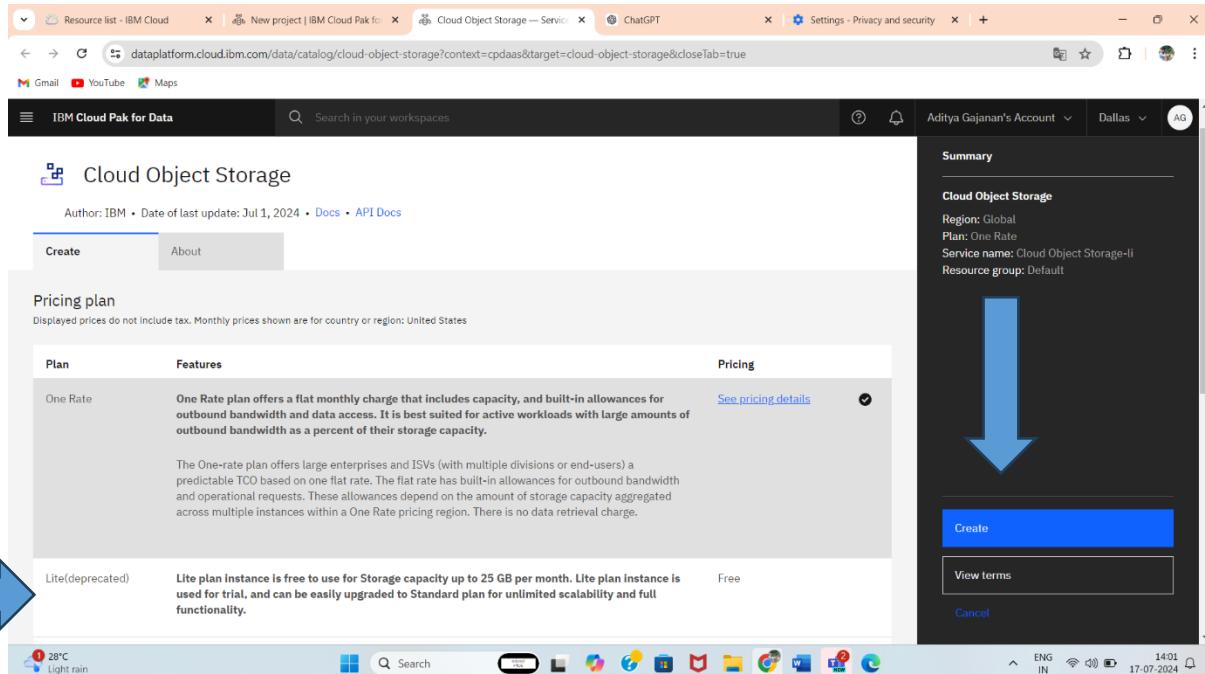
Step 6: Define the Name & Problem Statement of the project below



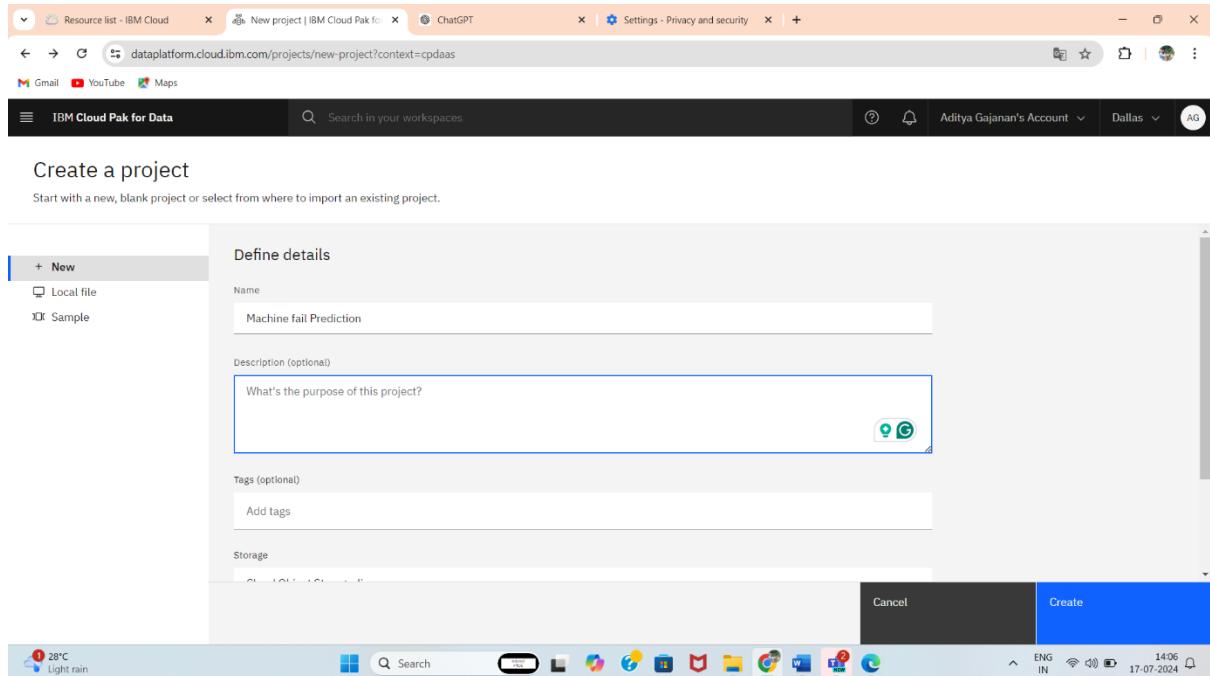
Step 7 : Add the storage by clicking on Add storage



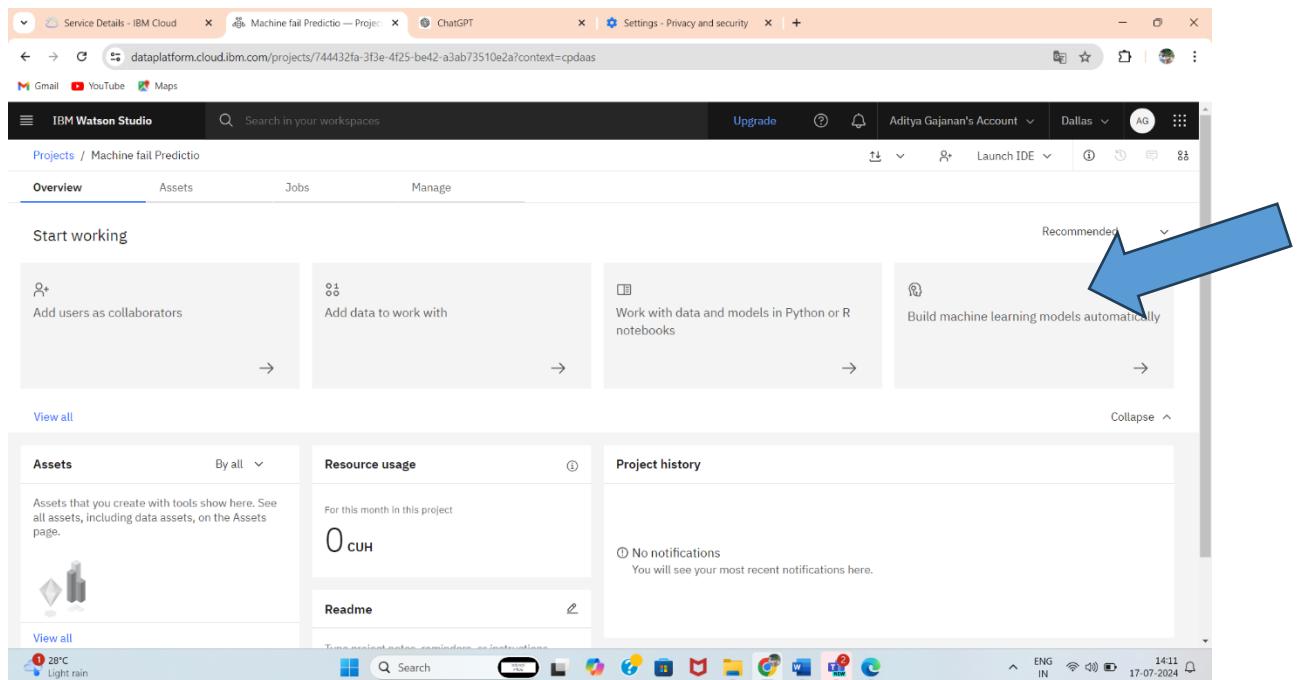
Step 8 : Add the Cloud Object Storage& Select the Free Plan & Click On Create



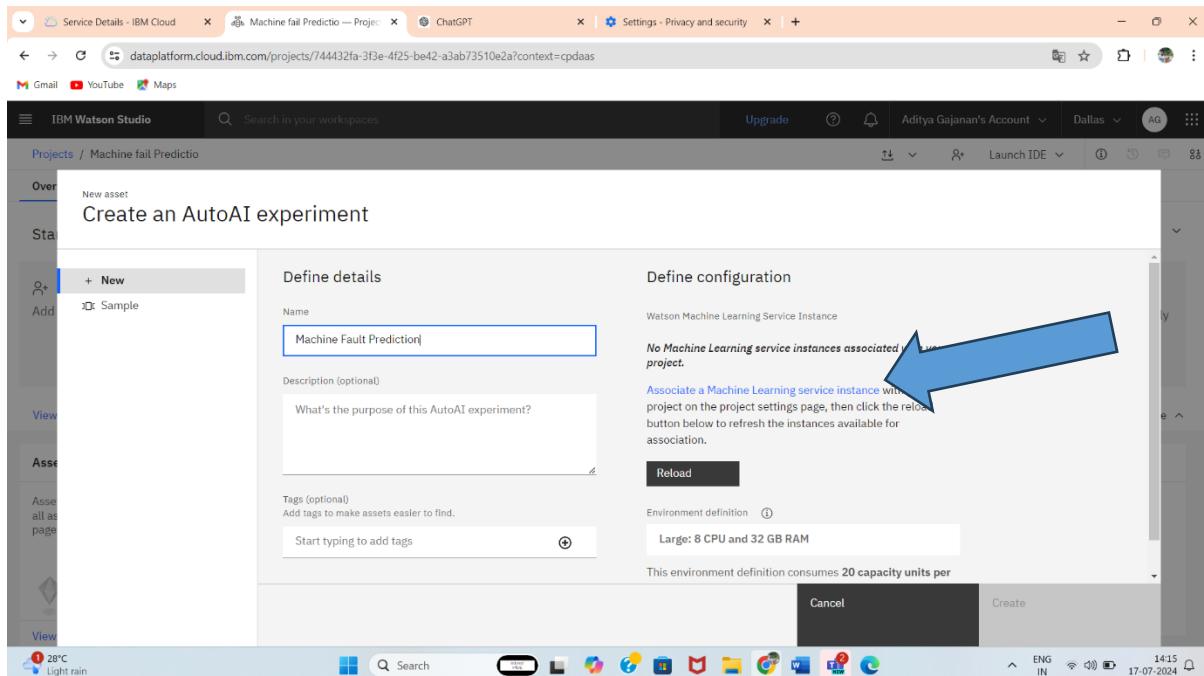
Step 9: Click on the Create Again



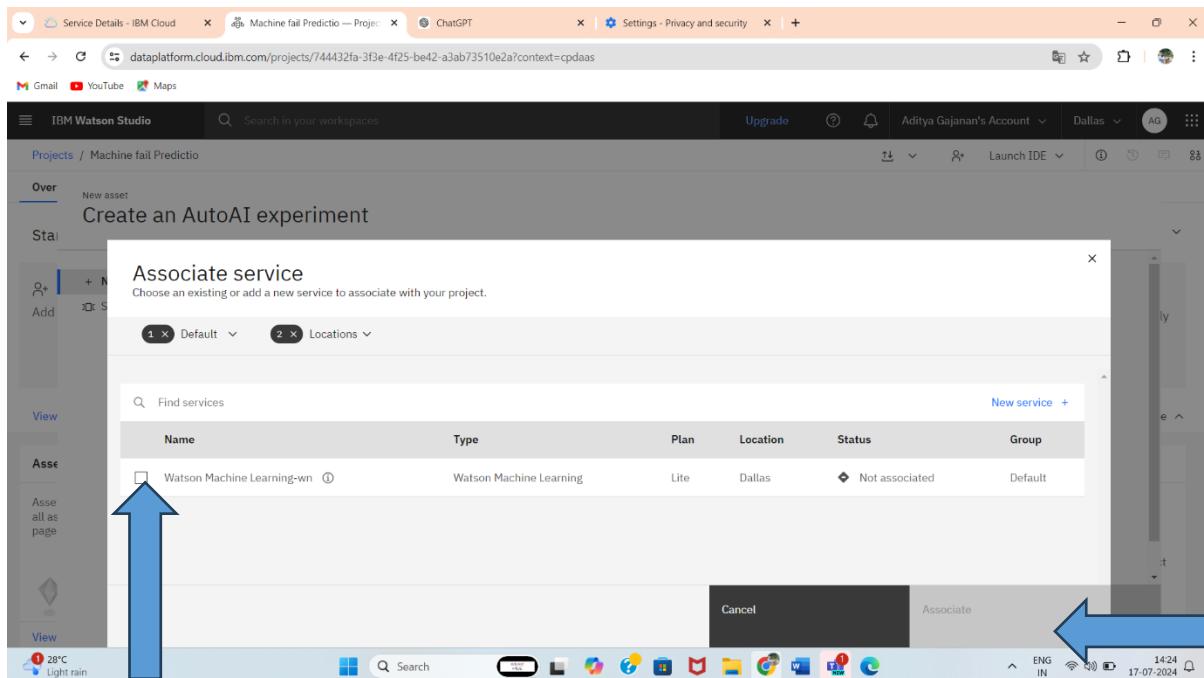
Step 10 : click on the Build Machine Learning Models Automaticaly



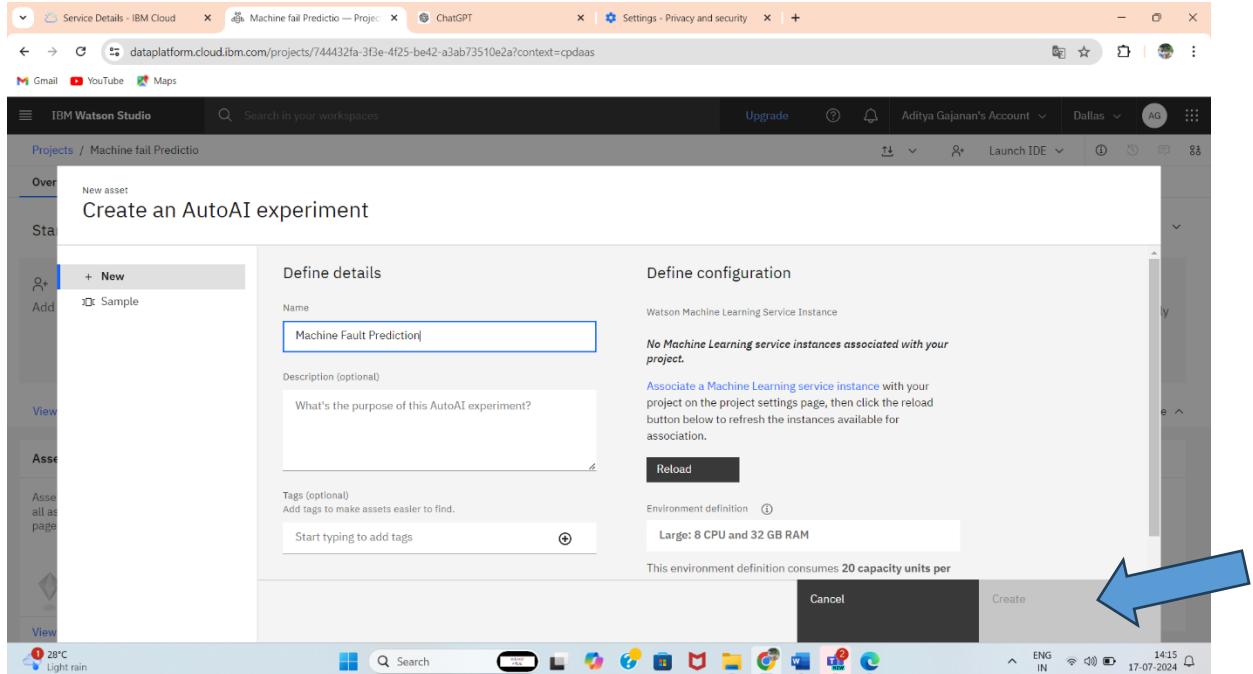
Step 11: define details & click on Associate a machine Learning instance



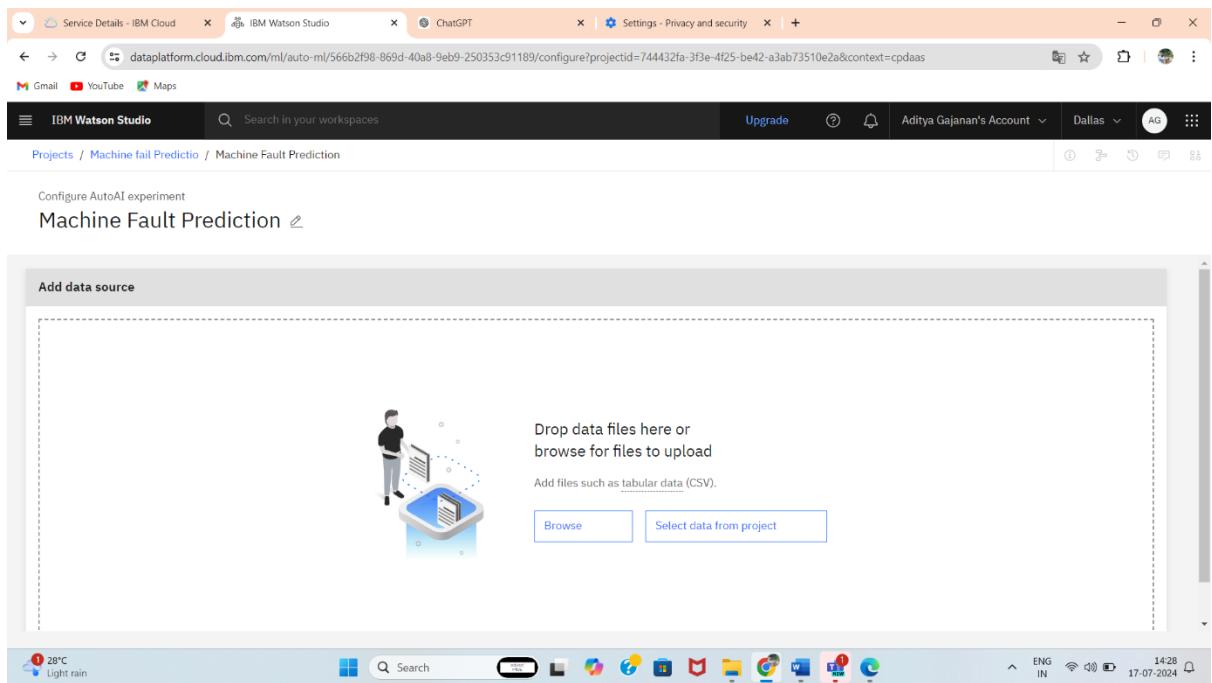
Step 12: Click on Checkbox And Click on the Associate



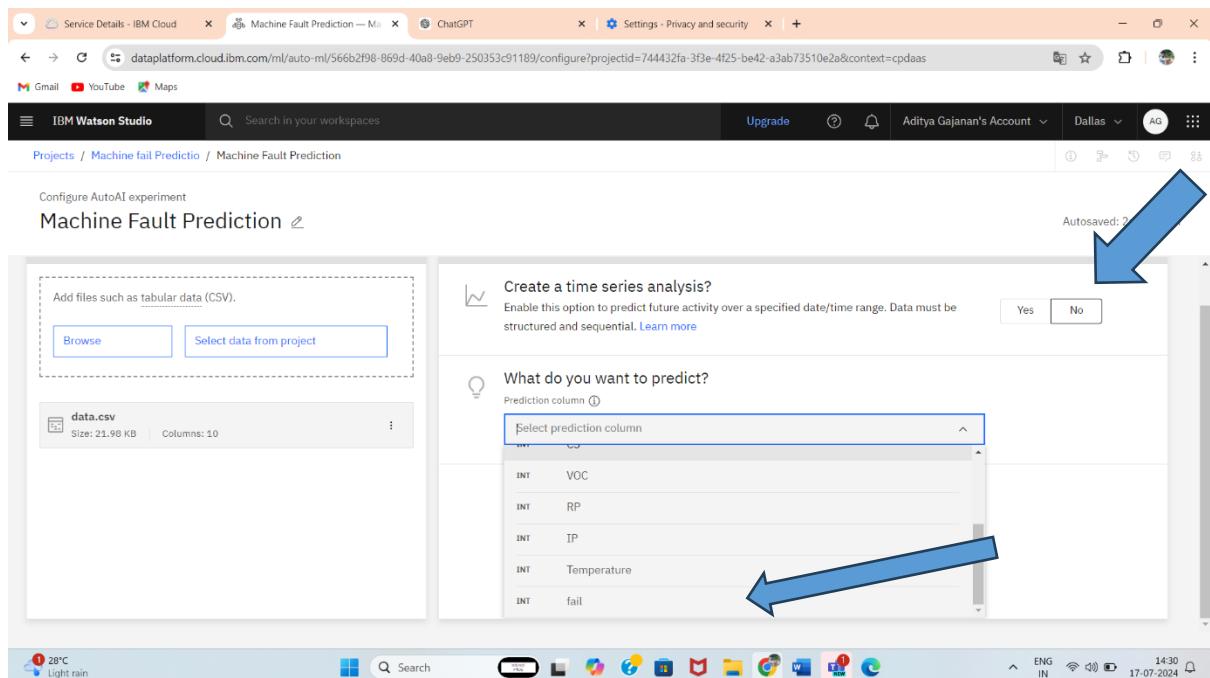
Step 13: Click on the Create



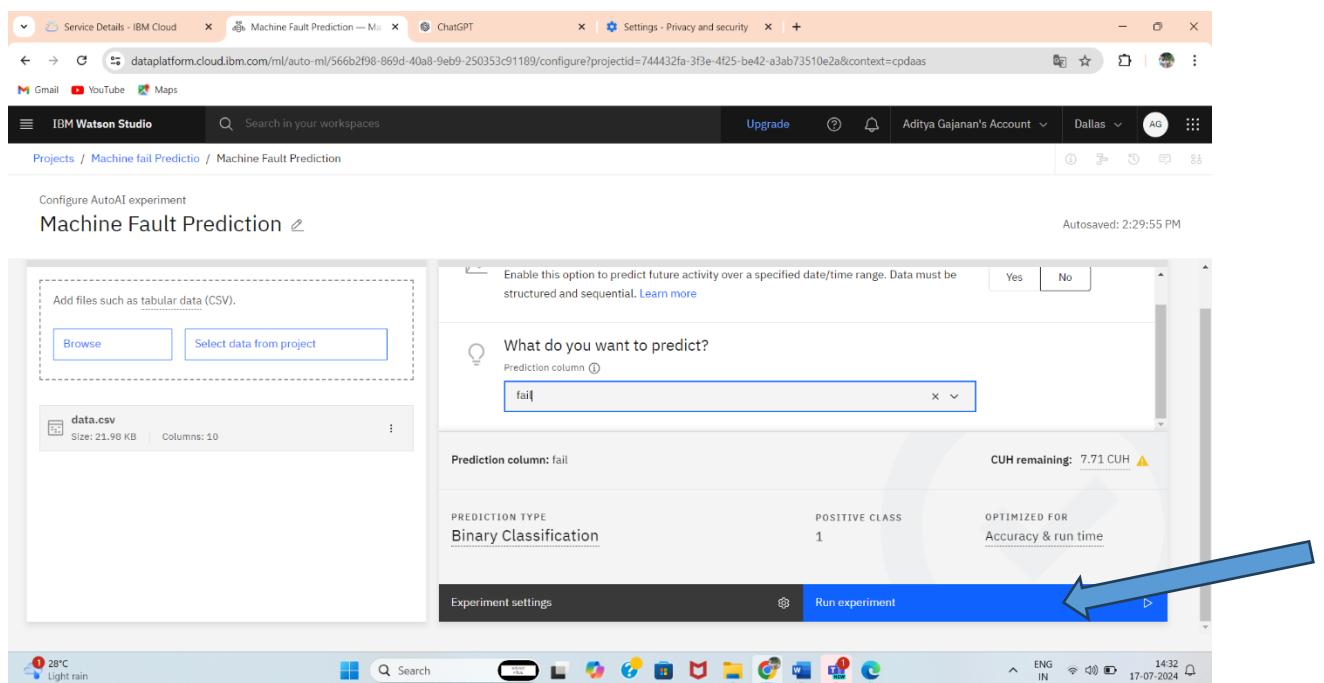
Step14: Click on the Browse and Select the Dataset



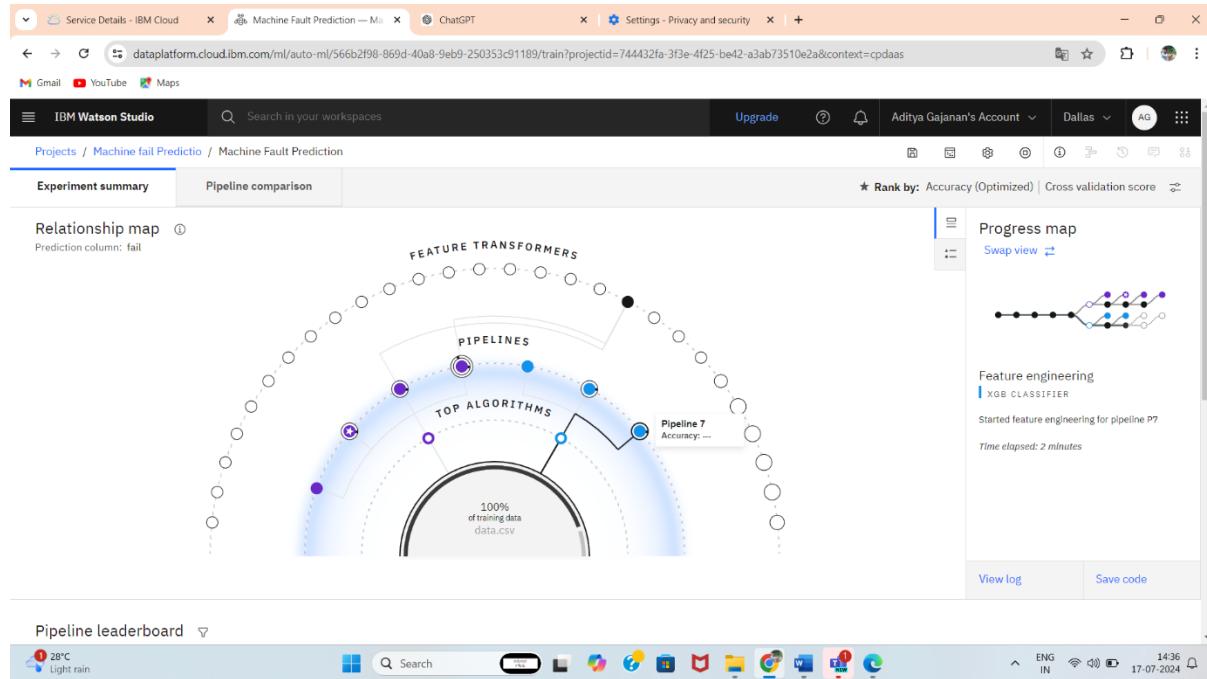
Step 15: Select the Time series Analysis as NO & And in the what do you want to predict select the target Column



Step 16: Click on the Run EXPERIMENT



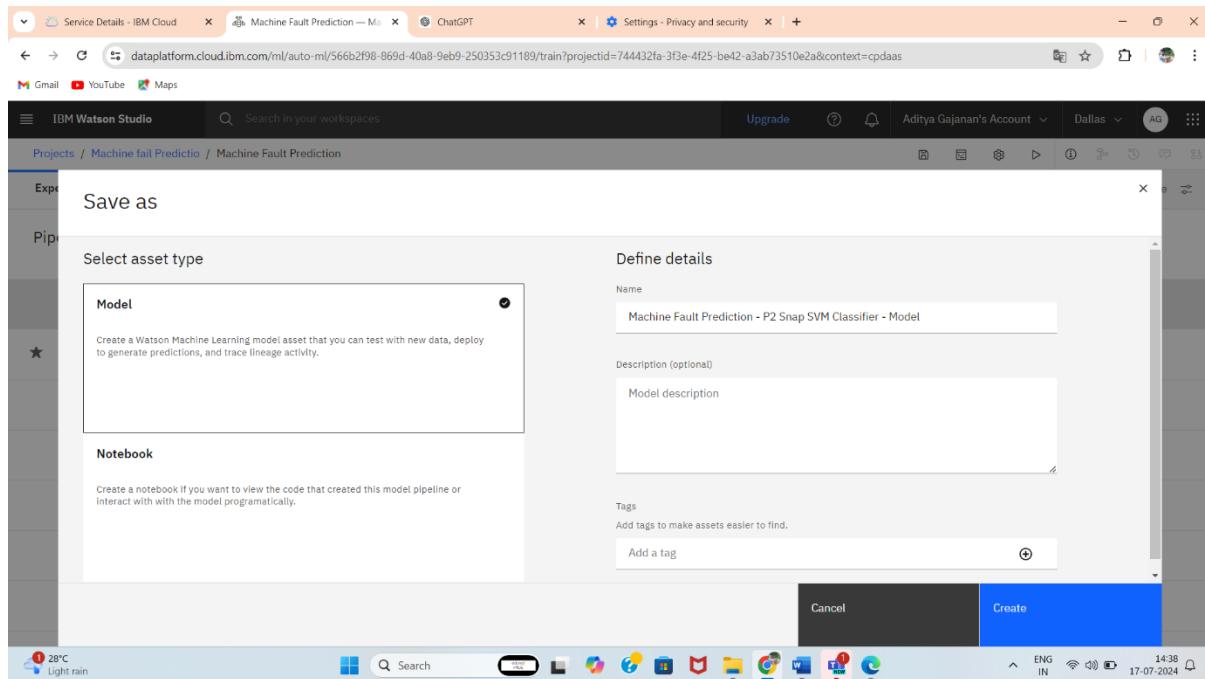
Step 17 : Lest wait so that Our model get trained on the dataset



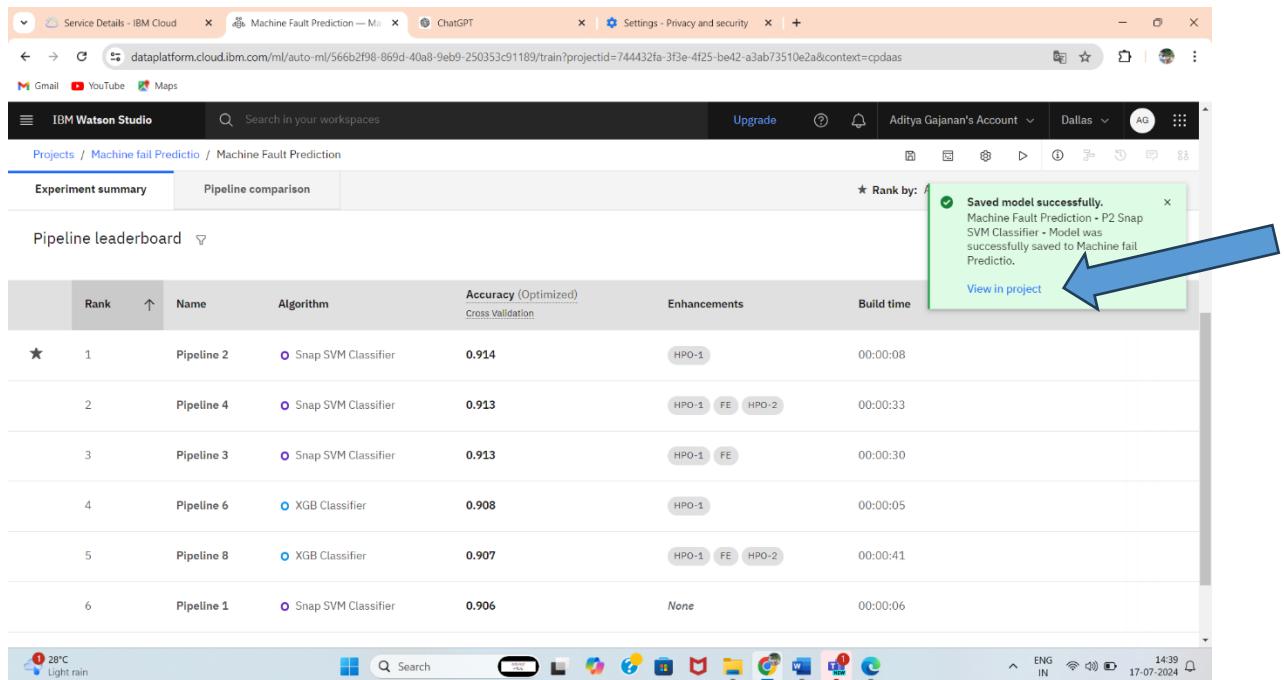
Step 18: now scroll down and select the model with less time required and high accuracy and click on the save as

Rank	Name	Algorithm	Accuracy (Optimized) Cross Validation	Enhancements	Build time
1	Pipeline 2	Snap SVM Classifier	0.914	HPO-1	00:00:08
2	Pipeline 4	Snap SVM Classifier	0.913	HPO-1, FE, HPO-2	00:00:33
3	Pipeline 3	Snap SVM Classifier	0.913	HPO-1, FE	00:00:30
4	Pipeline 6	XGB Classifier	0.908	HPO-1	00:00:05
5	Pipeline 8	XGB Classifier	0.907	HPO-1, FE, HPO-2	00:00:41
6	Pipeline 1	Snap SVM Classifier	0.906	None	00:00:06

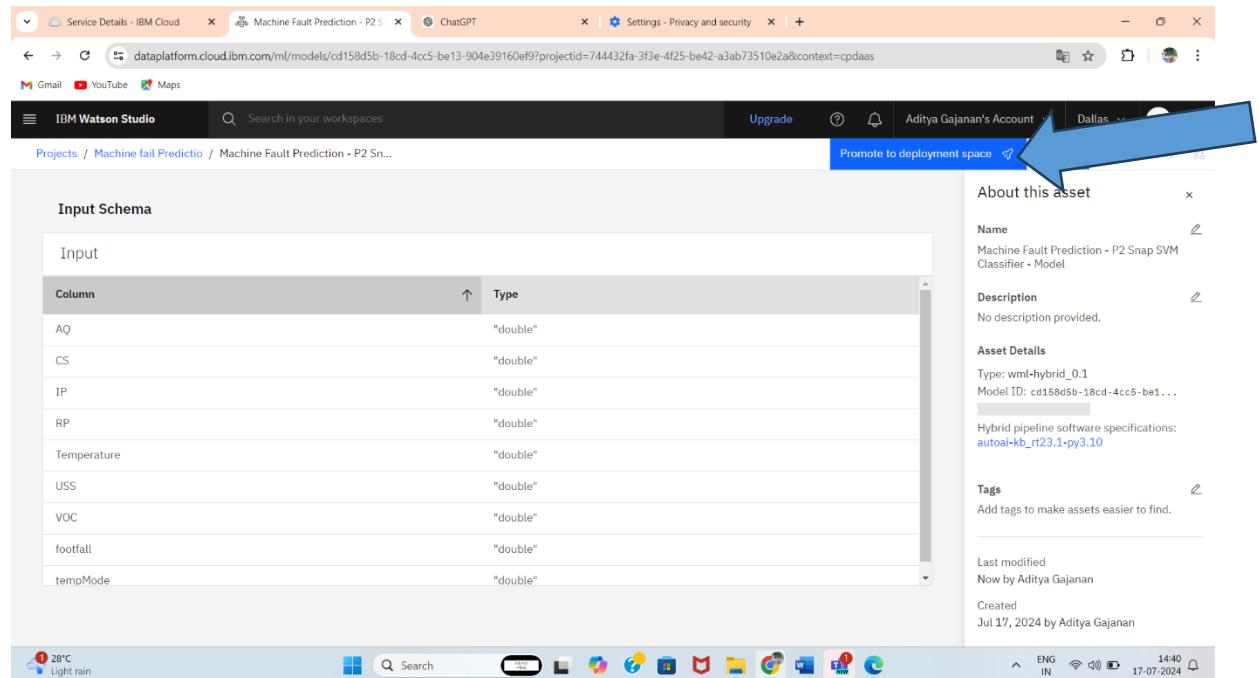
Step 19: Click on the model and click on create



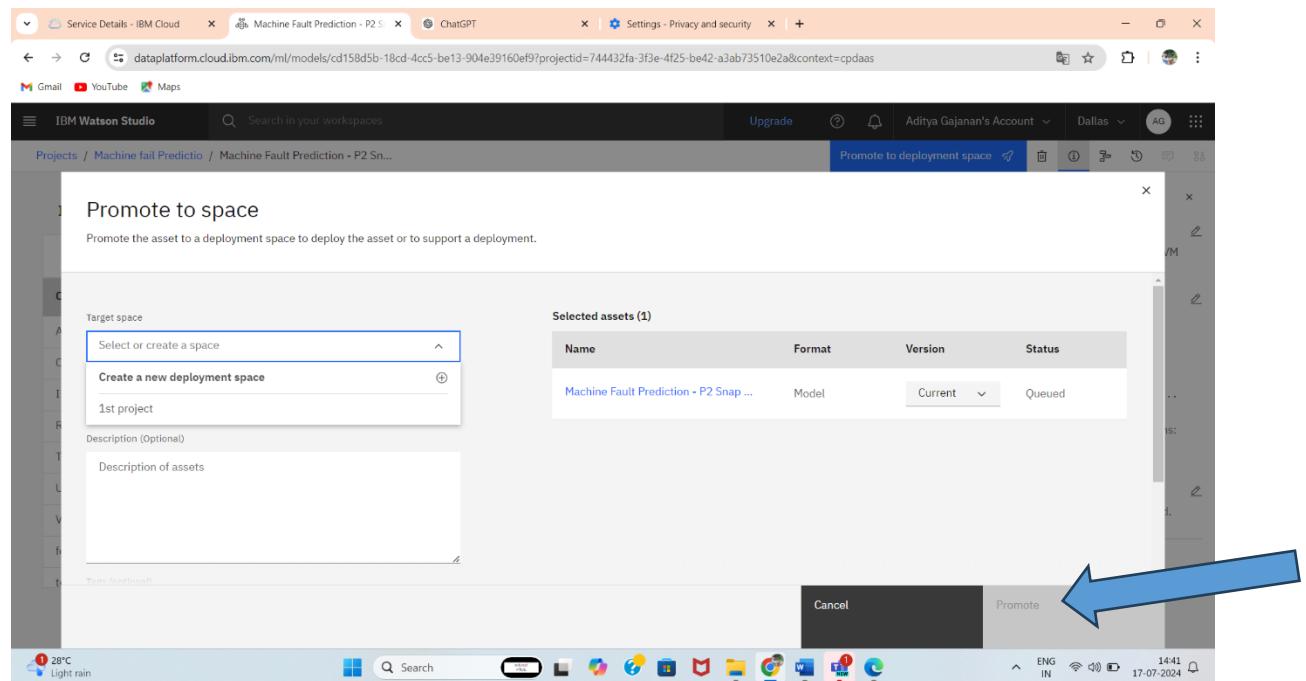
Step 20 : click on the view project



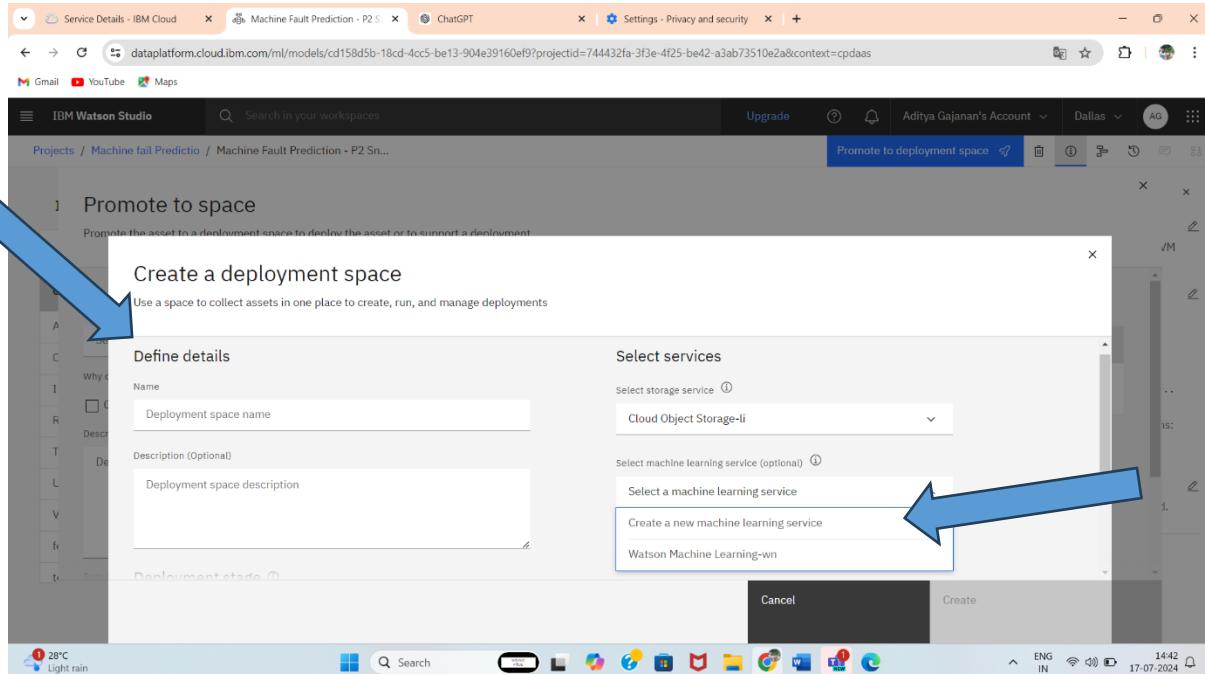
Step 21: Click on the Promote to deployment



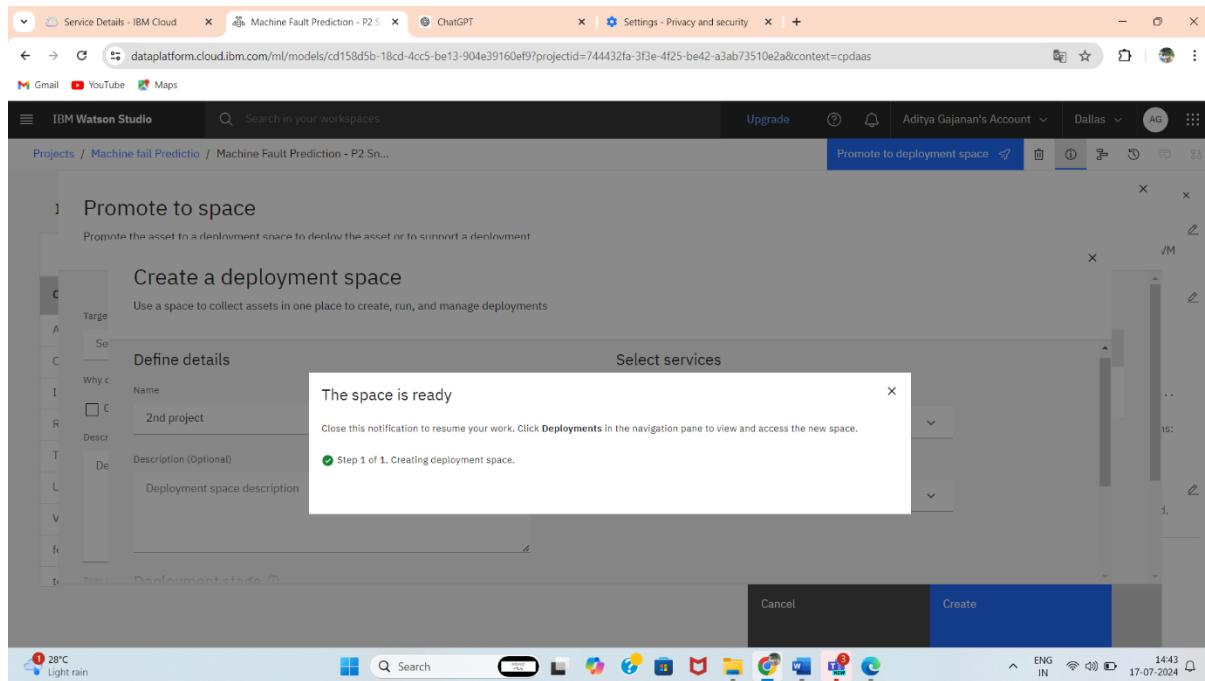
Step 23: now select the deployment space & Click on the promote



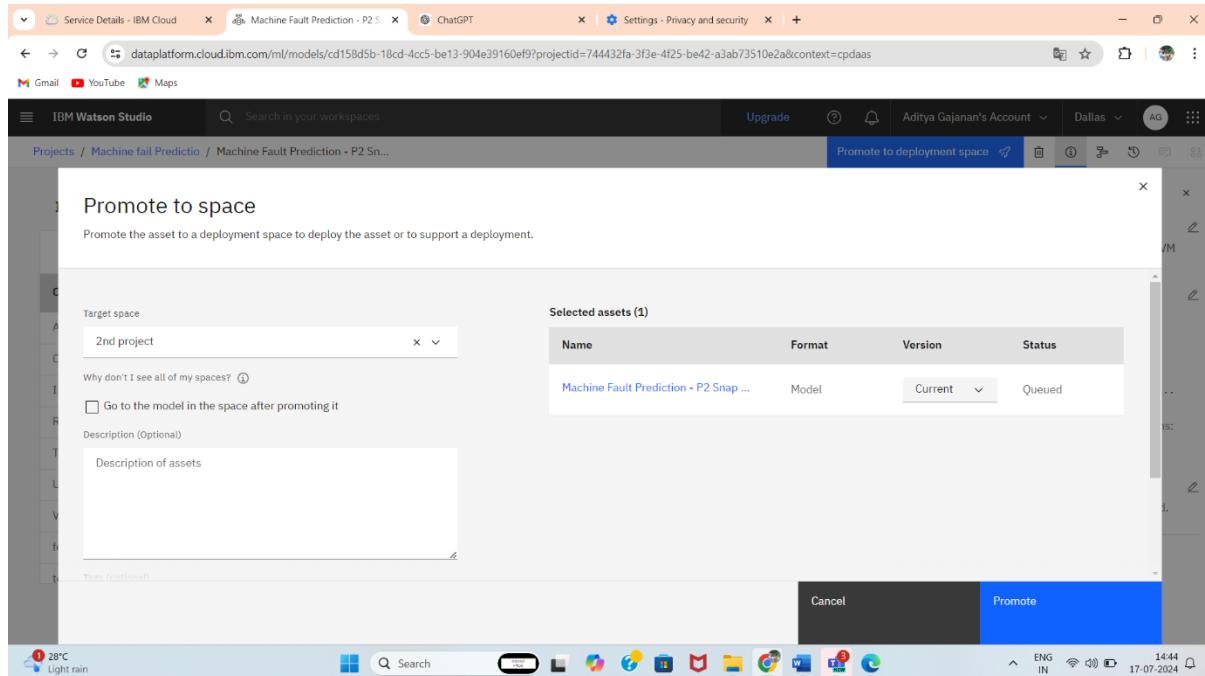
Step 24: now define the details of the project and select the machine learning space service ass Watson machine learning



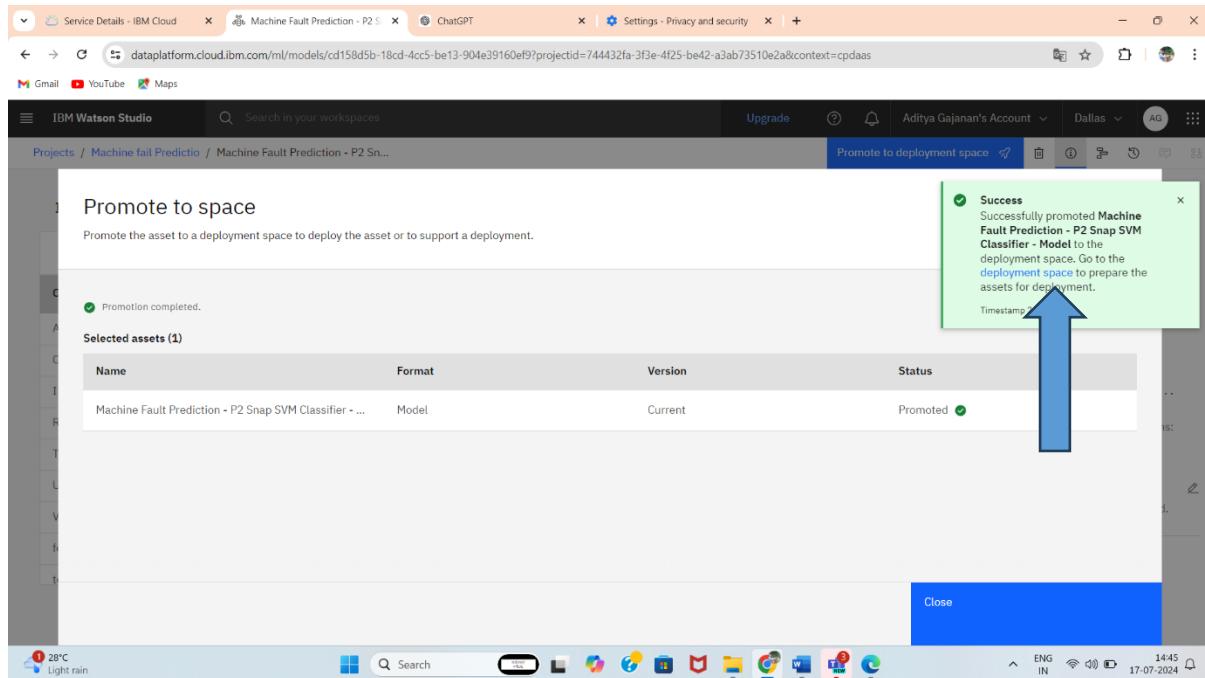
Step 26:Lets wait to become space ready



Step 28: now enter the space name & click on the promote



Step 29: go to deployment space



Step 30: now click on the asset name

2nd project

Overview Assets Deployments Jobs Manage

Find assets Import assets

1 asset All assets 1 Asset types Models 1

Assets

Name	Last modified
Machine Fault Prediction - P2 Snap SVM Classifier - Model	46 seconds ago Service

https://dataplatform.cloud.ibm.com/ml-runtime/models/0cd949e-b6ea-4cf4-8806-fbf752cff9?space_id=0fae2aed-7622-4483-9f0e-bba2af96bc83&context=cpdaas

Step 31: Now click on the new deployment

Service Details - IBM Cloud Machine Fault Prediction - P2 S ChatGPT Settings - Privacy and security

Gmail YouTube Maps

IBM Watson Studio Search in your workspaces Upgrade Aditya Gajanan's Account Dallas AG

Deployments / 2nd project / Machine Fault Prediction - P2 Snap SVM Classifier - Model

New deployment

Deployments Model details

Name Type Status Tags Last modified

This asset doesn't have any deployments yet. Use the New Deployment button to create a deployment for this asset.

About this asset

Name: Machine Fault Prediction - P2 Snap SVM Classifier - Model

Description: No description provided.

Asset Details

Type: wml-hybrid_0.1

Model ID: ec7d949e-b6ea-4cf4-8806-fbf752cff9

Software specification: hybrid_0.1

Hybrid pipeline software specifications: autoai-kb_rt23.1-py3.10

Tags

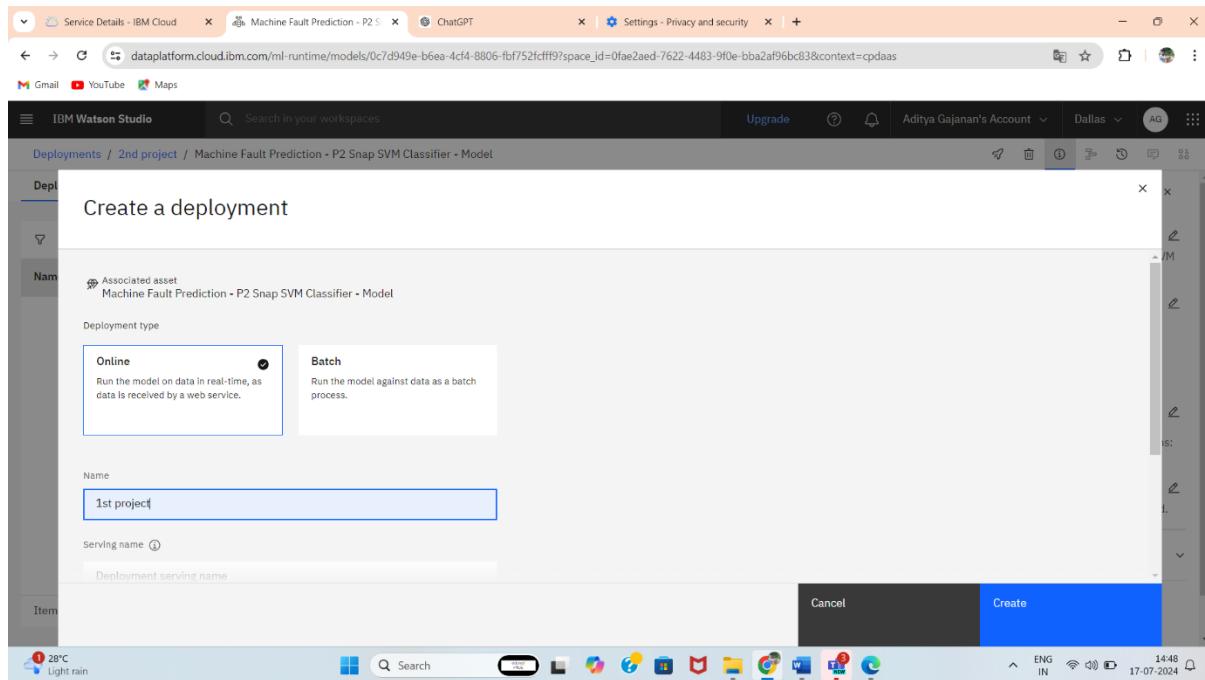
Source asset details

Last modified: 1 minute ago by Service

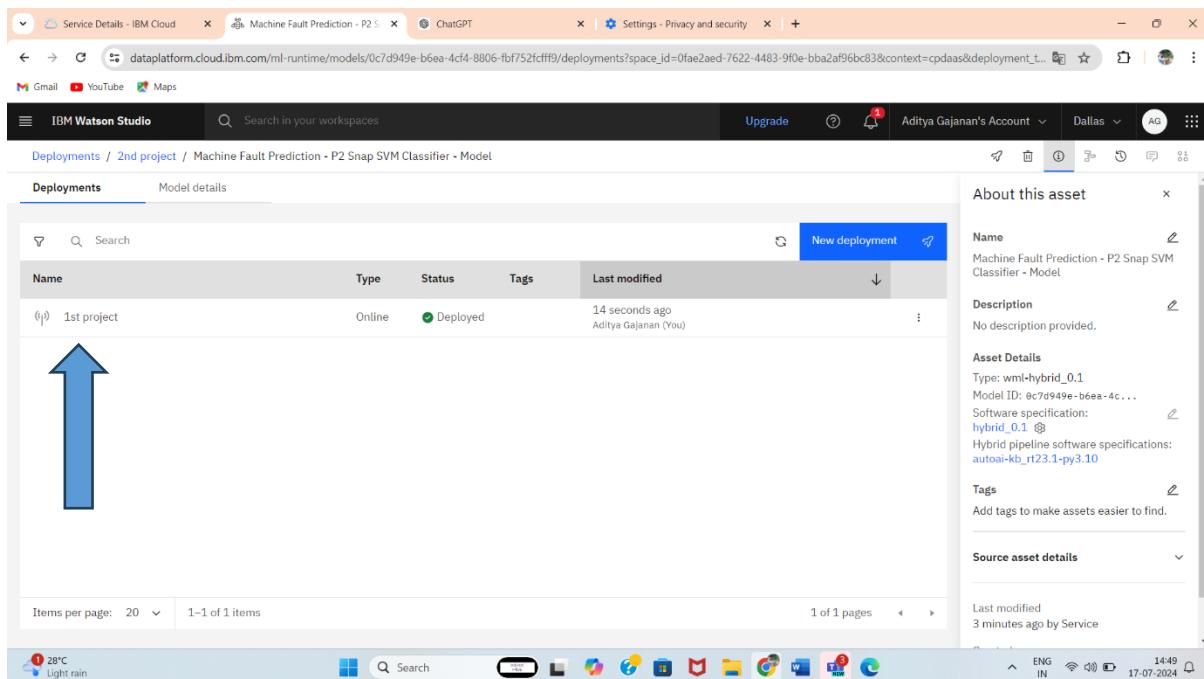
Items per page: 20 0–0 of 0 items

28°C Light rain

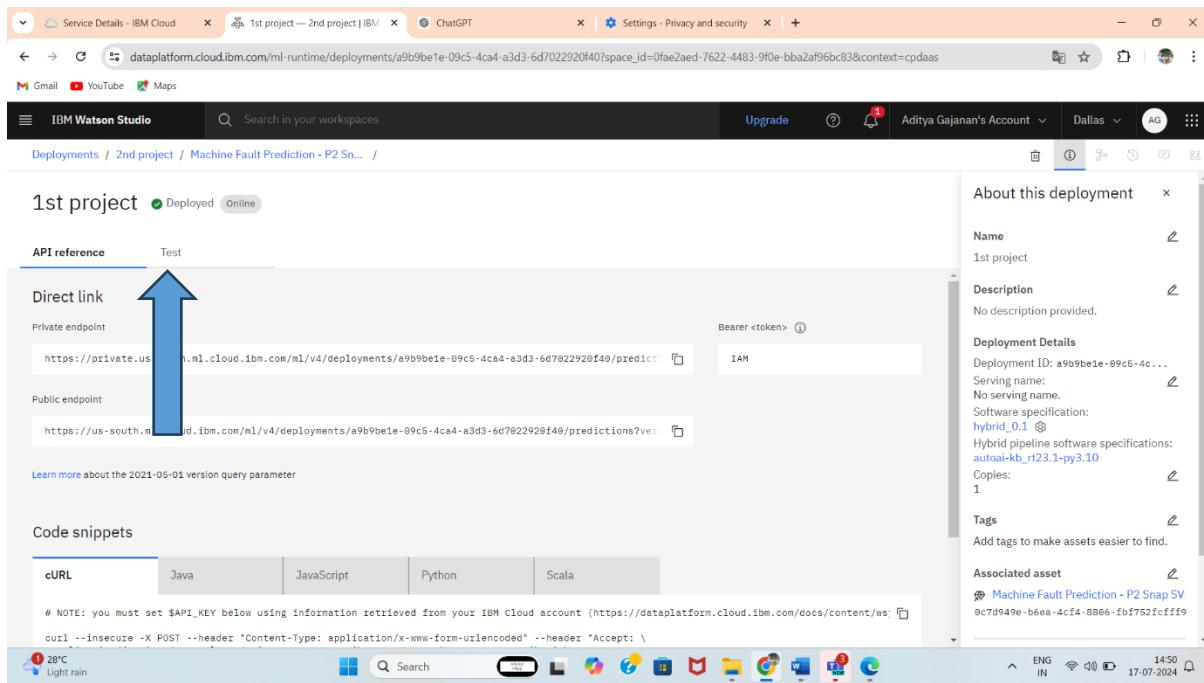
Step 32: click on the online & fill the name of project & click on the create



Step 33: click on the 1st project ot test the model



Step 34: now go to the test



Step 35: now fill the values according to the prediction value and predict the target variable

	footfall (double)	tempMode (double)	AQ (double)	USS (double)	CS (double)	VOC (double)	RP (double)	IP (double)	Temperature (double)
1	36	5	41	51	65	4	7	88	6
2									
3									
4									
...									

1 row, 9 columns

Predict

Step 37: finally we have done with the prediction and you can see the target variable values according to the parameter values