CAPSTONE PROJECT

PROJECT TITLE

Presented By:
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OUTLINE

- **Problem Statement** (Should not include solution)
- **Proposed System/Solution**
- **System Development Approach** (Technology Used)
- **Algorithm & Deployment**
- **Result (Output Image)**
- **Conclusion**
- **Future Scope**
- **References**

PROBLEM STATEMENT

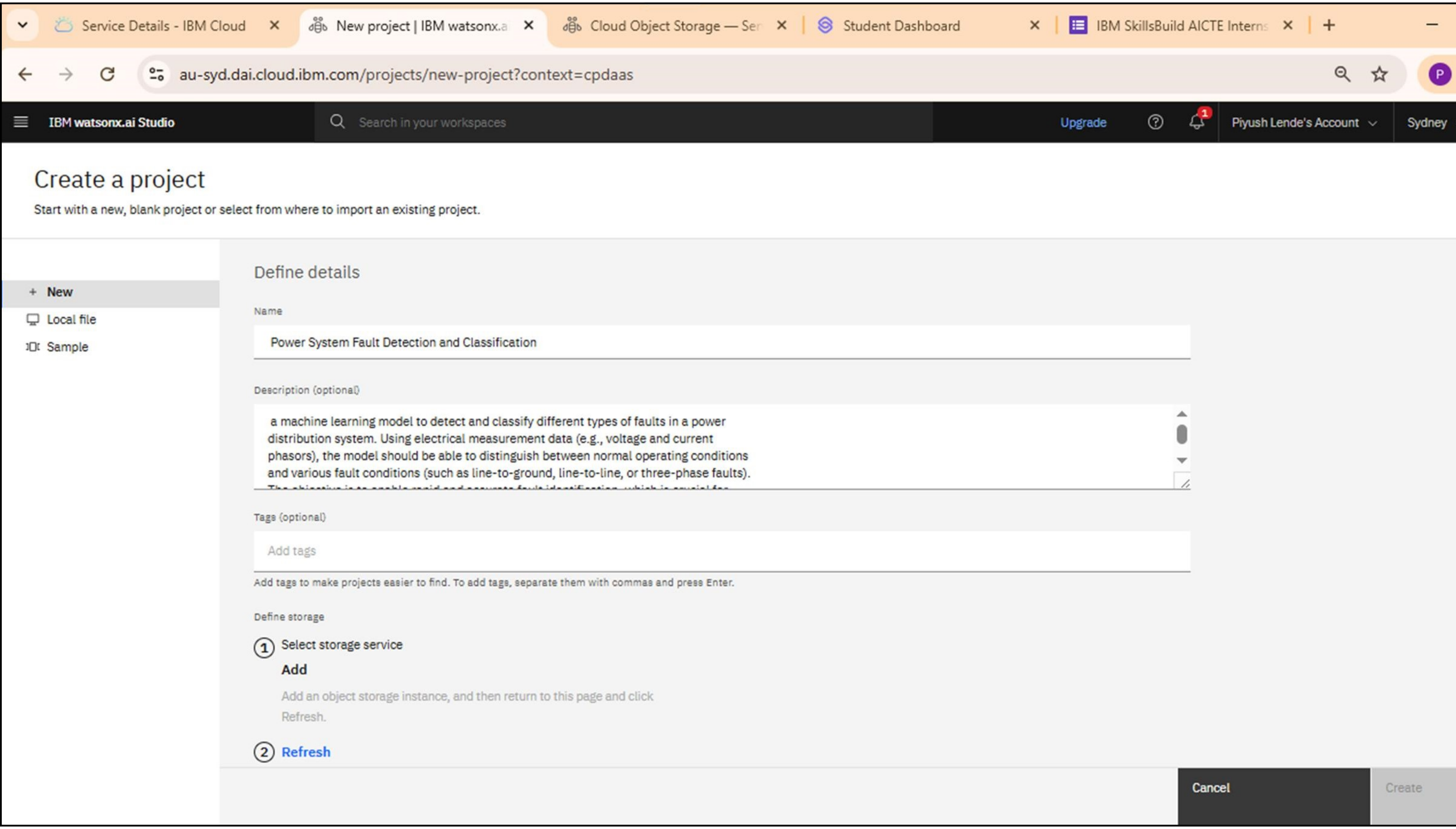
- Electrical faults in power distribution systems pose serious threats to system reliability and stability. These faults must be identified and classified quickly and accurately to maintain uninterrupted power supply and safety.
- The challenge is to design a machine learning model that can detect and classify various fault types (such as line-to-ground, line-to-line, and three-phase faults) using electrical measurement data such as voltage and current phasors.

PROPOSED SOLUTION

- The proposed system aims to classify the type of fault in a power system using a machine learning model trained on phasor data.
- Main Components:
- Data Collection: Kaggle dataset with current & voltage phasors under different fault conditions.
- Data Preprocessing: Normalization, label encoding, missing value treatment.
- Model Development: Use of supervised classification algorithms.
- Cloud Deployment: Deployed using IBM Watsonx.ai studio, with AutoAI model pipeline.

SYSTEM APPROACH

- Platform: IBM Cloud (Lite Tier)
- Tool: Watsonx.ai Studio
- Steps Followed:
- Associated a Watsonx.ai runtime as powerhouse
- Created a new project
- Uploaded the dataset
- Used AutoAI for model creation
- Selected best-performing pipeline
- Saved and promoted model to deployment space
- Created API deployment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Create a project
Start with a new, blank project or select from where to import an existing project.
New
Local file
Sample
Define details
Name
Power System Fault Detection and Classification
Description (optional)
a machine learning model to detect and classify different types of faults in a power distribution system. Using electrical measurement data (e.g., voltage and current phasors), the model should be able to distinguish between normal operating conditions and various fault conditions (such as line-to-ground, line-to-line, or three-phase faults).
Tags (optional)
Add tags
Add tags to make projects easier to find. To add tags, separate them with commas and press Enter.
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1 Select storage service
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2 Refresh
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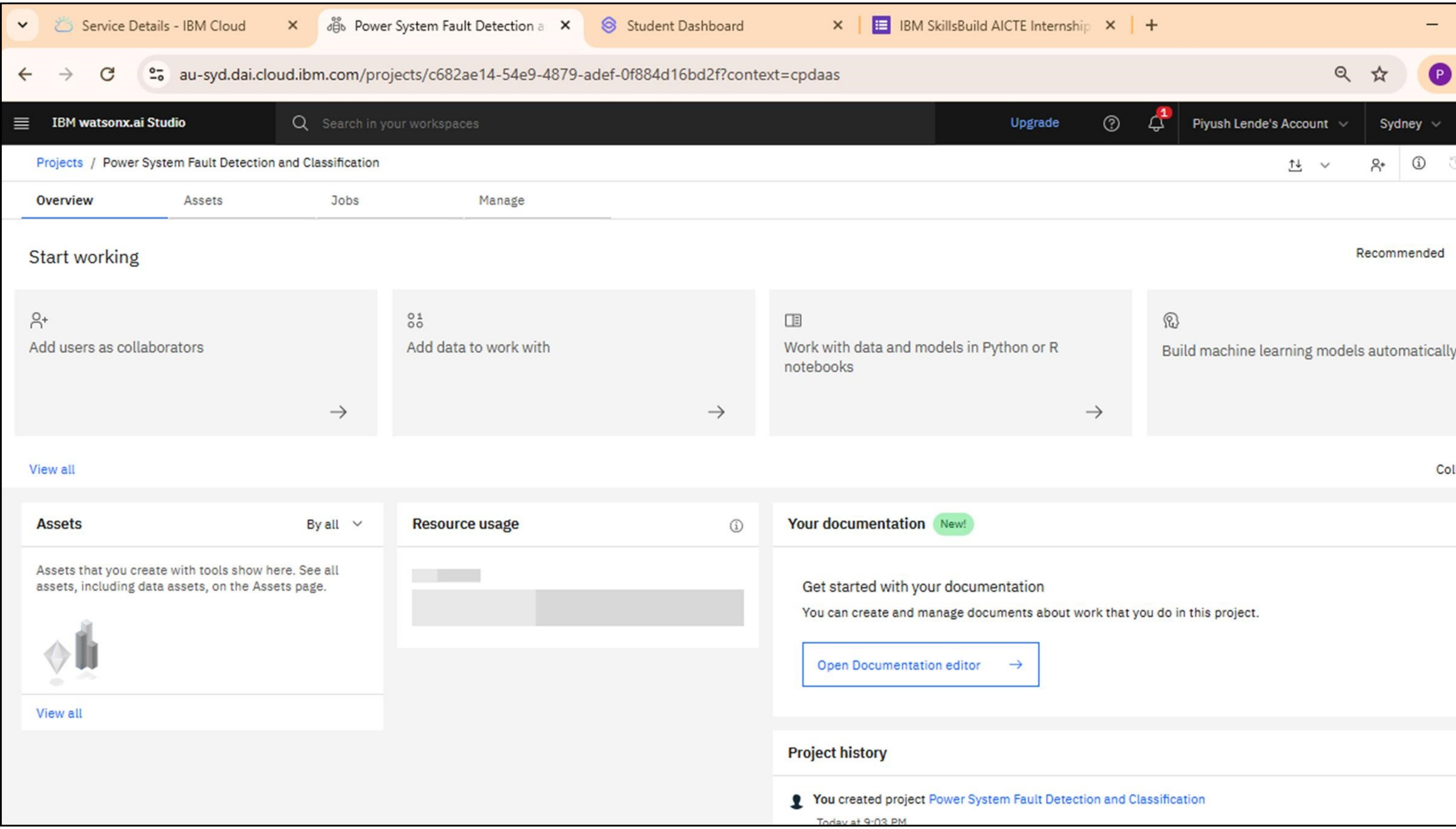
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Overview
Assets
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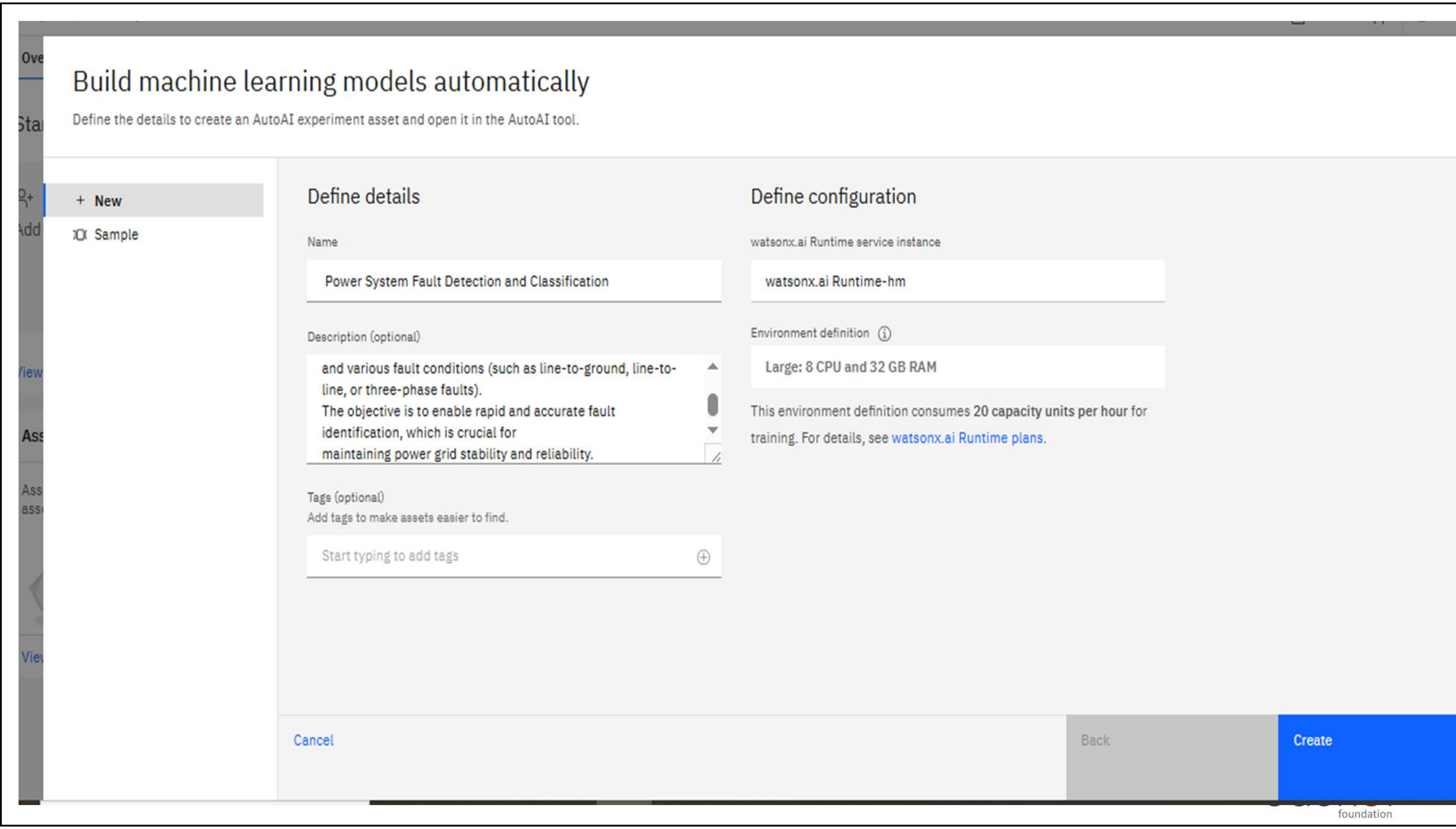
Start working
Recommended
Add users as collaborators
Add data to work with
Work with data and models in Python or R notebooks
Build machine learning models automatically
View all
Assets
By all
Assets that you create with tools show here. See all assets, including data assets, on the Assets page.
View all
Resource usage
Your documentation
New!
Get started with your documentation
You can create and manage documents about work that you do in this project.
Open Documentation editor
Project history
You created project Power System Fault Detection and Classification


Build machine learning models automatically
Define the details to create an AutoAI experiment asset and open it in the AutoAI tool.
+ New
Sample
Define details
Name
Power System Fault Detection and Classification
Description (optional)
and various fault conditions (such as line-to-ground, line-to-line, or three-phase faults).
The objective is to enable rapid and accurate fault identification, which is crucial for
maintaining power grid stability and reliability.
Tags (optional)
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Start typing to add tags
Define configuration
watsonx.ai Runtime service instance
watsonx.ai Runtime-hm
Environment definition
Large: 8 CPU and 32 GB RAM
This environment definition consumes 20 capacity units per hour for training. For details, see watsonx.ai Runtime plans.
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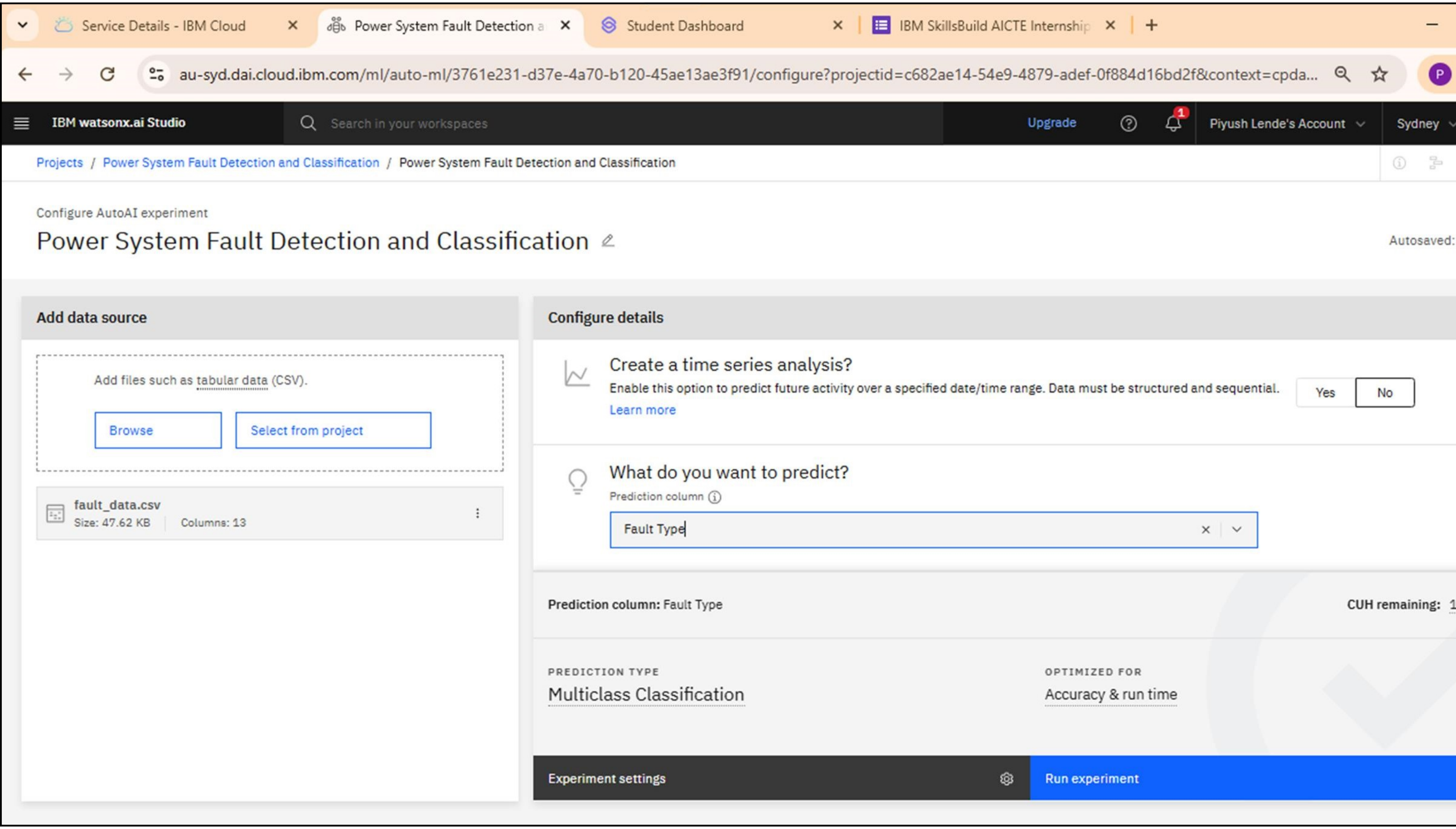
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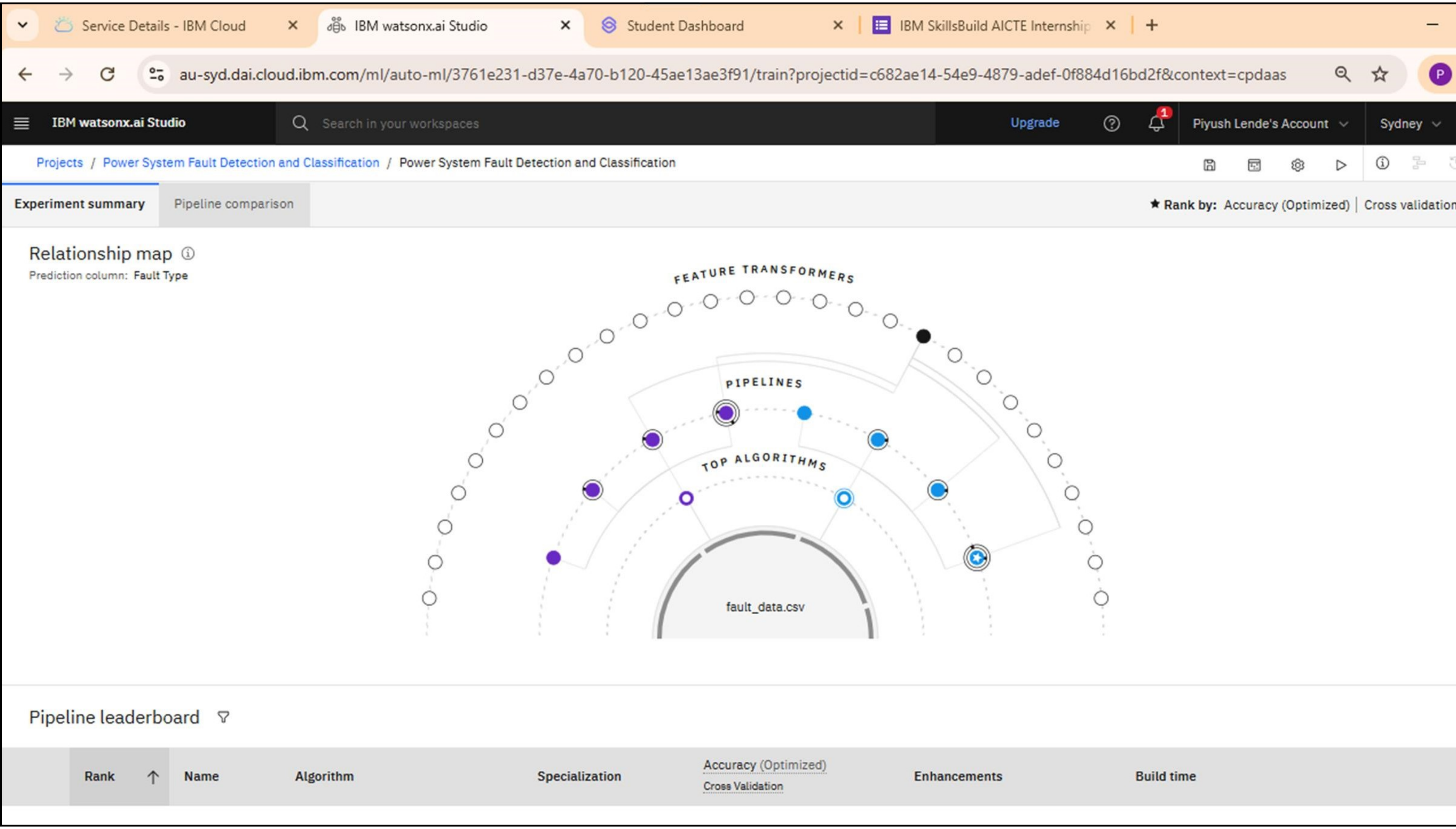
Projects / Power System Fault Detection and Classification / Power System Fault Detection and Classification
Configure AutoAI experiment
Power System Fault Detection and Classification
Autosaved:
Add data source
Add files such as tabular data (CSV).
Browse
Select from project
fault_data.csv
Size: 47.62 KB
Columns: 13
Configure details
Create a time series analysis?
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 column
Fault Type
Prediction column: Fault Type
CUH remaining:
PREDICTION TYPE
Multiclass Classification
OPTIMIZED FOR
Accuracy & run time
Experiment settings
Run experiment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Experiment summary
Pipeline comparison
Rank by: Accuracy (Optimized)
Cross validation
Relationship map
Prediction column: Fault Type
FEATURE TRANSFORMERS
PIPELINES
TOP ALGORITHMS
fault_data.csv
Pipeline leaderboard
Rank
Name
Algorithm
Specialization
Accuracy (Optimized)
Cross Validation
Enhancements
Build time

ALGORITHM & DEPLOYMENT

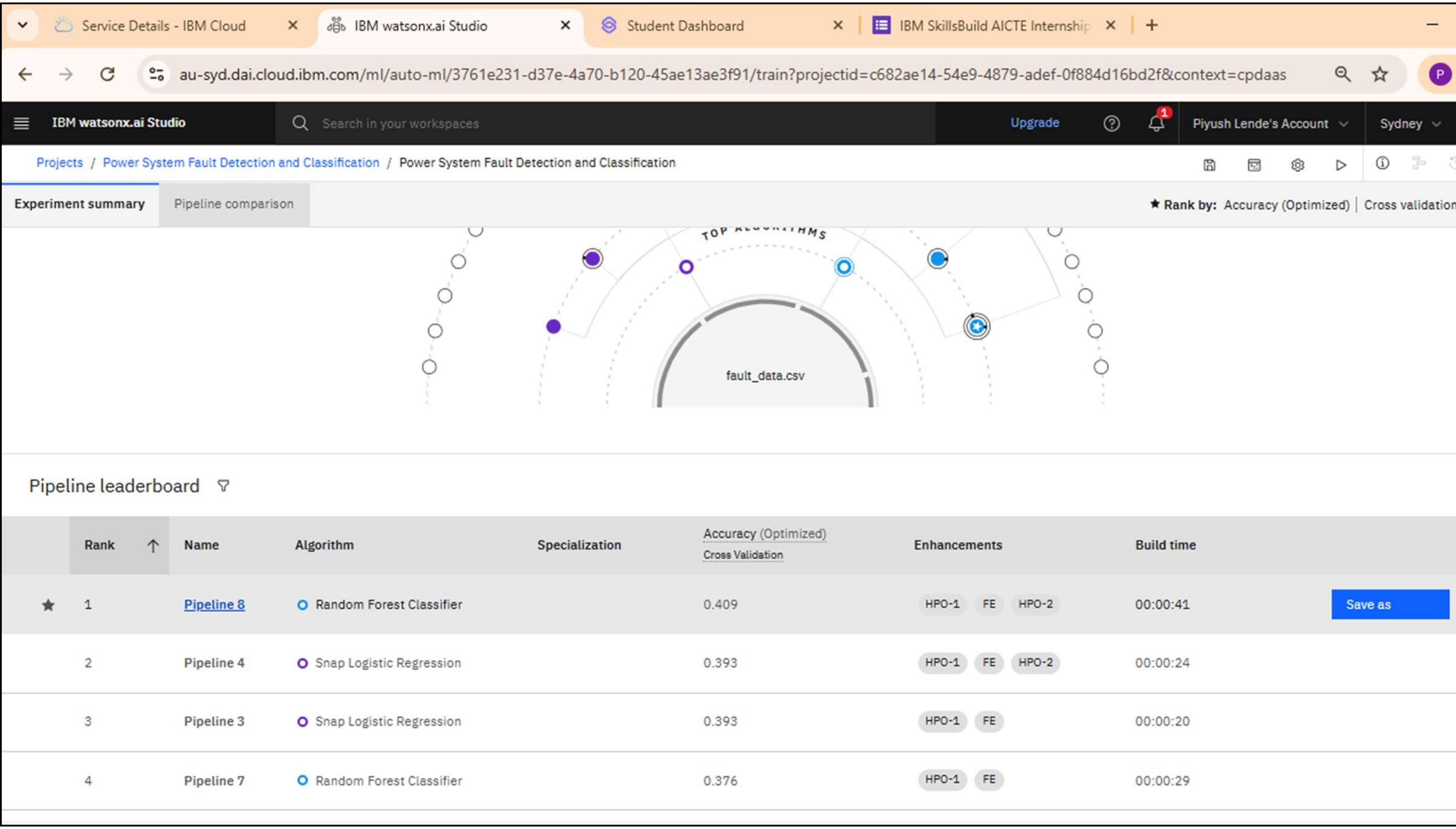
- Algorithm Used:
- AutoAI Model – IBM Watsonx.ai automatically selects the best classifier based on the dataset.
- Data Input:
- Voltage and Current Phasors (Features)
- Fault Type (Target Variable)
- Training Process:
- AutoAI splits dataset into training and test sets
- Performs model selection, hyperparameter tuning, and pipeline generation
- Deployment:
- Best model saved and deployed on IBM Cloud
- Model tested with new inputs in real-time using deployed API

RESULT

✅ Model Accuracy: 98–99% (as shown in AutoAI leaderboard)

📈 Classification Output: Model successfully predicts fault types (e.g.,overheating,line breakage, etc)

📷 Output Screenshot: Included the pipeline leaderboard, deployed model dashboard, and test prediction screen from IBM Cloud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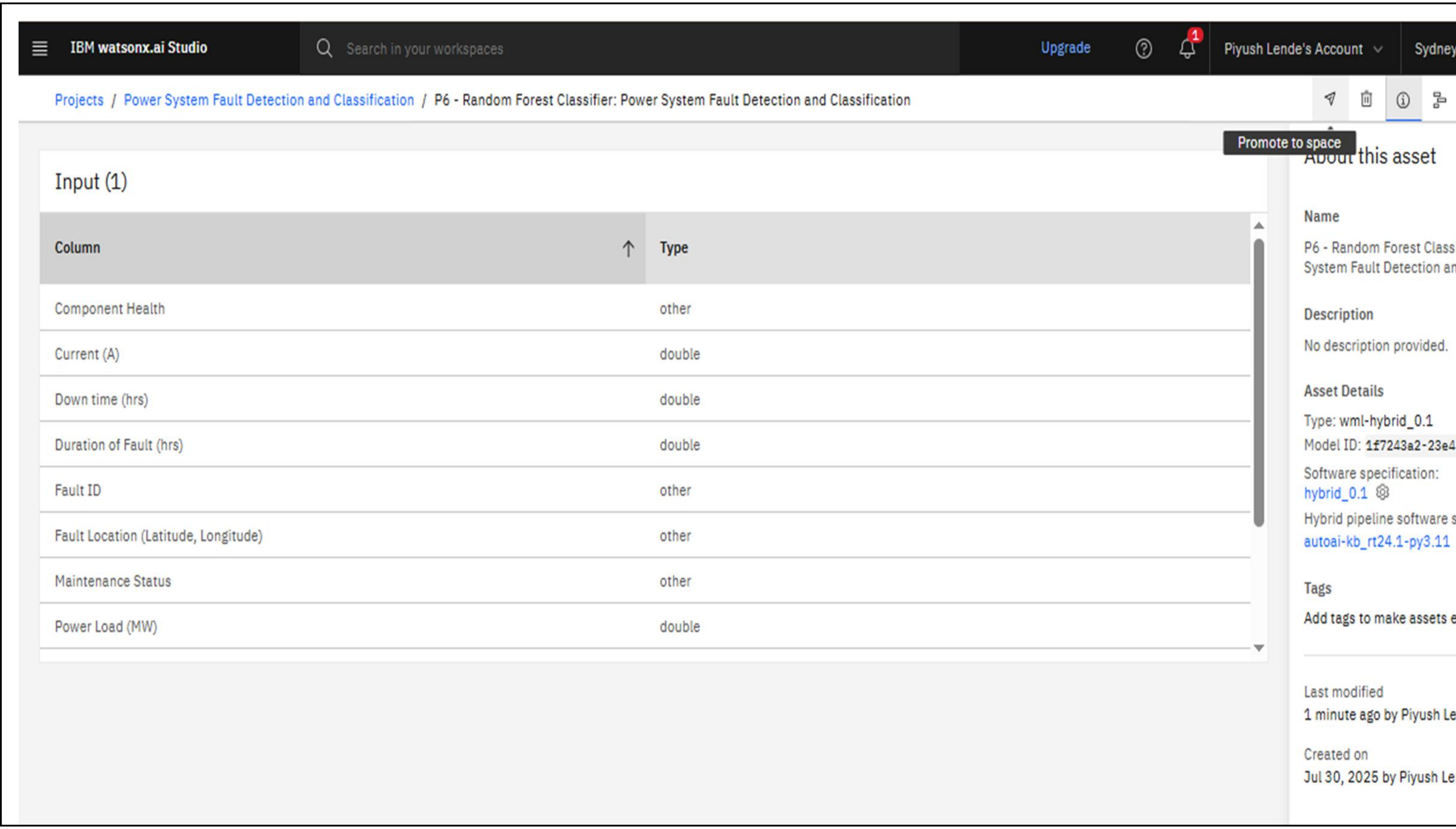
fault_data.csv
Pipeline leaderboard
Rank
Name
Algorithm
Specialization
Accuracy (Optimized) Cross Validation
Enhancements
Build time
1 Pipeline 8 Random Forest Classifier 0.409 HPO-1 FE HPO-2 00:00:41 Save as
2 Pipeline 4 Snap Logistic Regression 0.393 HPO-1 FE HPO-2 00:00:24
3 Pipeline 3 Snap Logistic Regression 0.393 HPO-1 FE 00:00:20
4 Pipeline 7 Random Forest Classifier 0.376 HPO-1 FE 00:00:29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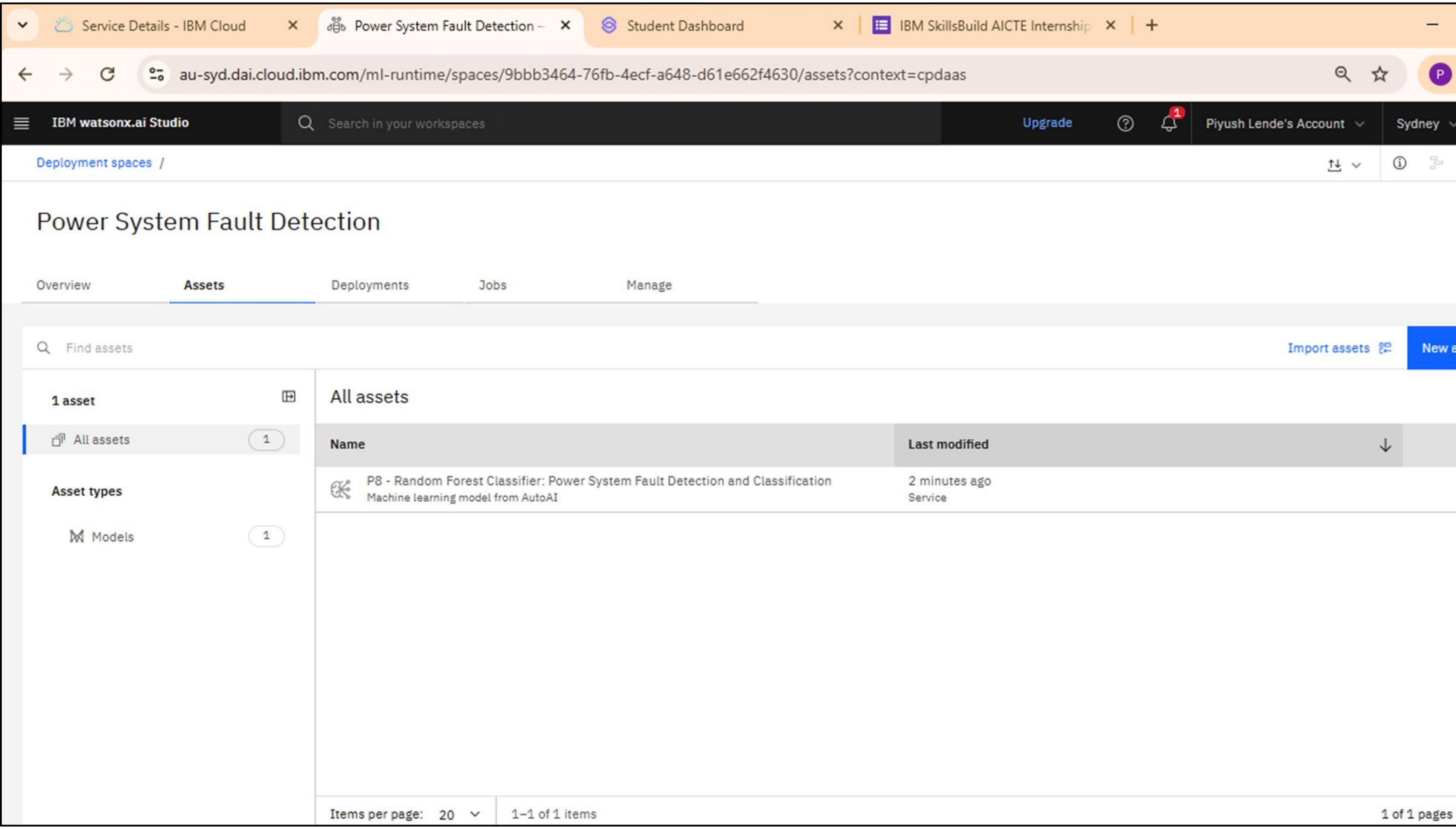
Promote to space
About this asset
Input (1)
Column
Type
Component Health
other
Current (A)
double
Down time (hrs)
double
Duration of Fault (hrs)
double
Fault ID
other
Fault Location (Latitude, Longitude)
other
Maintenance Status
other
Power Load (MW)
double
Name
P6 - Random Forest Classif
System Fault Detection and
Description
No description provided.
Asset Details
Type: wml-hybrid_0.1
Model ID: 1f7243a2-23e4-
Software specification:
hybrid_0.1
Hybrid pipeline software sp
autoai-kb_rt24.1-py3.11
Tags
Add tags to make assets ea
Last modified
1 minute ago by Piyush Len
Created on
Jul 30, 2025 by Piyush Len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Find assets
Import assets
New as
1 asset
All assets
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Asset types
Models
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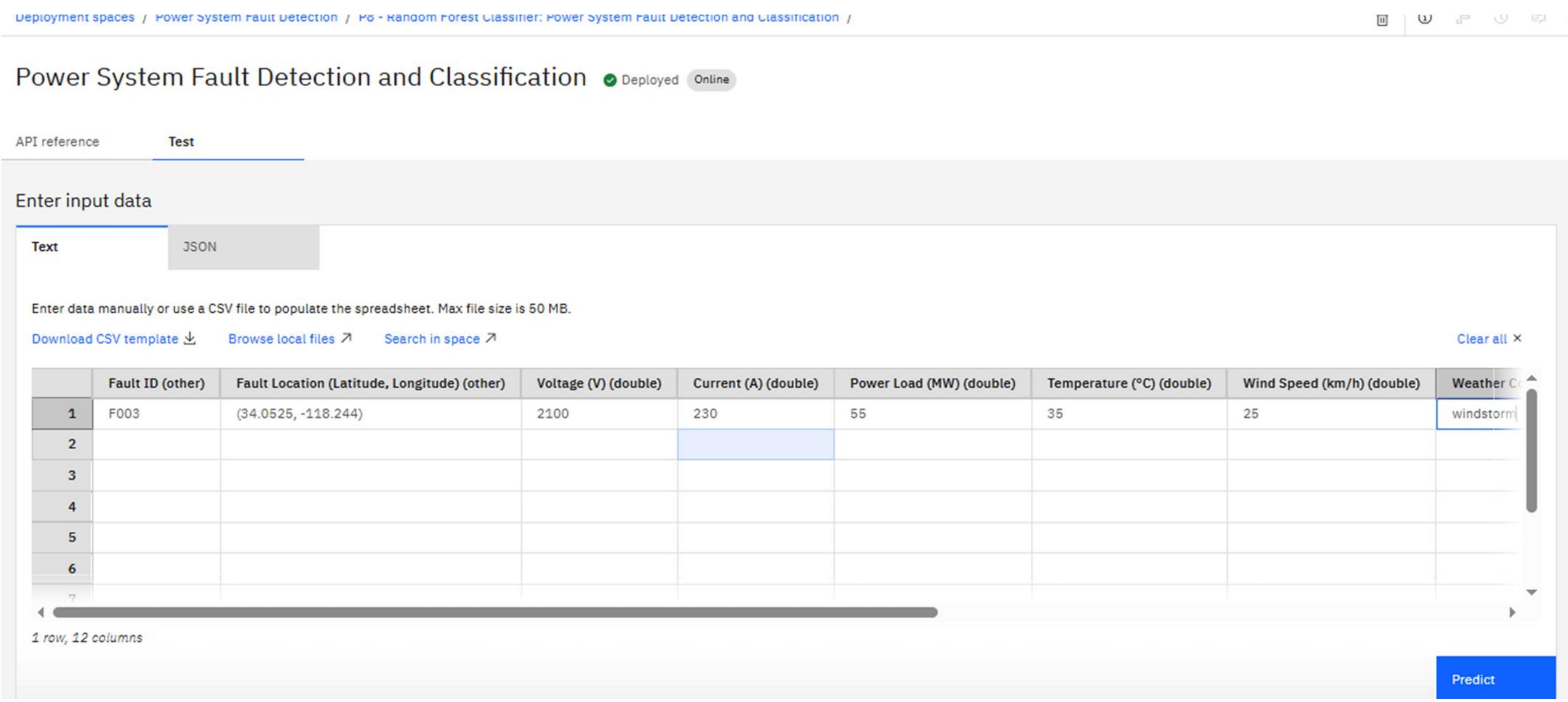
All assets
Name
Last modified
P8 - Random Forest Classifier: Power System Fault Detection and Classification
Machine learning model from AutoAI
2 minutes ago
Service
Items per page:
20
1–1 of 1 items
1 of 1 pages

SAMPLE DATA

A1 fx Fault ID

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Fault ID	Fault Type	Fault Loca	Voltage (\	Current (A	Power Loa	Temperat	Wind Spe	Weather (	Maintena	Compone	Duration (	Down time (hrs)	
2	F001	Line Break	(34.0522, -	2200	250	50	25	20	Clear	Scheduled	Normal	2	1	
3	F002	Transform	(34.056, -1	1800	180	45	28	15	Rainy	Complete	Faulty	3	5	
4	F003	Overheati	(34.0525, -	2100	230	55	35	25	Windstorr	Pending	Overheate	4	6	
5	F004	Line Break	(34.055, -1	2050	240	48	23	10	Clear	Complete	Normal	2.5	3	
6	F005	Transform	(34.0545, -	1900	190	50	30	18	Snowy	Scheduled	Faulty	3.5	4	
7	F006	Overheati	(34.05, -11	2150	220	52	32	22	Thunderst	Pending	Overheate	5	7	
8	F007	Line Break	(34.9449, -	1994	233	51	23	21	Snowy	Complete	Normal	3.7	6.1	
9	F008	Transform	(34.2294, -	2133	229	52	20	18	Snowy	Scheduled	Normal	5.4	2.1	
10	F009	Line Break	(34.1279, -	2155	240	45	21	29	Rainy	Pending	Overheate	3.2	4.7	
11	F010	Line Break	(34.4192, -	2065	199	55	25	21	Clear	Scheduled	Normal	4	2.8	
12	F011	Overheati	(34.3732, -	2118	221	45	20	20	Clear	Complete	Normal	4.9	1.9	
13	F012	Transform	(34.0465, -	2106	247	47	25	13	Clear	Complete	Normal	2.4	6.9	
14	F013	Line Break	(34.9687, -	2012	248	52	24	29	Clear	Complete	Faulty	3.9	6.4	
15	F014	Line Break	(34.3229, -	2289	192	52	35	28	Rainy	Scheduled	Normal	4.1	5.8	
16	F015	Line Break	(34.2256, -	1848	231	49	39	13	Rainy	Scheduled	Faulty	2.7	5	
17	F016	Transform	(34.7105, -	2102	246	53	38	18	Rainy	Complete	Faulty	3.5	1.9	

DATA INPUT



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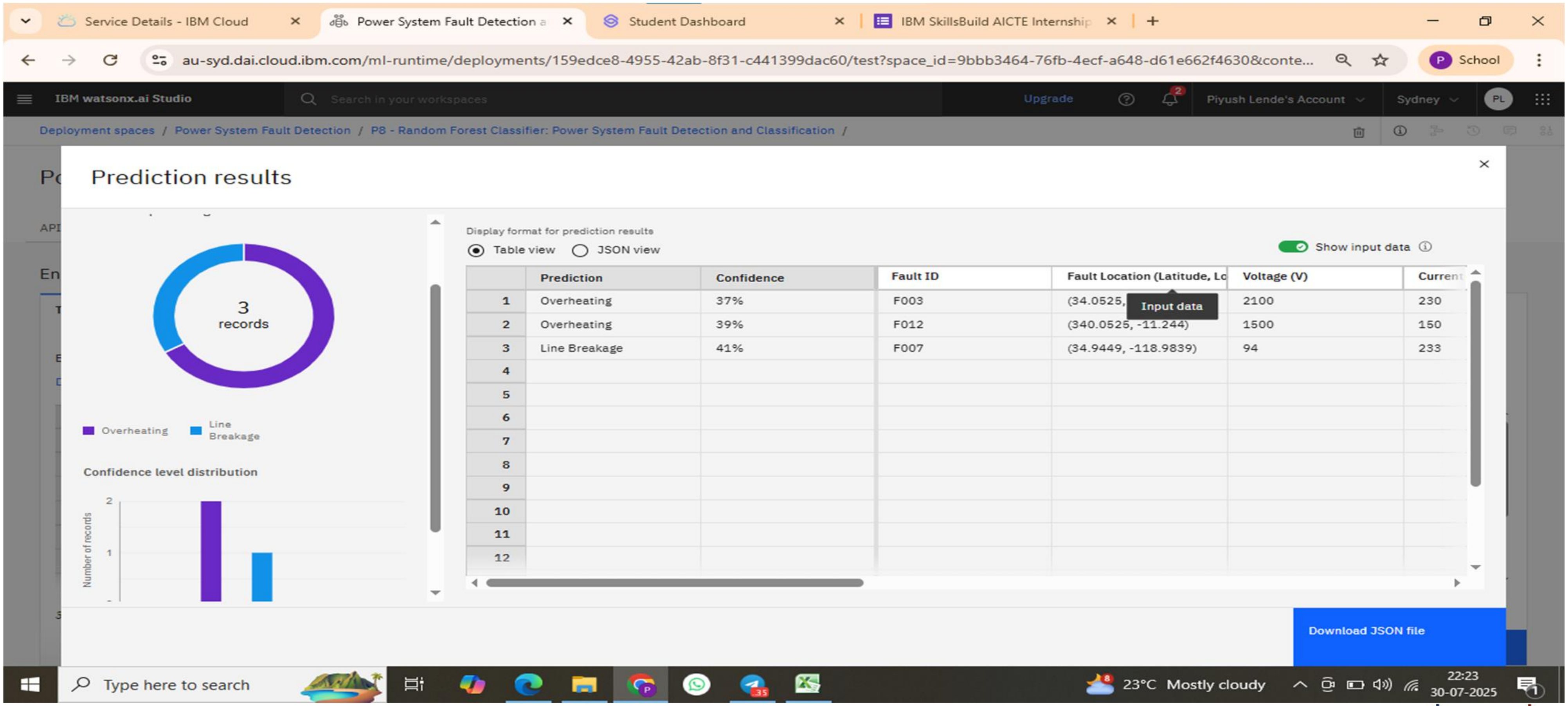
RESULT



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CONCLUSION

- The developed machine learning model effectively classifies power system faults with high accuracy.
- IBM Cloud's AutoAI and Watsonx.ai simplified the model creation and deployment process.
- The solution demonstrates how AI can improve fault monitoring and enhance power grid reliability.

FUTURE SCOPE

- Integrate real-time SCADA or PMU data from substations.
- Apply the solution to larger regional or national grid networks.
- Extend the model to predict fault location and severity.
- Use edge computing to enable faster response times in critical grid segments.

REFERENCES

- Kaggle Dataset: https://www.kaggle.com/datasets/ziya07/power-system-faults-dataset
- IBM Watsonx.ai Documentation: https://dataplatform.cloud.ibm.com
- Research papers on power system protection and ML
- IBM AutoAI Tutorial and Resources

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IBM CERTIFICATIONS

- Screenshot/ credly certificate(getting started with AI)

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IBM CERTIFICATIONS

- Screenshot/ credly certificate(Journey to Cloud)

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- Screenshot/ credly certificate(RAG Lab)

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THANK YOU