CAPSTONE PROJECT

POWER SYSTEM FAULT DETECTION AND CLASSIFICATION

– Presented By –

Student Name - Shivam Laxman Dhamankar
College Name - Wainganga College of Engineering, Nagpur
Department - Computer Science & Engineering

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OUTLINE

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PROBLEM STATEMENT

- Design 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).
- The objective is to enable rapid and accurate fault identification, which is crucial for maintaining power grid stability and reliability.

PROPOSED SOLUTION

- Fault Pattern Analysis :-

  1) Use clustering (e.g., K-Means) on fault types with environmental and load data to identify risk zones.

  2) Analyze correlation between high temperature, load, and specific fault types (e.g., Overheating).

- Predictive Maintenance System :-

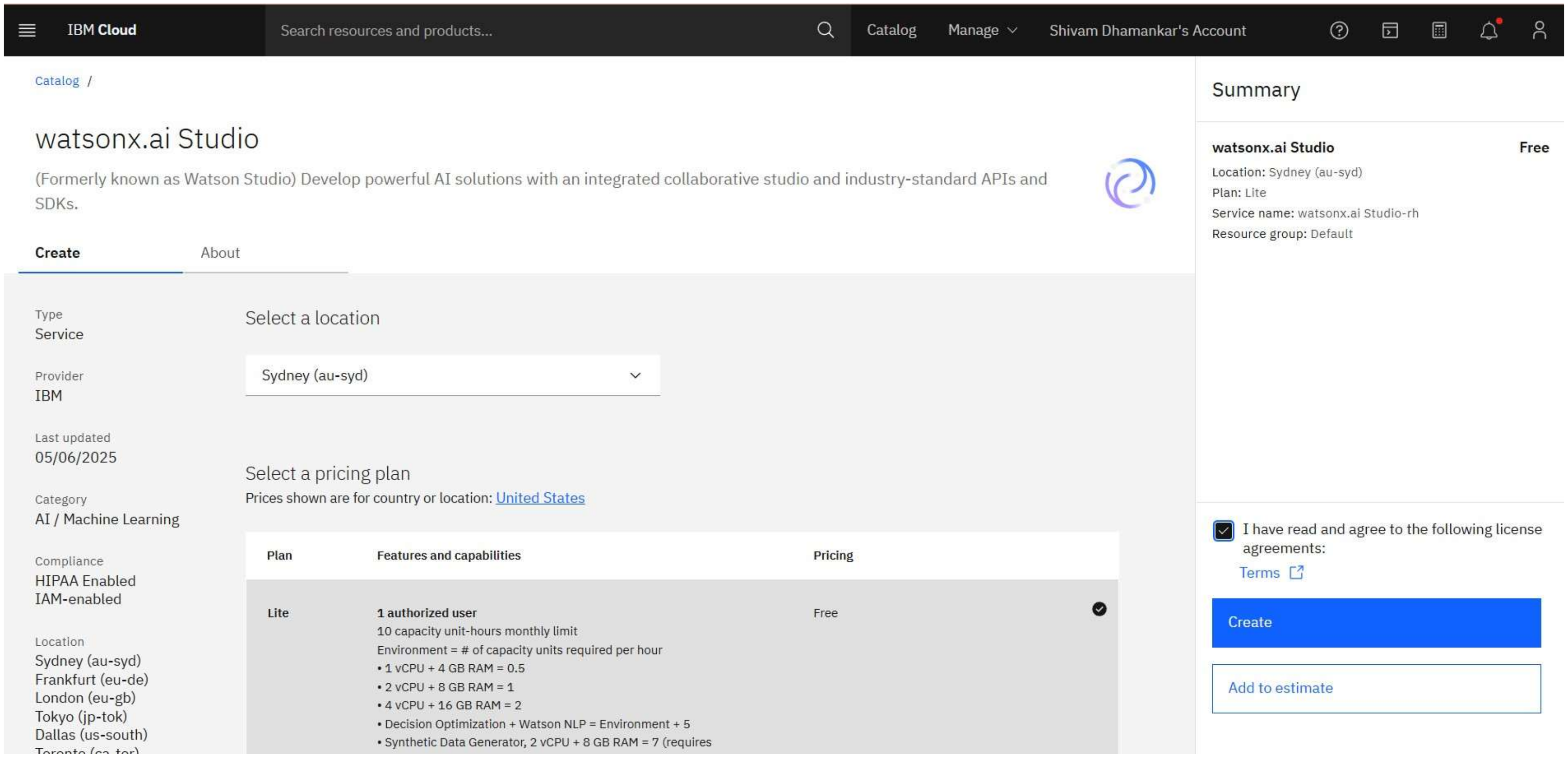
  1) Train a classification model using features like temperature, current, and component health to predict fault likelihood.

  2) Use anomaly detection for identifying abnormal readings.

SYSTEM APPROACH

- IBM Cloud Lite Services
- Watsonx AI Studio (Service)
- Watson.ai Runtime
- IBM Cloud Object Storage
- IBM Cloud Tools (Auto AI)
- Windows 11

PROCESS (AUTO AI)



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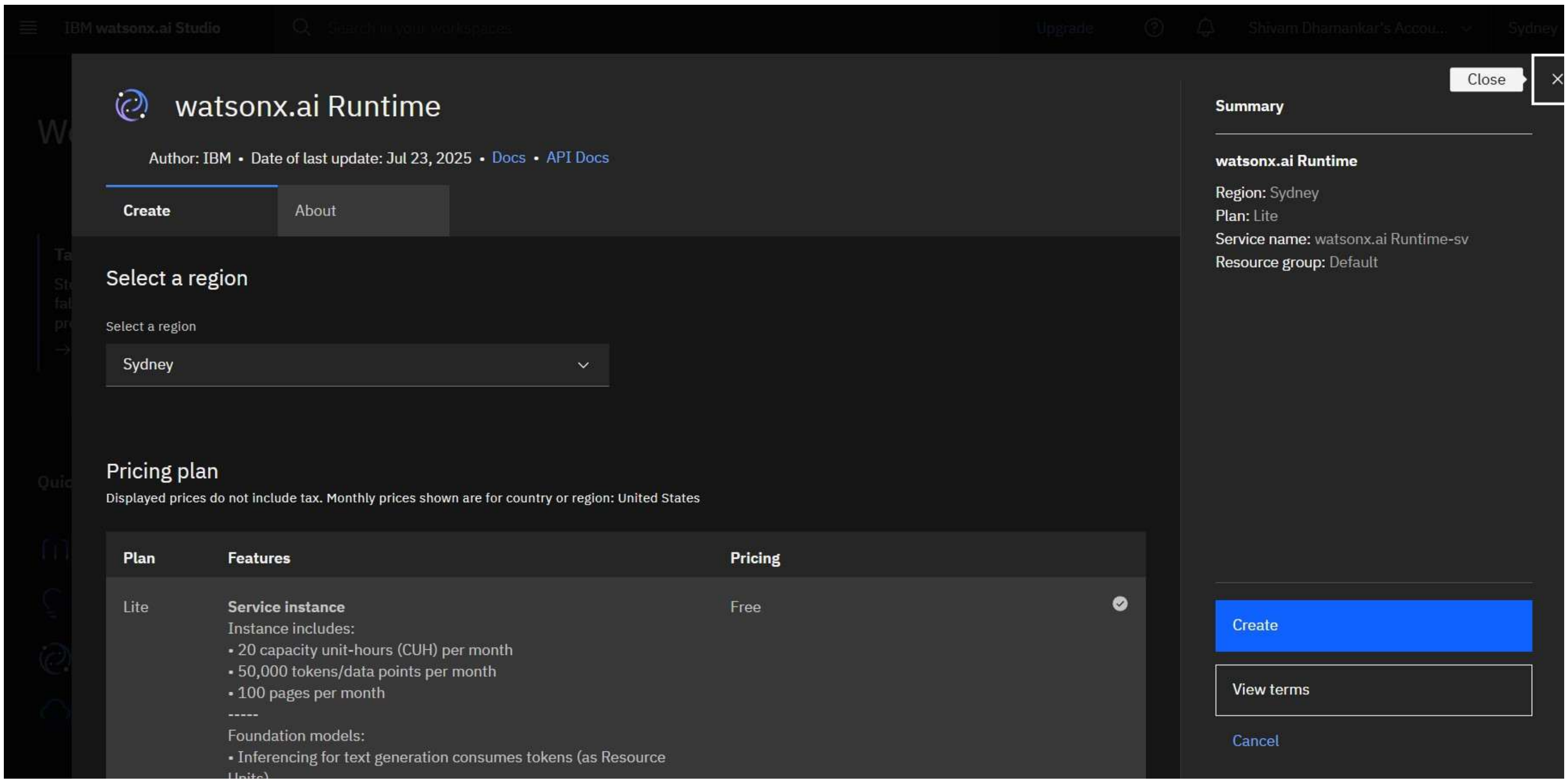

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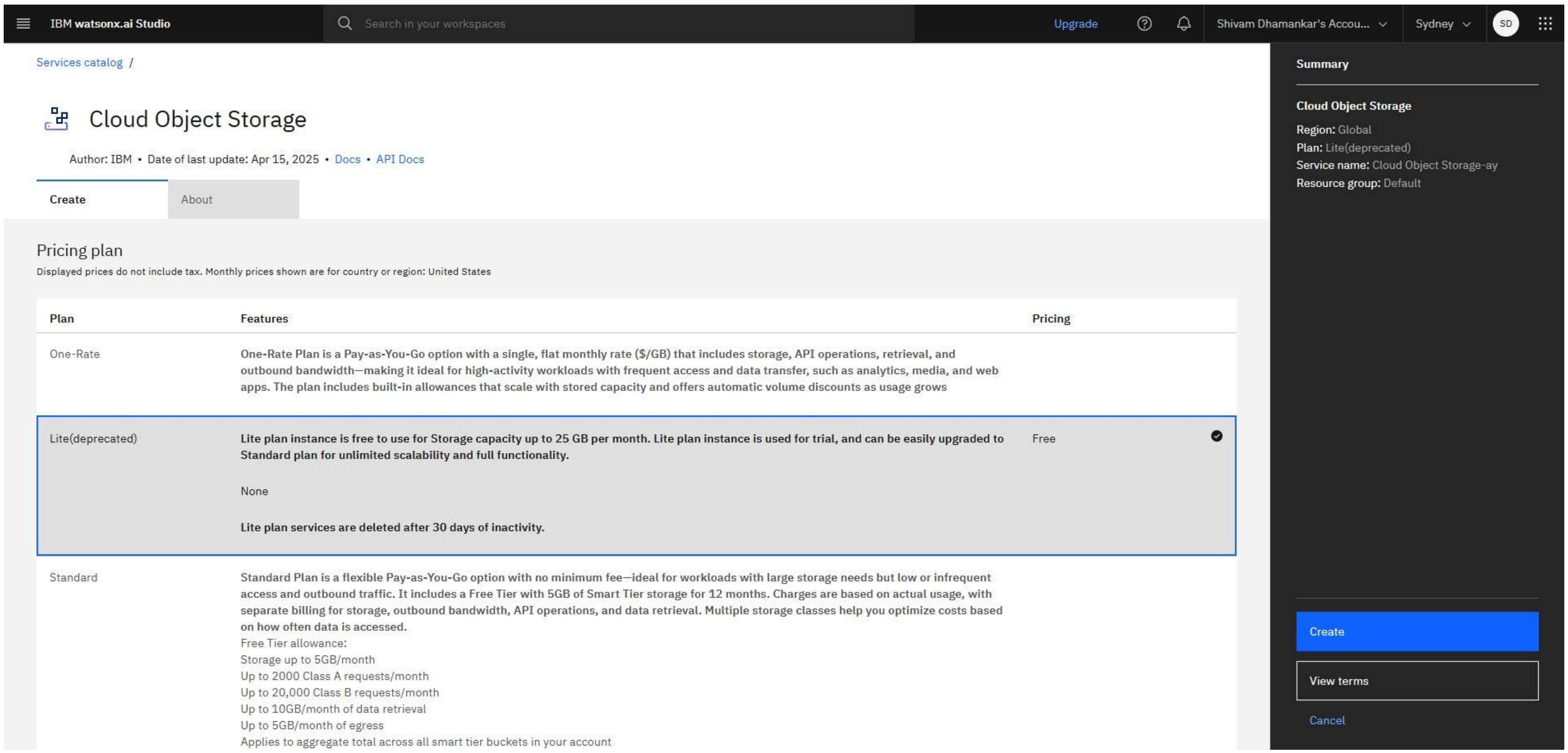

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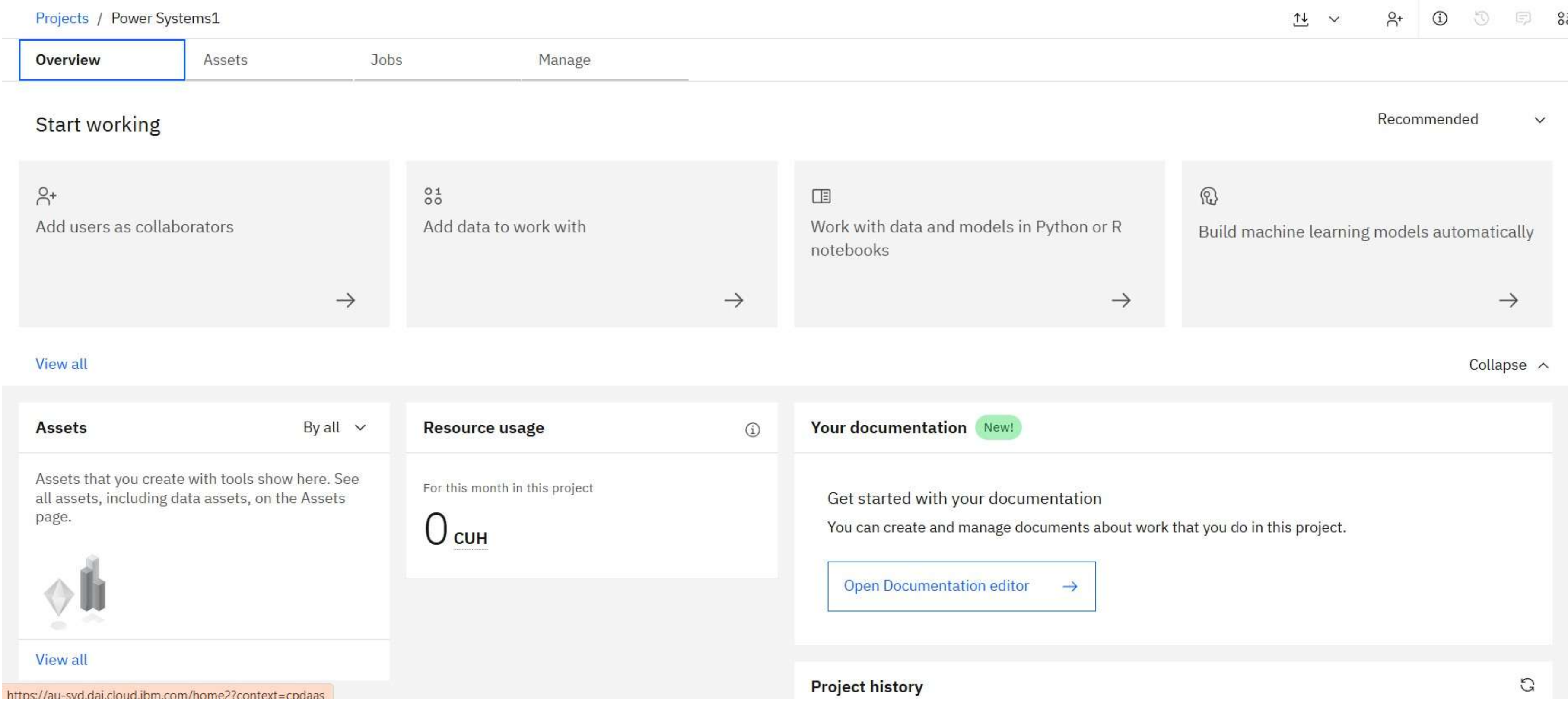

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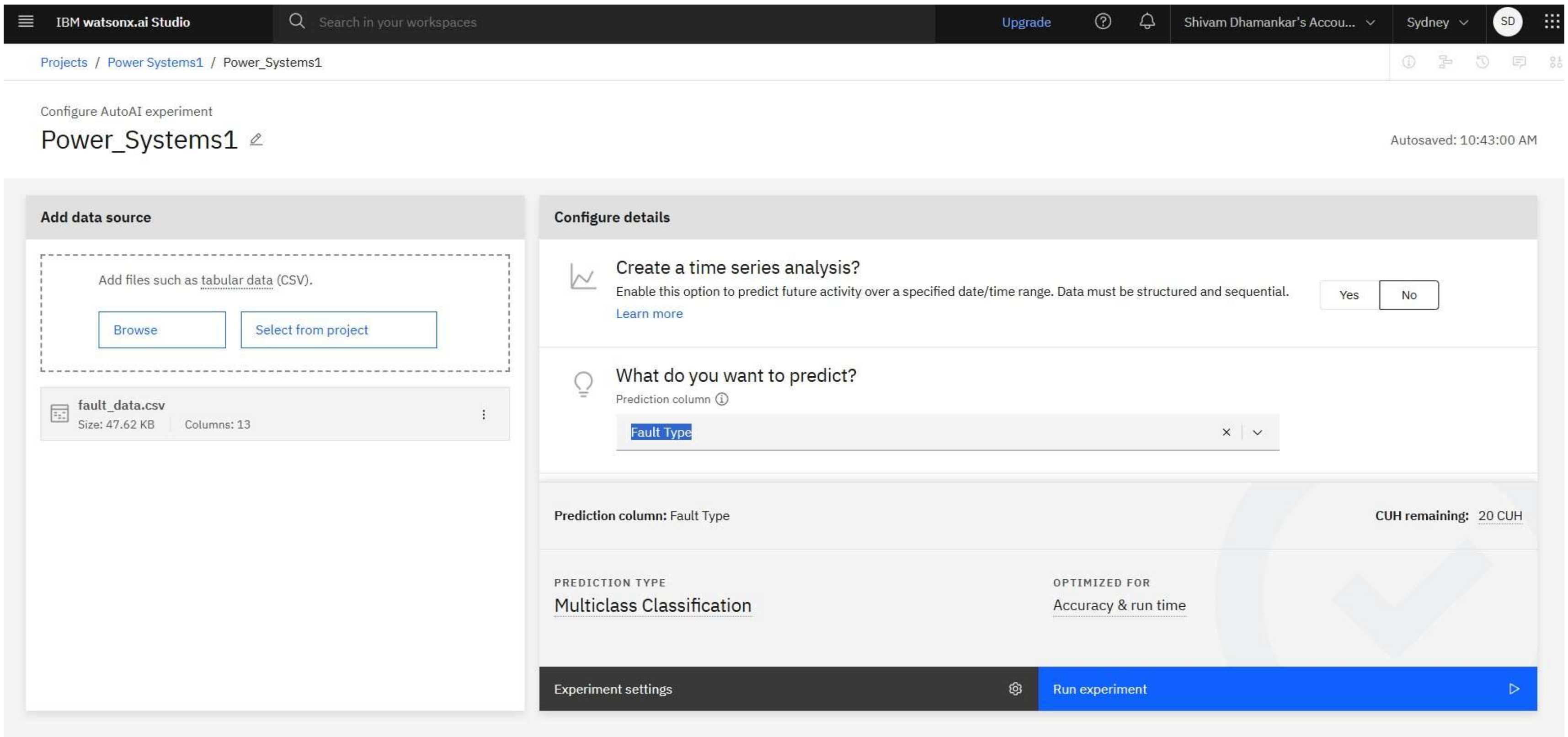

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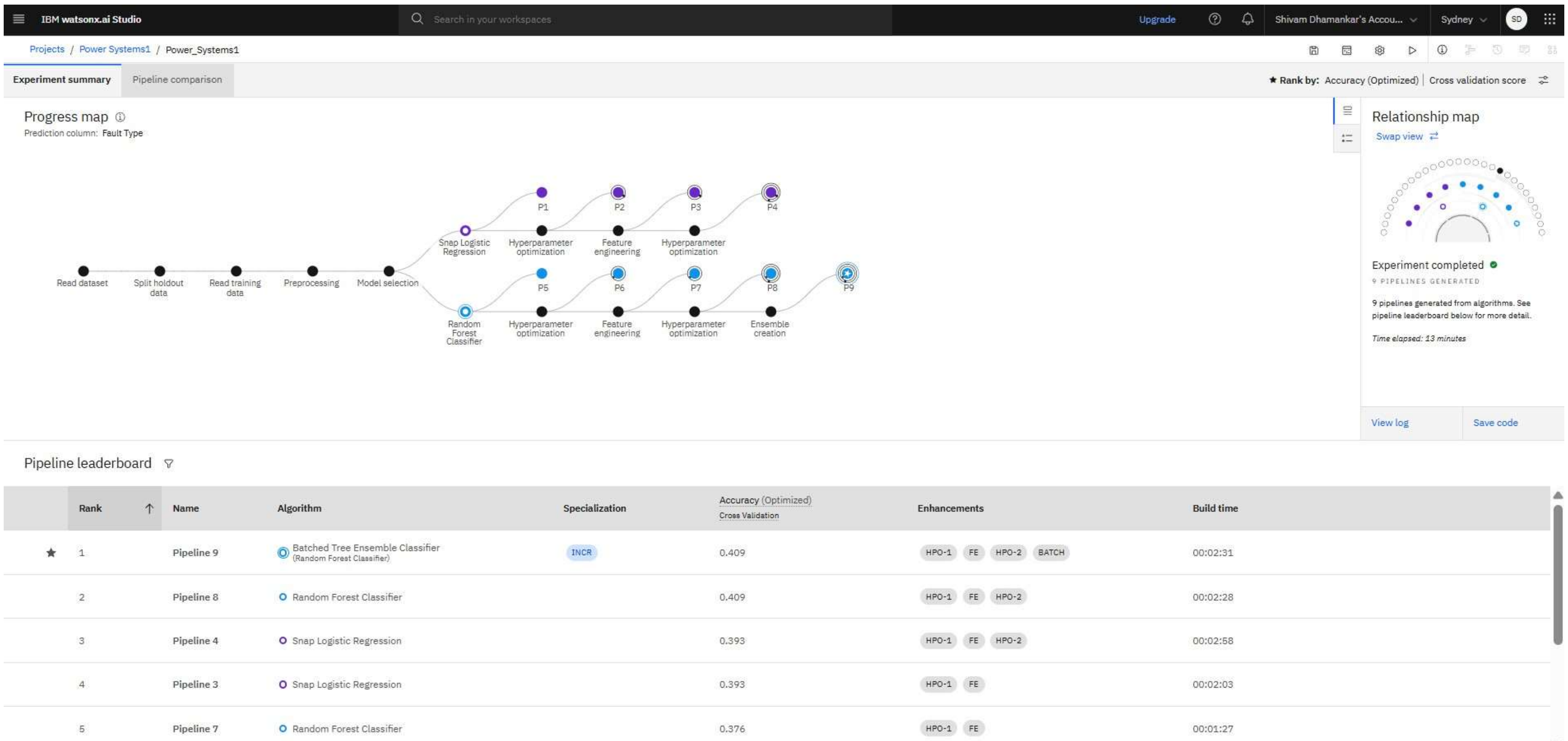

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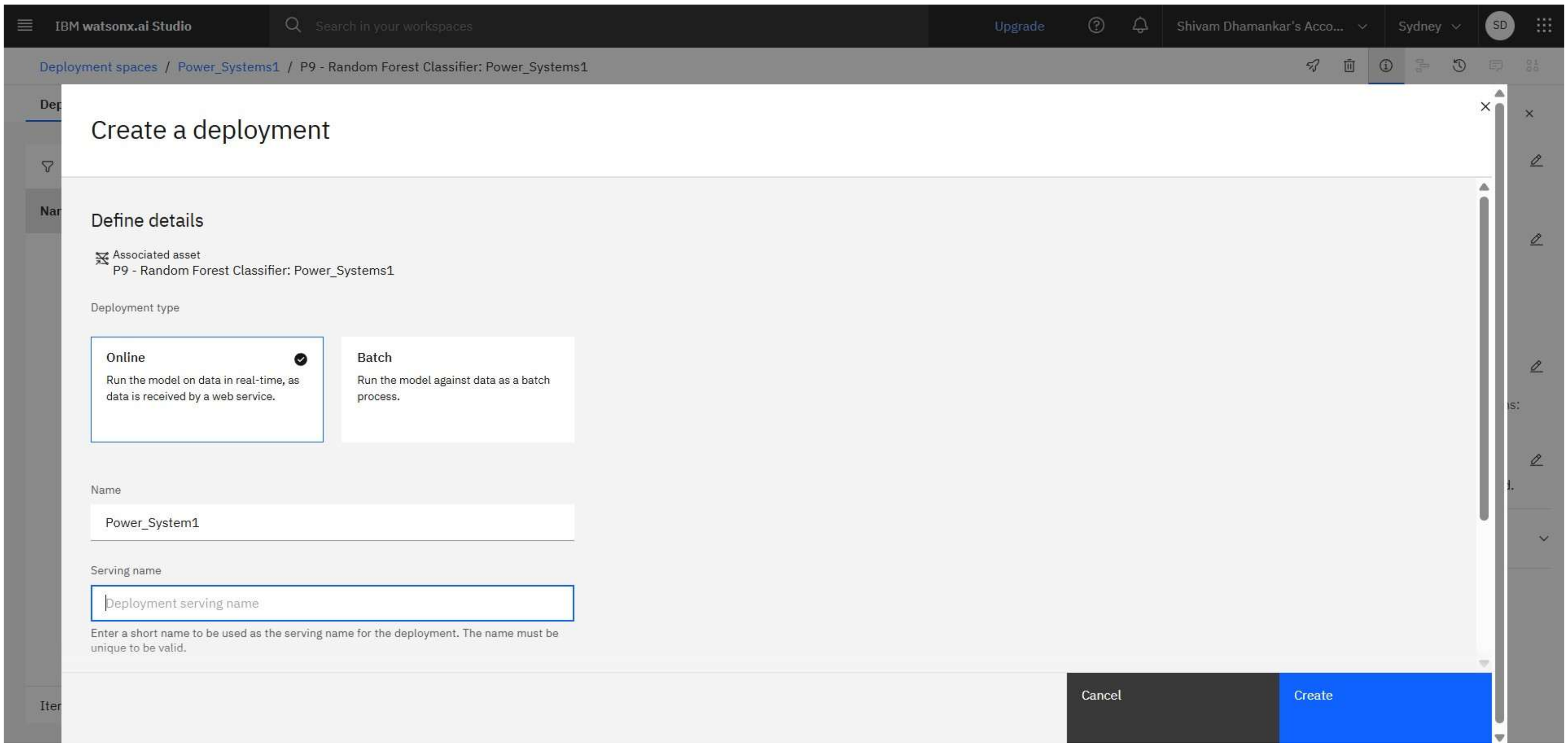
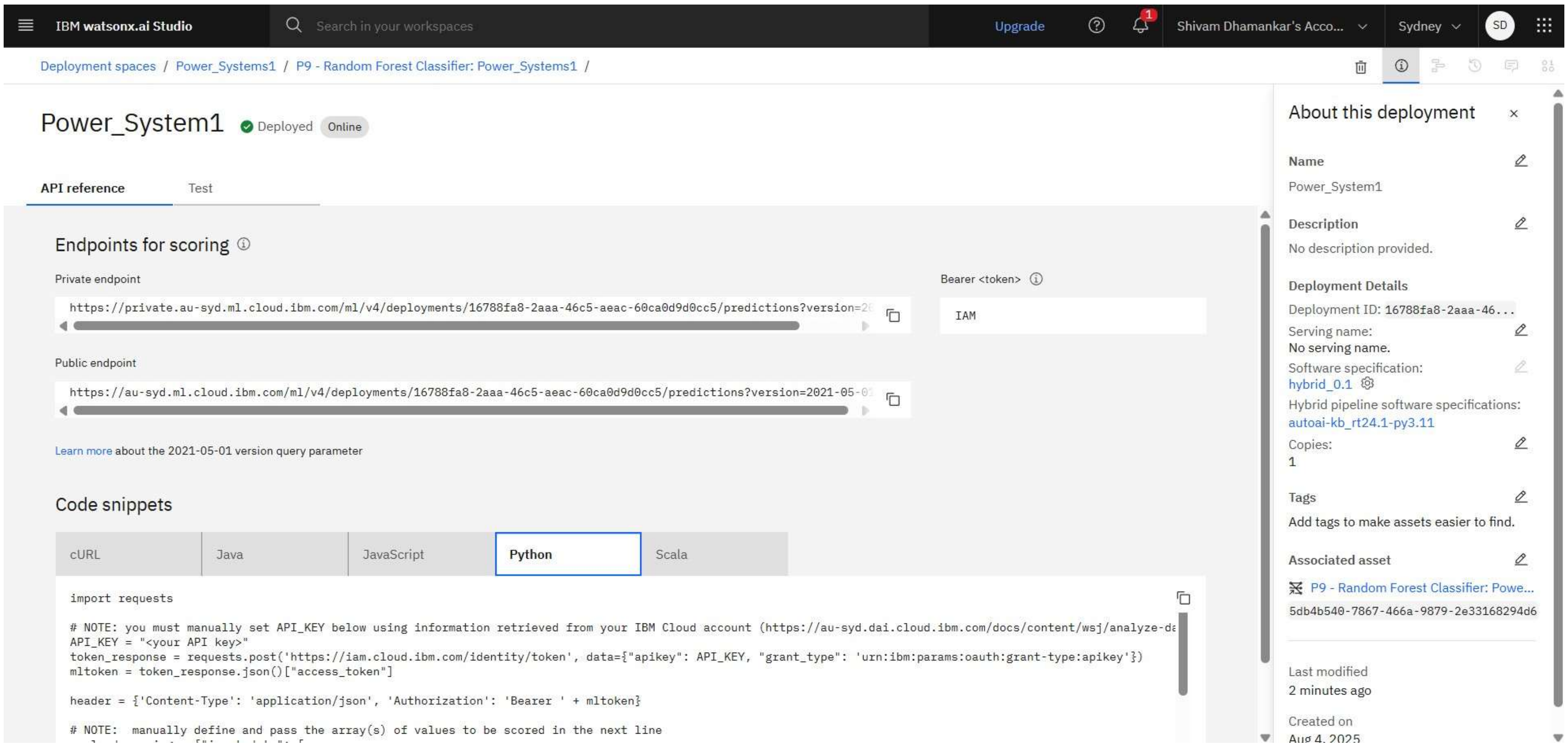
DEPLOYMENT


IBM watsonx.ai Studio
Search in your workspaces
Upgrade
Shivam Dhamankar's Acco...
Sydney
SD
Deployment spaces / Power_Systems1 / P9 - Random Forest Classifier: Power_Systems1
Create a deployment
Define details
Associated asset
P9 - Random Forest Classifier: Power_Systems1
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
Power_System1
Serving name
Deployment serving name
Enter a short name to be used as the serving name for the deployment. The name must be unique to be valid.
Cancel
Create



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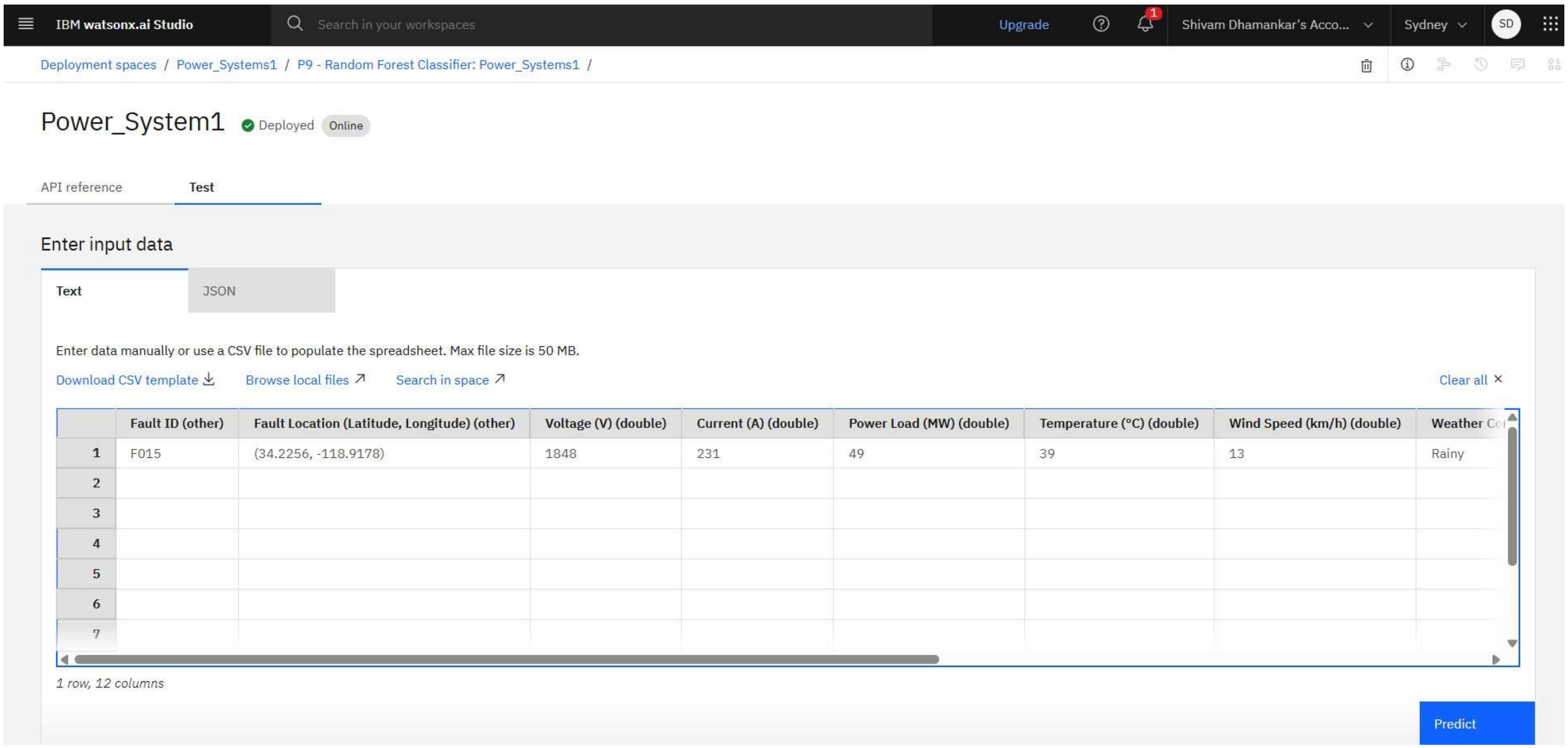
RESULT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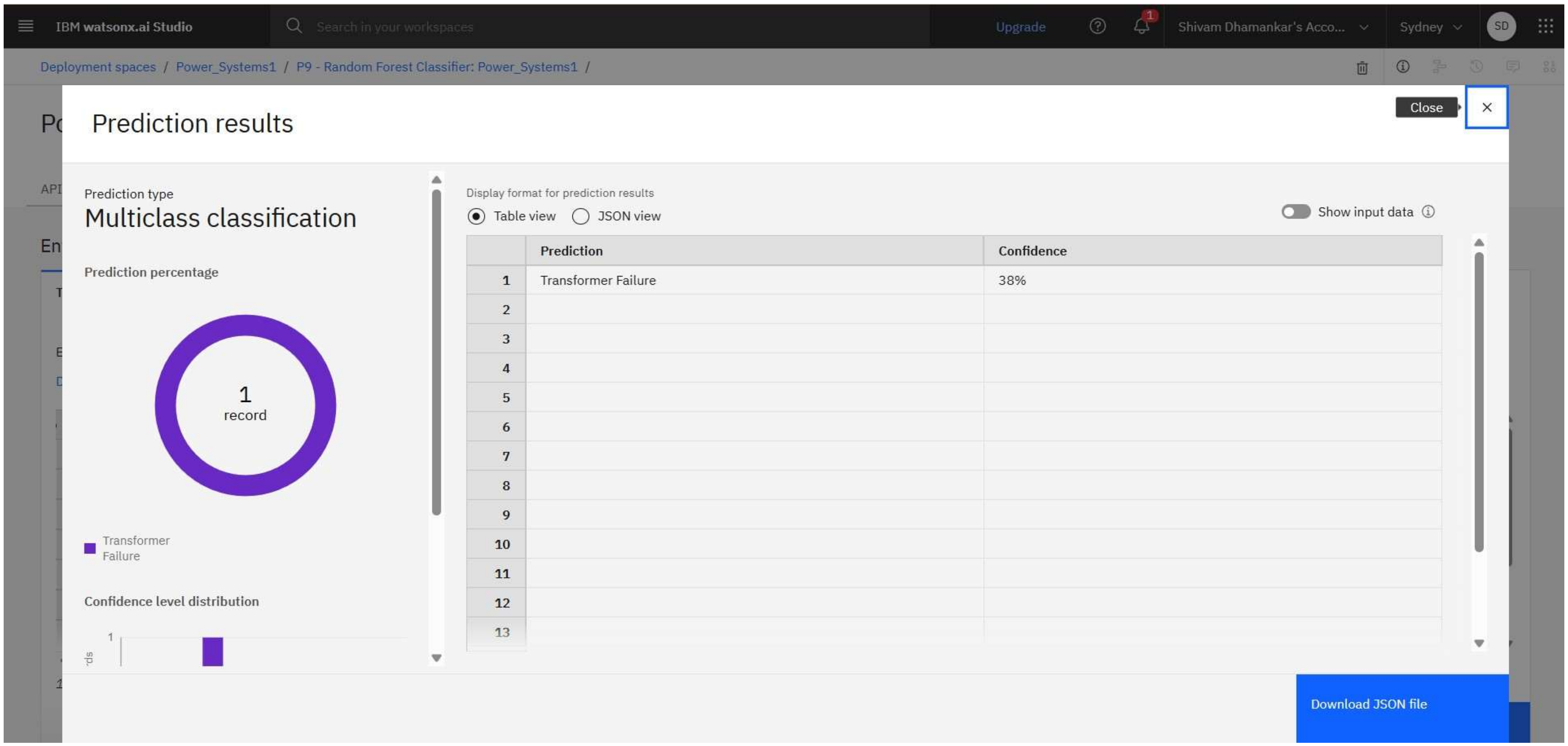
Deployment spaces / Power_Systems1 / P9 - Random Forest Classifier: Power_Systems1 /
Power_System1
Deployed
Online
API reference
Test
Enter input data
Text
JSON
Enter data manually or use a CSV file to populate the spreadsheet. Max file size is 50 MB.
Download CSV template
Browse local files
Search in space
Clear all
Fault ID (other)
Fault Location (Latitude, Longitude) (other)
Voltage (V) (double)
Current (A) (double)
Power Load (MW) (double)
Temperature (°C) (double)
Wind Speed (km/h) (double)
1
F015
(34.2256, -118.9178)
1848
231
49
39
13
Rainy
2
3
4
5
6
7
1 row, 12 columns
Predict



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Sydney
SD
Deployment spaces / Power_Systems1 / P9 - Random Forest Classifier: Power_Systems1 /
Prediction results
Close
Prediction type
Multiclass classification
Prediction percentage
1
record
Transformer
Failure
Confidence level distribution
Display format for prediction results
Table view
JSON view
Show input data
Prediction
Confidence
1
Transformer Failure
38%
2
3
4
5
6
7
8
9
10
11
12
13
Download JSON file

CONCLUSION

- In this project, a machine learning-based approach was designed and implemented to rapidly detect and classify faults in a power distribution system using electrical measurement data, such as voltage and current phasors.

- The model was trained to distinguish between normal operation and various types of faults — including line-to-ground (LG), line-to-line (LL), double line-to-ground (LLG), and three-phase faults (LLL, LLLG).

- These measurements serve as critical indicators of the operating state of power systems and are essential for making timely decisions during fault conditions.

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FUTURE SCOPE

- The future of power system fault detection lies in the integration of intelligent, adaptive, and explainable ML solutions that operate in real-time, across distributed networks, and in concert with other smart grid technologies.

- By extending the model's scope to include localization, adaptive learning, real-time deployment, and cybersecurity, this research can play a foundational role in building the next-generation resilient and intelligent power grid.

- Fault Localization

REFERENCES

- IBM Cloud - https://cloud.ibm.com/
- Watsonx AI Studio – https://cloud.ibm.com/catalog/services/watsonxai-studio
- Data Sets - https://www.kaggle.com/datasets/ziya07/power-system-faults-dataset

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IBM **SkillsBuild** Completion Certificate

This certificate is presented to

Shivam Dhamankar

for the completion of

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(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 24 Jul 2025 (GMT)

Learning hours: 20 mins

THANK YOU

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