
CAPSTONE PROJECT

FAULT DETECTION

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Electronics and Telecommunication

OUTLINE

- Problem Statement
- Technology used
- Wow factor
- End users
- Result
- Conclusion
- Git-hub Link
- Future scope
- IBM Certifications

PROBLEM STATEMENT

- Power distribution systems are critical infrastructures that must operate reliably to ensure continuous delivery of electricity. However, these systems are prone to various types of faults, such as line-to-ground, line-to-line, or three-phase faults, which can lead to outages, equipment damage, and safety hazards. Detecting and classifying these faults quickly and accurately is essential to maintain power grid stability and prevent system failures.
- Proposed Solution:
Develop a Machine Learning model that leverages electrical measurement data—such as voltage, current, and phasors—to automatically detect and classify different types of power system faults. The model will distinguish between normal operating conditions and various fault scenarios, enabling rapid response and proactive maintenance.
Deployment will be done using IBM Cloud Lite services, ensuring scalability and real-time monitoring capabilities.

TECHNOLOGY USED

IBM cloud lite services

IBM Cloud auto Ai

IBM CLOUD SERVICES USED

- IBM Cloud Watsonx AI Studio
- IBM Cloud Watsonx AI runtime
- IBM Cloud Agent Lab

WOW FACTORS

This system will significantly enhance the reliability and resilience of power distribution networks by enabling early and accurate fault detection. It helps utilities and operators prevent outages, reduce downtime, and ensure uninterrupted power supply by enabling proactive fault management.

- **Unique features:**
- Real-time monitoring and detection of electrical faults using sensor data
- Automatic classification of fault types (line-to-ground, line-to-line, and three-phase faults)
- High-accuracy machine learning model trained on realistic electrical measurement data
- Fast response time reduces equipment damage and repair costs
- Cloud-based deployment using IBM Cloud Lite for scalability and remote access
- Easy integration with SCADA and other grid management systems
- Supports predictive maintenance strategies for smarter power grid operations

END USERS

- Power Utility Companies
- Grid Operators and Substation Engineers
- Smart Grid Solution Providers
- Energy Management System Developers
- Electrical Maintenance Teams
- Industrial Automation Companies
- Government Energy Departments
- Academic and Industry Researchers


SETTING UP

Resource list /

watsonx.ai Studio-gu ✓ [Add tags](#) [✎](#) [Details](#) [Actions](#) ▼

Manage

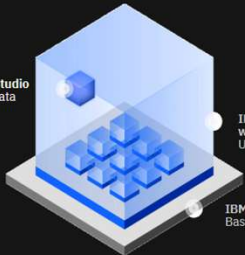
Plan



watsonx.ai Studio in Cloud Pak for Data and watsonx

Build and deploy machine learning models on either platform. Work with foundation models on watsonx as a Service.

[Launch in](#) ▼



IBM watsonx.ai Studio in Cloud Pak for Data and watsonx

IBM Cloud Pak for Data, watsonx Unifying platforms

IBM Cloud Base cloud infrastructure

IBM watsonx.ai Studio is part of IBM Cloud Pak for Data and watsonx, and serves as the AI capability of the data fabric architecture.

Helpful links

Documentation

Learn about tools, features, and how to perform a wide variety of Data and AI tasks.

[Cloud Pak for Data](#) →

Learning path

Start a step-by-step tutorial to get up and running quickly.

[Cloud Pak for Data](#) →

Videos

Watch videos to learn about watsonx.ai Studio.

[Cloud Pak for Data](#) →

CONFIGURE AUTO AI

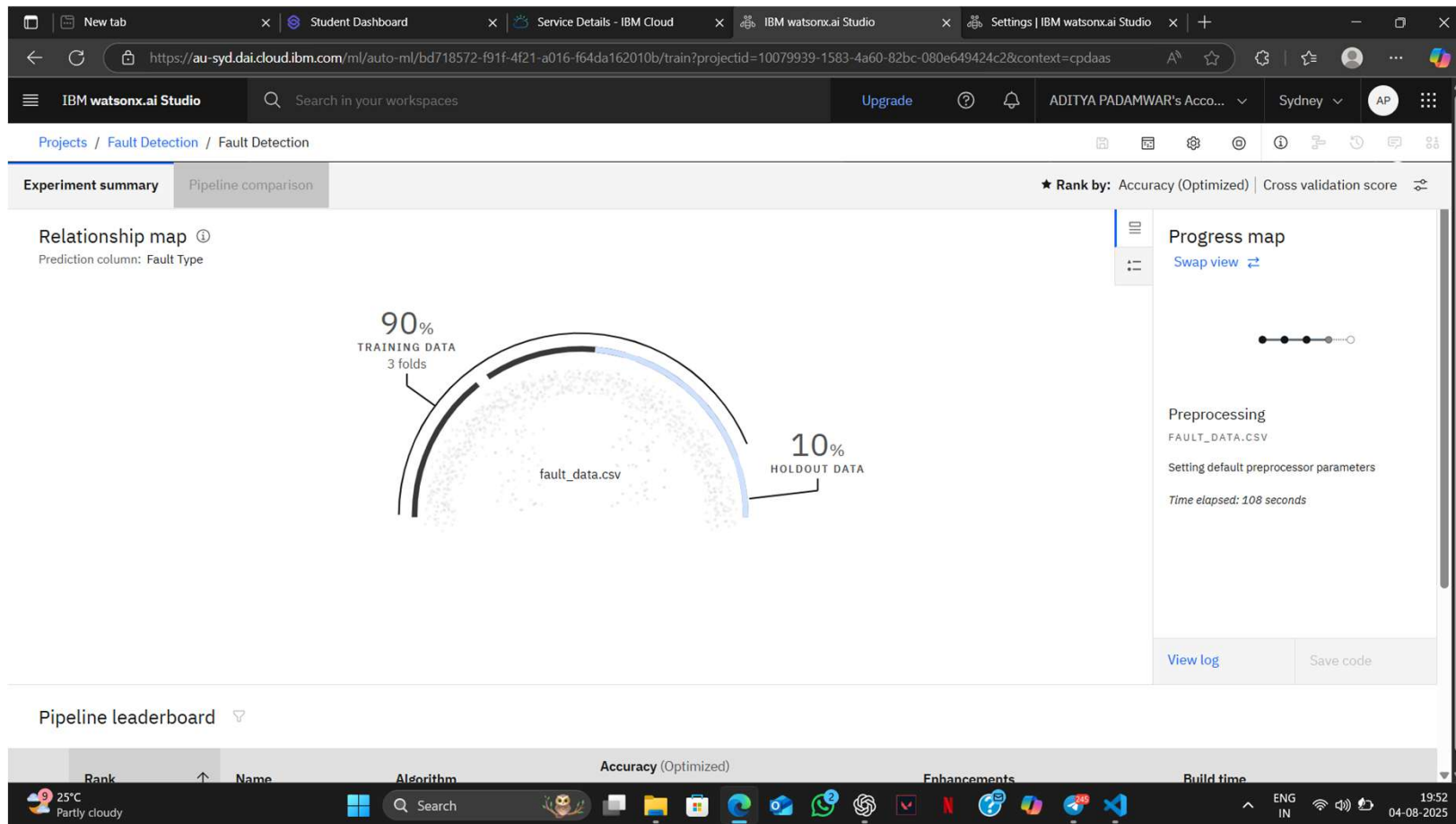
The screenshot displays the IBM Watson AI Studio interface for configuring an AutoAI experiment. The browser tabs include 'New tab', 'Student Dashboard', 'Service Details - IBM Cloud', 'Fault Detection — Fault Detection', and 'Settings | IBM watsonx.ai Studio'. The URL is <https://au-syd.dai.cloud.ibm.com/ml/auto-ml/bd718572-f91f-4f21-a016-f64da162010b/configure?projectId=10079939-1583-4a60-82bc-080e649424c2&context=cpdaas>. The page title is 'Configure AutoAI experiment' and the experiment name is 'Fault Detection'. The status 'Autosaved: 7:50:05 pm' is shown in the top right.

The interface is divided into two main sections:

- Add data source:** This section allows adding files as tabular data (CSV). It includes a 'Browse' button and a 'Select from project' button. Below this, a file named 'fault_data.csv' is listed with a size of 47.62 KB and 13 columns.
- Configure details:** This section contains several configuration options:
 - Enable this option to predict future activity over a specified date/time range. Data must be structured and sequential.** This option is currently set to 'No'.
 - What do you want to predict?** The 'Prediction column' is set to 'Fault Type'.
 - Prediction column:** 'Fault Type'.
 - CUH remaining:** 20 CUH.
 - PREDICTION TYPE:** 'Multiclass Classification'.
 - OPTIMIZED FOR:** 'Accuracy & run time'.

At the bottom, there is a 'Run experiment' button. The Windows taskbar at the bottom shows the system clock as 19:50 on 04-08-2025, with a temperature of 25°C and 'Partly cloudy' weather.

PIPELINE CREATION



MODEL CREATED

The screenshot displays the IBM Watson AI Studio interface. The top navigation bar includes the 'IBM watsonx.ai Studio' logo and a search bar. The breadcrumb trail indicates the current location: 'Deployment spaces / Fault Detection System / P9 - Random Forest Classifier: Fault Detection /'. The main content area is titled 'Fault Detection' and shows the model is 'Deployed' and 'Online'. Below this, there are tabs for 'API reference' and 'Test'. The 'API reference' tab is active, showing 'Endpoints for scoring' with private and public endpoints, and a 'Code snippets' section with a cURL example. A right-hand sidebar titled 'About this deployment' provides details such as the deployment ID, serving name, software specification, and associated asset. The bottom of the image shows a Windows taskbar with various application icons and system status information.

Deployment spaces / Fault Detection System / P9 - Random Forest Classifier: Fault Detection /

Fault Detection

Deployed Online

API reference Test

Endpoints for scoring

Private endpoint

Bearer <token>

https://private.au-syd.ml.cloud.ibm.com/ml/v4/deployments/0ec13077-fbe7-496f-896c-a112073123eb/predictions?version=2021-05-01

Public endpoint

https://au-syd.ml.cloud.ibm.com/ml/v4/deployments/0ec13077-fbe7-496f-896c-a112073123eb/predictions?version=2021-05-01

Learn more about the 2021-05-01 version query parameter

Code snippets

cURL

```
# NOTE: you must set $API_KEY below using information retrieved from your IBM Cloud account (https://au-syd.dai.cloud.ibm.com/docs/content/1)
export API_KEY=<your API key>

export IAM_TOKEN=$(curl --insecure -X POST --location "https://iam.cloud.ibm.com/identity/token" \
--header "Content-Type: application/x-www-form-urlencoded" \
```

About this deployment

Name: Fault Detection

Description: No description provided.

Deployment Details

Deployment ID: 0ec13077-fbe7-49...

Serving name: No serving name.

Software specification: hybrid_0.1

Hybrid pipeline software specifications: autoai-kb_rt24.1-py3.11

Copies: 1

Tags: Add tags to make assets easier to find.

Associated asset: P9 - Random Forest Classifier: Fault ...

Last modified

TESTING

 IBM watsonx.ai Studio

 Search in your workspaces

Upgrade



 1

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Sydney ▾

AP



Deployment spaces / Fault Detection System / P9 - Random Forest Classifier: Fault Detection /

Fault Detection ✔ 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](#) 

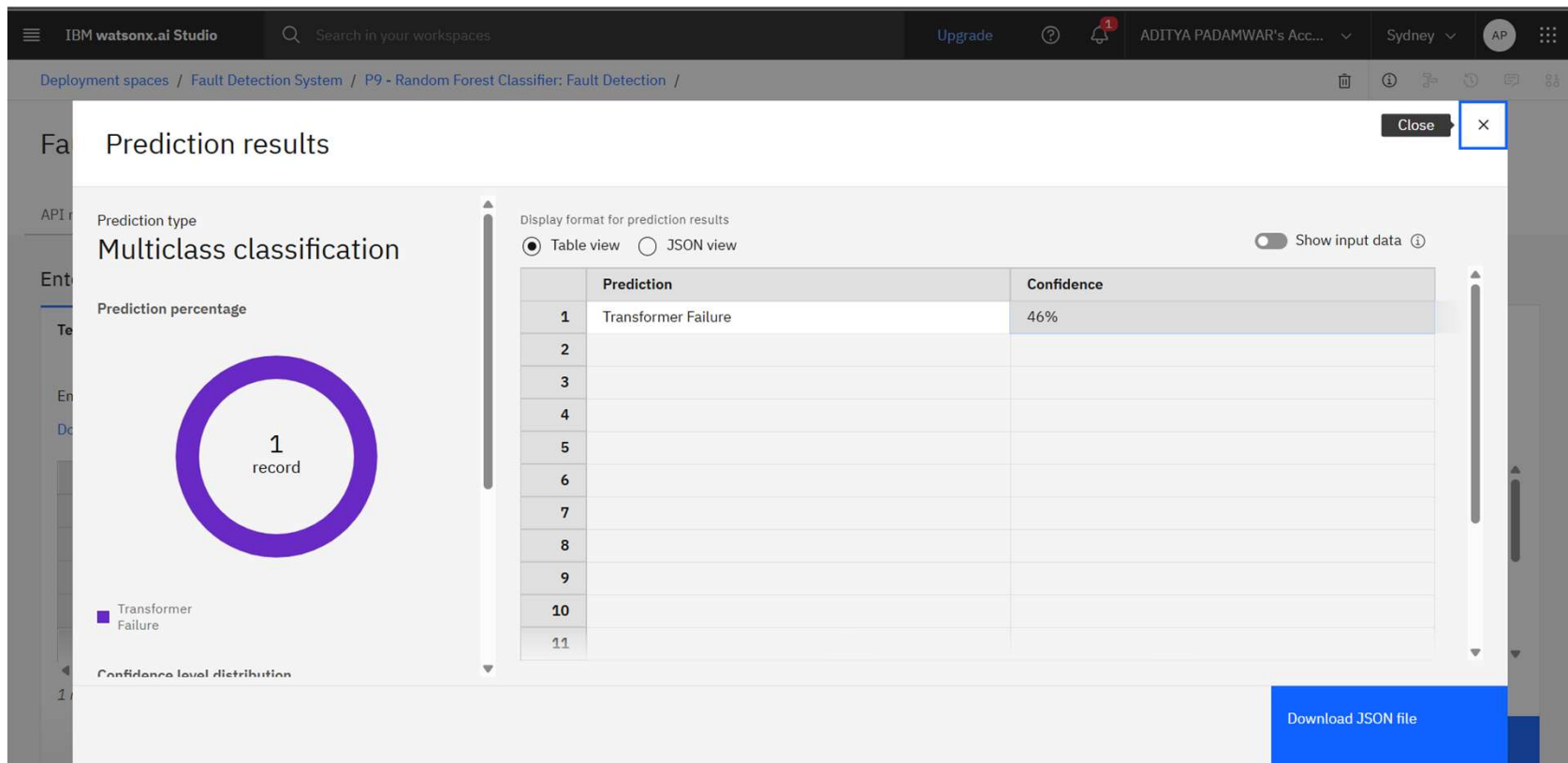
[Clear all](#) 

	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	F008	(34.2294, -118.2988)	2133	229	52	0	18
2							
3							
4							
5							

1 row, 12 columns

Predict

RESULTS



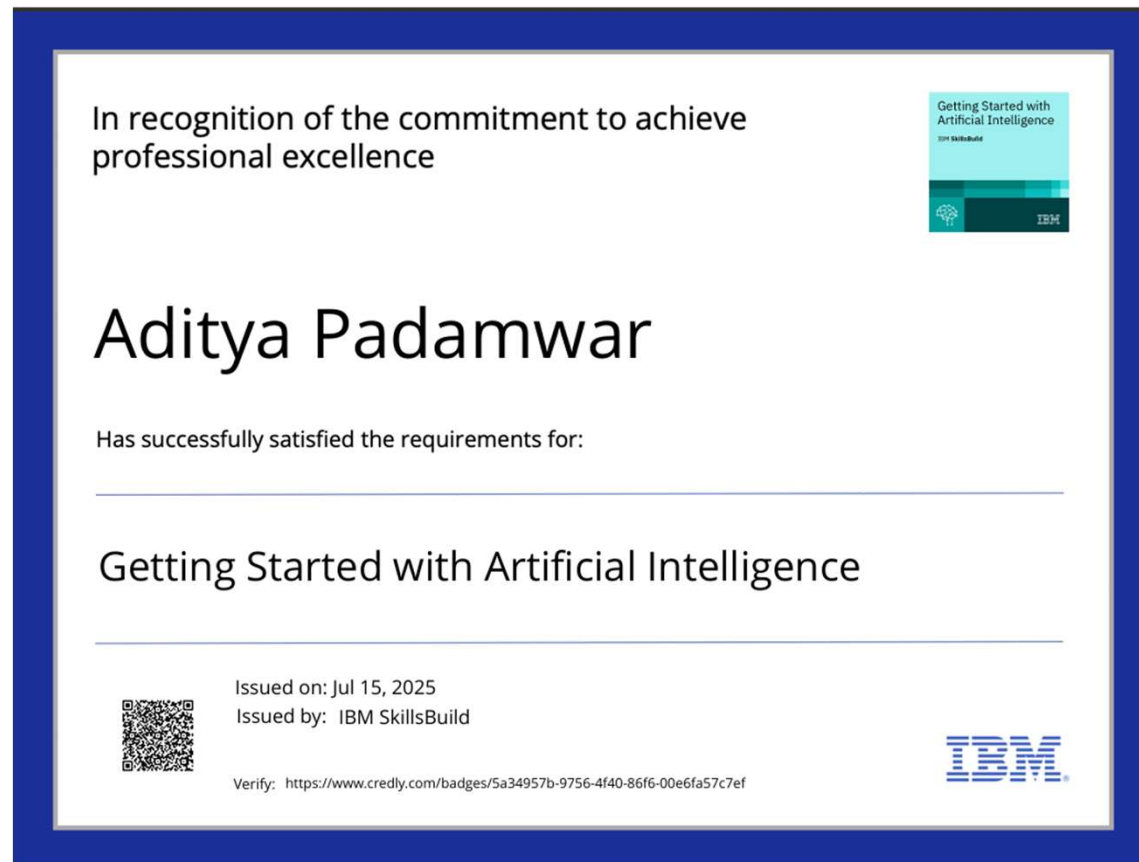
CONCLUSION

- The proposed system can detect and classify electrical faults in real-time, helping utilities maintain consistent power delivery.
- It reduces downtime and equipment damage by enabling fast and accurate fault identification.
- Automating fault detection improves overall system efficiency and reliability in both industrial and utility environments.
- This ML-based solution supports the future of smart grids by integrating predictive maintenance and intelligent automation.

FUTURE SCOPE

- Integration with IoT-enabled smart meters for edge-level fault detection
- Deployment on 5G-enabled smart grid infrastructure for ultra-fast response
- Use of Deep Learning for more complex fault pattern recognition
- Expansion to cover predictive analytics for equipment lifespan estimation
- Real-time integration with emergency response systems
- Visualization dashboards for dynamic fault mapping and analytics
- Incorporation of weather and environmental data for enhanced prediction

IBM CERTIFICATIONS



IBM CERTIFICATIONS



IBM **SkillsBuild**

Completion Certificate



This certificate is presented to
ADITYA PADAMWAR

for the completion of

**Lab: Retrieval Augmented Generation with
LangChain**

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 21 Jul 2025 (GMT)

Learning hours: 20 mins

GITHUB LINK

- <https://github.com/Adiii230806/Fault-Detection-System.git>

THANK YOU