
CAPSTONE PROJECT

POWER SYSTEM FAULT DETECTION AND CLASSIFICATION

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

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

- Develop a machine learning model that classifies power system faults using the dataset provided. The model will process electrical measurements to identify the type of fault rapidly and accurately. This classification will help automate fault detection and assist in quicker recovery actions, ensuring system reliability.
- Data Collection:
 - Use the Kaggle dataset on power system faults.
- Data Preprocessing:
 - Clean and preprocess the collected data to handle missing values, outliers, and inconsistencies.
- Model Training : Train a classification model (e.g.. Decision Tree, Random Forest, or SVM)
- Evaluation:
 - Validate the model using accuracy, precision, recall, and F1-score.

SYSTEM APPROACH

The "System Approach" section outlines the overall strategy and methodology for developing and implementing the rental bike prediction system. Here's a suggested structure for this section:

- System requirements:
 - IBM Cloud (mandatory)
 - IBM Watson Studio for model development and Deployment
 - IBM Cloud object storage for dataset handling

ALGORITHM & DEPLOYMENT

- In the Algorithm section, describe the machine learning algorithm chosen for predicting bike counts. Here's an example structure for this section:
- **Algorithm Selection:**
 - Batched Tree Ensemble Classifier(RFC) for better accuracy and Enhancements like HPO 1&2, FE, BATCH
- **Data Input:**
 - Voltage, Current and measurements from the dataset
- **Training Process:**
 - Supervised learning using labelled fault types
- **Prediction Process:**
 - Model deployed on IBM Watson Studio with API endpoint for real time predictions

RESULT

IBM watsonx.ai Studio

Search in your workspaces

Upgrade


Sagar Chhatani's Account

Sydney

SC

Projects / fault

Import data files



Drop data files here or browse for files to upload

Add files as data assets

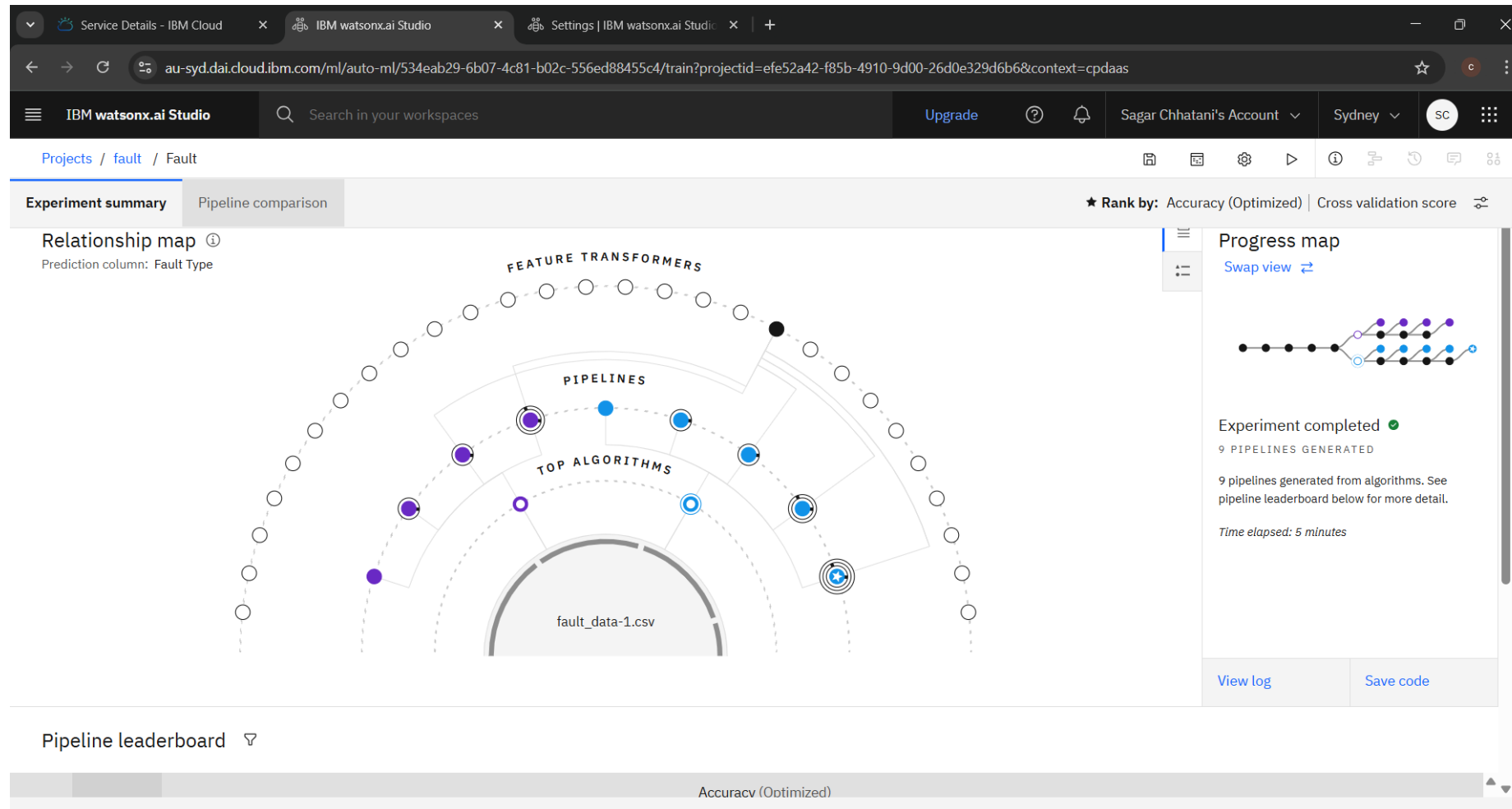
Browse

Name	File size	Status
fault_data.csv	47.62 KB	100% Completed

Back

Done

RESULT



RESULT

The screenshot displays the IBM Watsonx.ai Studio interface. At the top, there's a navigation bar with tabs for 'Service Details - IBM Cloud', 'IBM watsonx.ai Studio', and 'Settings | IBM watsonx.ai Studio'. The main header shows the project name 'Projects / fault / Fault' and a search bar. Below this, there's a 'Pipeline comparison' section with a visual diagram of a pipeline. The diagram shows a flow from 'fault_data-1.csv' through various steps, with a 'Batched Ensemble' step highlighted. A tooltip for 'Batched Ensemble' states: 'This pipeline supports training with batches of data in a notebook.' Below the diagram is a 'Pipeline leaderboard' table.

Rank	Name	Algorithm	Specialization	Accuracy (Optimized) Cross Validation	Enhance	Time elapsed	Actions
★ 1	Pipeline 9	Batched Tree Ensemble Classifier (Random Forest Classifier)	INCR	0.409	HPO-1 FE HPO-2 BATCH	00:03:25	Save as
2	Pipeline 8	Random Forest Classifier		0.409	HPO-1 FE HPO-2	00:03:22	
3	Pipeline 4	Snap Logistic Regression		0.393	HPO-1 FE HPO-2	00:00:26	
4	Pipeline 3	Snap Logistic Regression		0.393	HPO-1 FE	00:00:21	

RESULT

The screenshot displays the IBM watsonx.ai Studio interface. The browser address bar shows the URL: `au-syd.dai.cloud.ibm.com/ml-runtime/models/c9c17369-88b7-4a0a-ae47-3b77942e4148/deployments?space_id=5bb31b38-7833-4370-a961-40fa406c6974&context=cpdaas&deployment_type=online`. The page title is "P9 - Random Forest Classifier: Fault". The main content area shows a table of deployments with one item:

Name	Type	Status	Tags	Last modified
(1) Fault type	Online	✓ Deployed		20 seconds ago Sagar Chhatani (You)

At the bottom of the table, it says "Items per page: 20" and "1-1 of 1 items". On the right side, there is a sidebar titled "About this asset" with the following details:

- Name:** P9 - Random Forest Classifier: Fault
- Description:** No description provided.
- Asset Details:**
 - Type: wml-hybrid_0.1
 - Model ID: c9c17369-88b7-4a...
 - Software specification: hybrid_0.1
 - Hybrid pipeline software specifications: autoai-kb_rt24.1-py3.11
- Tags:** Add tags to make assets easier to find.
- Source asset details:**
 - Last modified: 3 minutes ago by Service
 - Created on: Aug 2, 2025 by Sagar Chhatani

RESULT

Service Details - IBM Cloud

Fault type — Fault | IBM watson

Settings | IBM watsonx.ai Studio

au-syd.dai.cloud.ibm.com/ml-runtime/deployments/1fe03a94-f7b4-4ec9-82f2-1528e3301283/test?space_id=5bb31b38-7833-4370-a961-40fa406c6974&context=cpdaas&flush=true

IBM watsonx.ai Studio

Search in your workspaces

Upgrade

?

1

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

Fault type

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

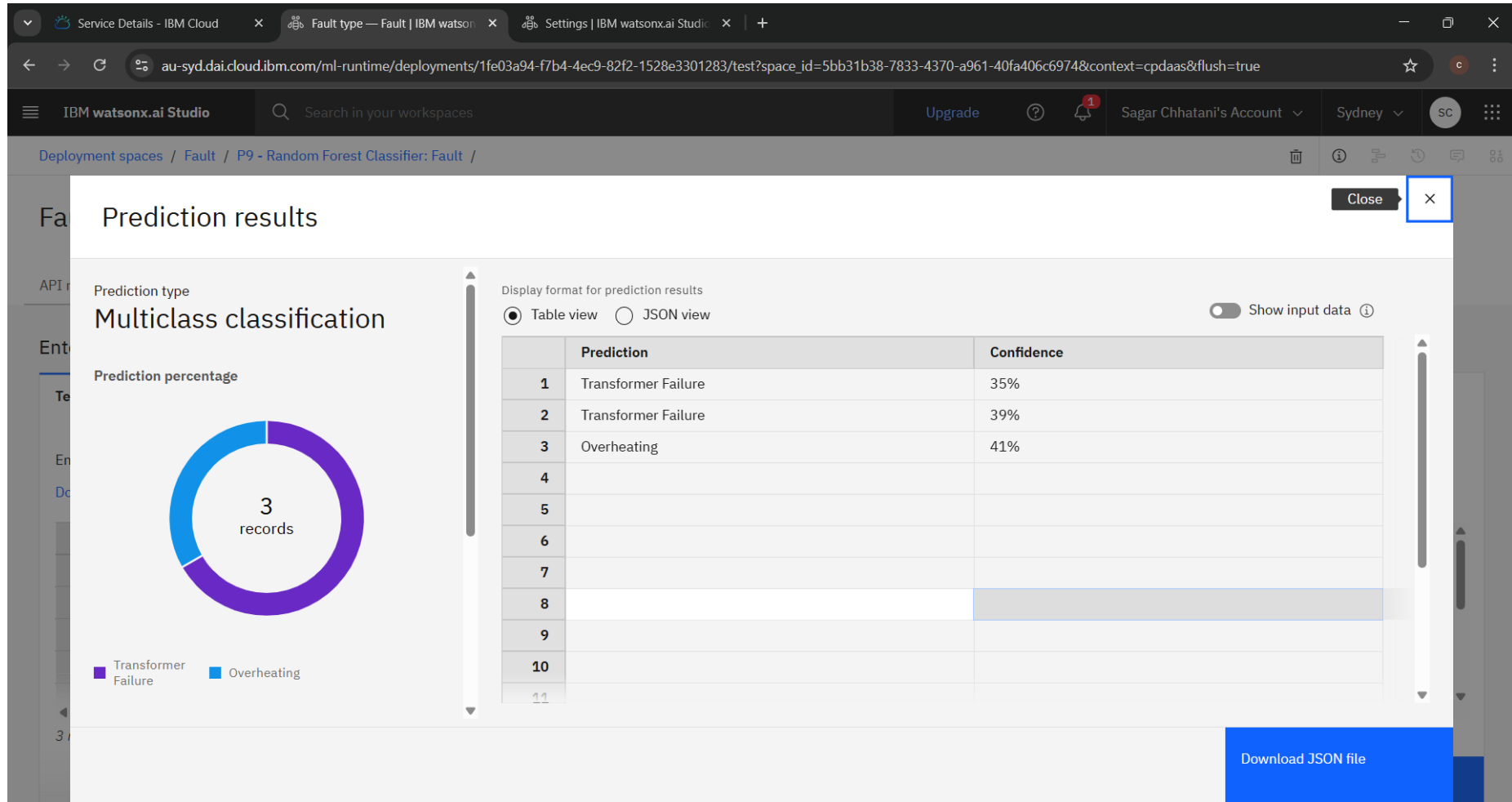
Search in space

Clear all

3 rows, 12 columns

Predict

RESULT



CONCLUSION

- The machine learning model effectively identifies and classifies power system faults, improving fault response time. This contributes to a more stable and reliable power grid.

FUTURE SCOPE

- In the future, this system can be enhanced to work in real-time using IoT sensors and cloud computing for instant fault detection. It can be integrated with automated control systems to isolate faults quickly, reducing downtime. Advanced AI techniques like deep learning can improve accuracy for complex grid conditions.

REFERENCES

- Ziya07. (2023). *Power System Faults Dataset*. Kaggle.
- Kundur, P. (1994). *Power System Stability and Control*. McGraw-Hill.
- IBM Cloud Docs – *Getting Started with IBM Watson Machine Learning*.

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IBM SkillsBuild	Completion Certificate
	<p>This certificate is presented to</p> <p>Sagar Chhatani</p> <p>for the completion of</p> <p>Lab: Retrieval Augmented Generation with LangChain</p> <p>(ALM-COURSE_3824998)</p> <p>According to the Adobe Learning Manager system of record</p>
Completion date: 24 Jul 2025 (GMT)	Learning hours: 20 mins



THANK YOU