CAPSTONE PROJECT

POWER SYSTEM FAULT DETECTION AND CLASSIFICATION USING MACHINE LEARNING

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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**

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.
- Key components:

1. Data collection: Use the Dataset from Kaggle on power system faults.
2. Preprocessing: Clean and Normalize the dataset.
3. Model Training: Train a classification model(e.g, Decision Tree , Random Forest , or SVM).
4. 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

- **Algorithm Selection:**

  Random Forest Classifier (or SVM based on performance)

- **Data Input:**

  Voltage, current, and phasor measurements from the dataset.

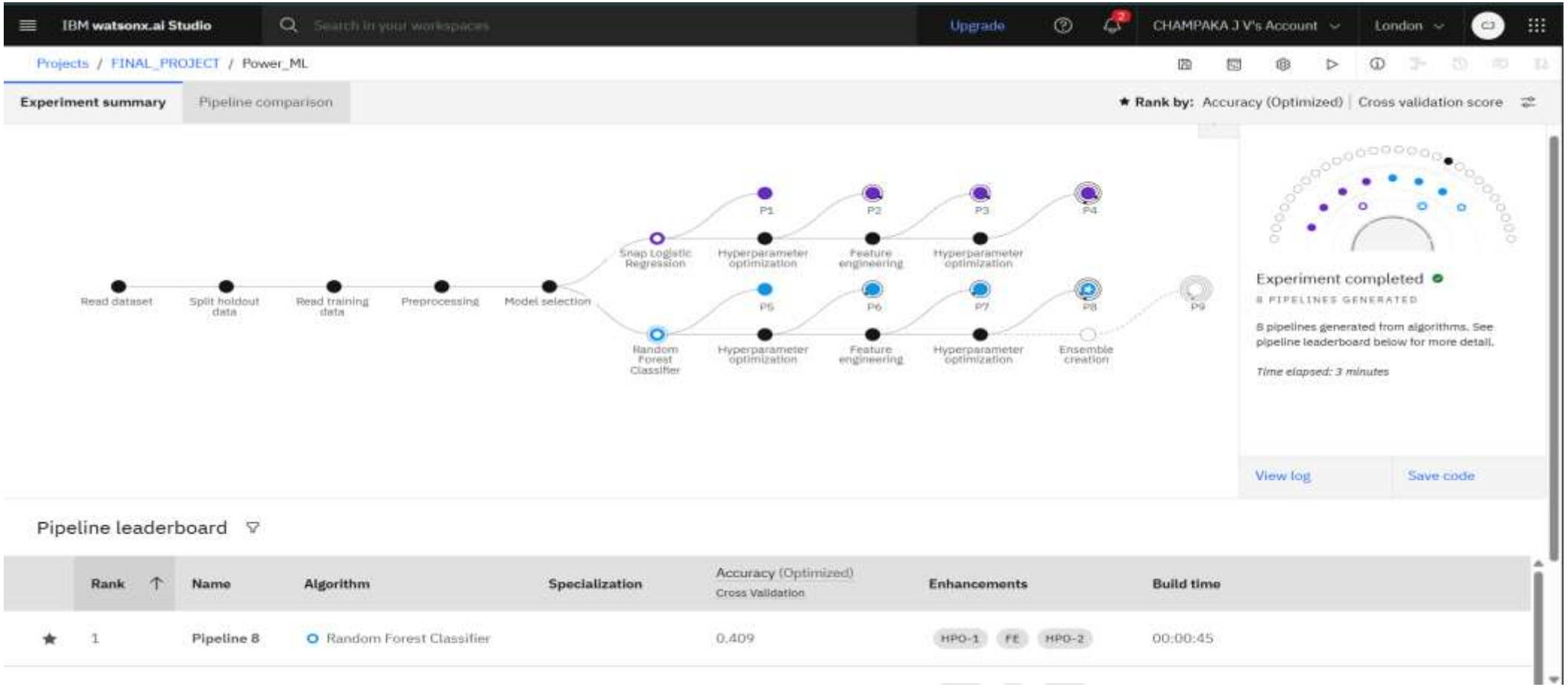
- **Training Process:**

  Supervised learning using labelled fault types.

- **Prediction Process:**

  Model deployed on IBM Watson Studio with API endpoint for real-time predictions.

RESULT



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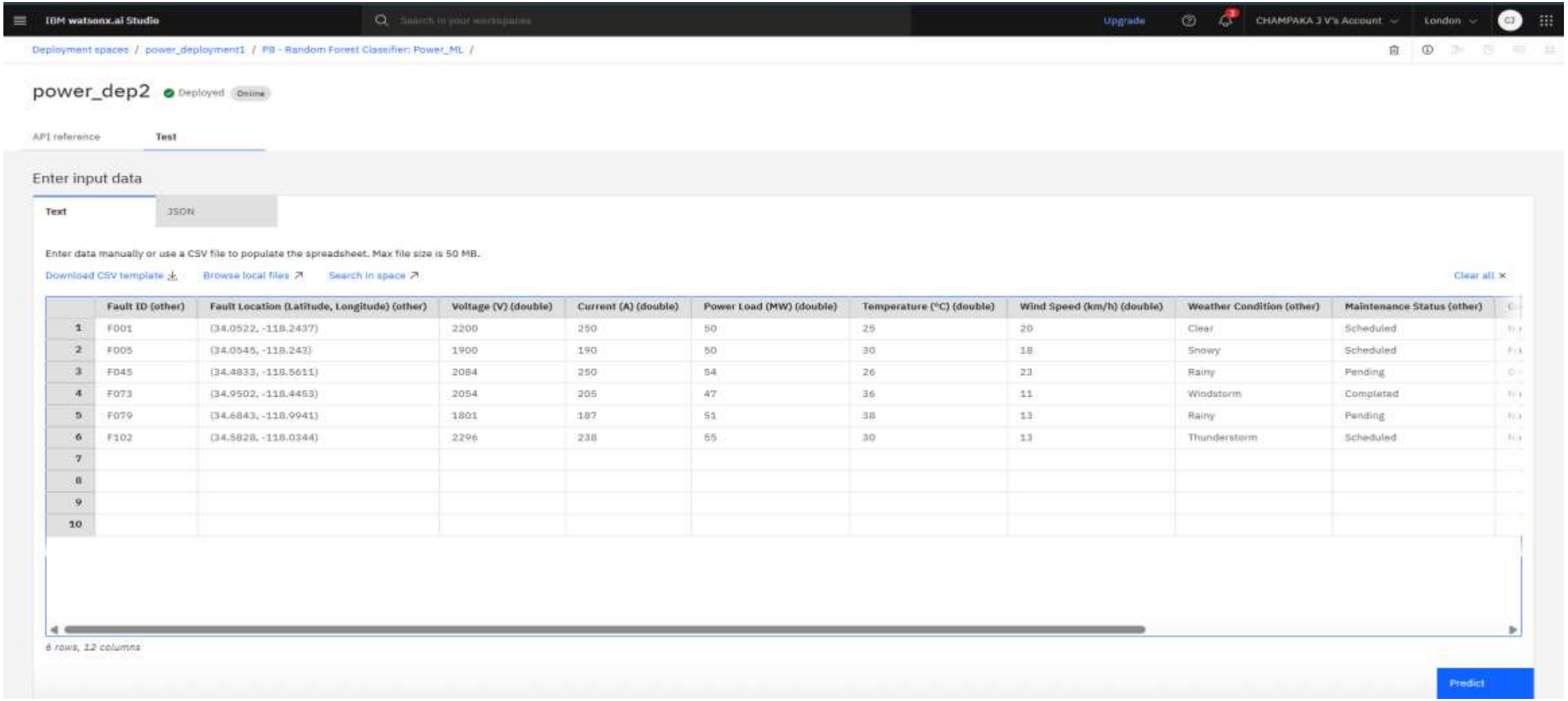
RESULT



	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)	Weather Condition (other)	Maintenance Status (other)
1	F001	(34.0522, -118.2437)	2200	250	50	25	20	Clear	Scheduled
2	F005	(34.0545, -118.243)	1900	190	50	30	18	Snowy	Scheduled
3	F045	(34.4833, -118.5611)	2084	250	54	26	23	Rainy	Pending
4	F073	(34.9502, -118.4463)	2054	205	47	36	11	Windstorm	Completed
5	F079	(34.6843, -118.9941)	1801	187	51	38	13	Rainy	Pending
6	F102	(34.5828, -118.0344)	2296	238	55	30	13	Thunderstorm	Scheduled
7									
8									
9									
10									

6 rows, 12 columns

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RESULT

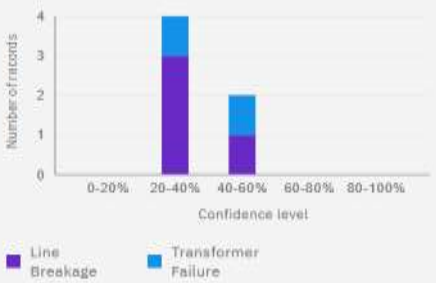
Prediction results

Prediction type

Multiclass classification

Prediction percentage

Confidence level distribution



Display format for prediction results

(•) Table view ( ) JSON view

Show input data

	Prediction	Confidence
1	Line Breakage	39%
2	Transformer Failure	38%
3	Line Breakage	37%
4	Line Breakage	39%
5	Line Breakage	43%
6	Transformer Failure	46%
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

Download JSON file

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CONCLUSION

- This project developed a machine learning-based system to detect and classify power system faults using voltage, current, and phasor data. After preprocessing the dataset, models like Random Forest and SVM were trained to accurately identify fault types. The best-performing model was deployed on IBM Watson Studio, enabling real-time fault detection through an API. This solution enhances power grid reliability by ensuring faster and more accurate fault response.

FUTURE SCOPE

- The developed fault detection system can be enhanced further by integrating real-time data from smart grid sensors for live monitoring. Future work may involve using advanced deep learning models like LSTM or CNN to capture more complex fault patterns. The system can also be extended to detect multiple or cascading faults and deployed on edge devices for faster, low-latency responses. Adding explainable AI features would help increase operator trust, while scaling the model for larger power grids and diverse regional topologies would make it suitable for widespread smart grid applications.

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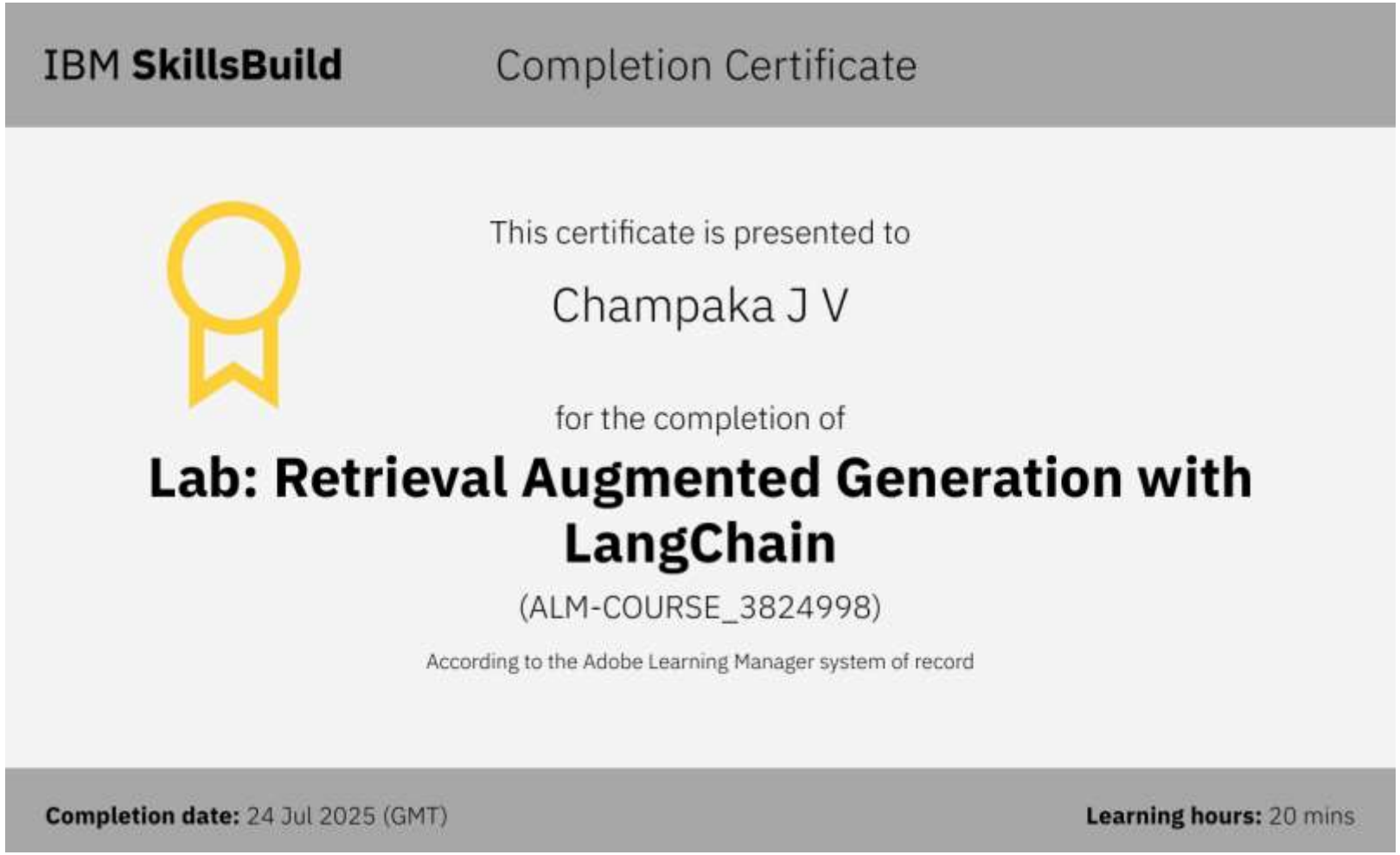

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According to the Adobe Learning Manager system of record

Completion date: 24 Jul 2025 (GMT) **Learning hours:** 20 mins

THANK YOU

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