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.

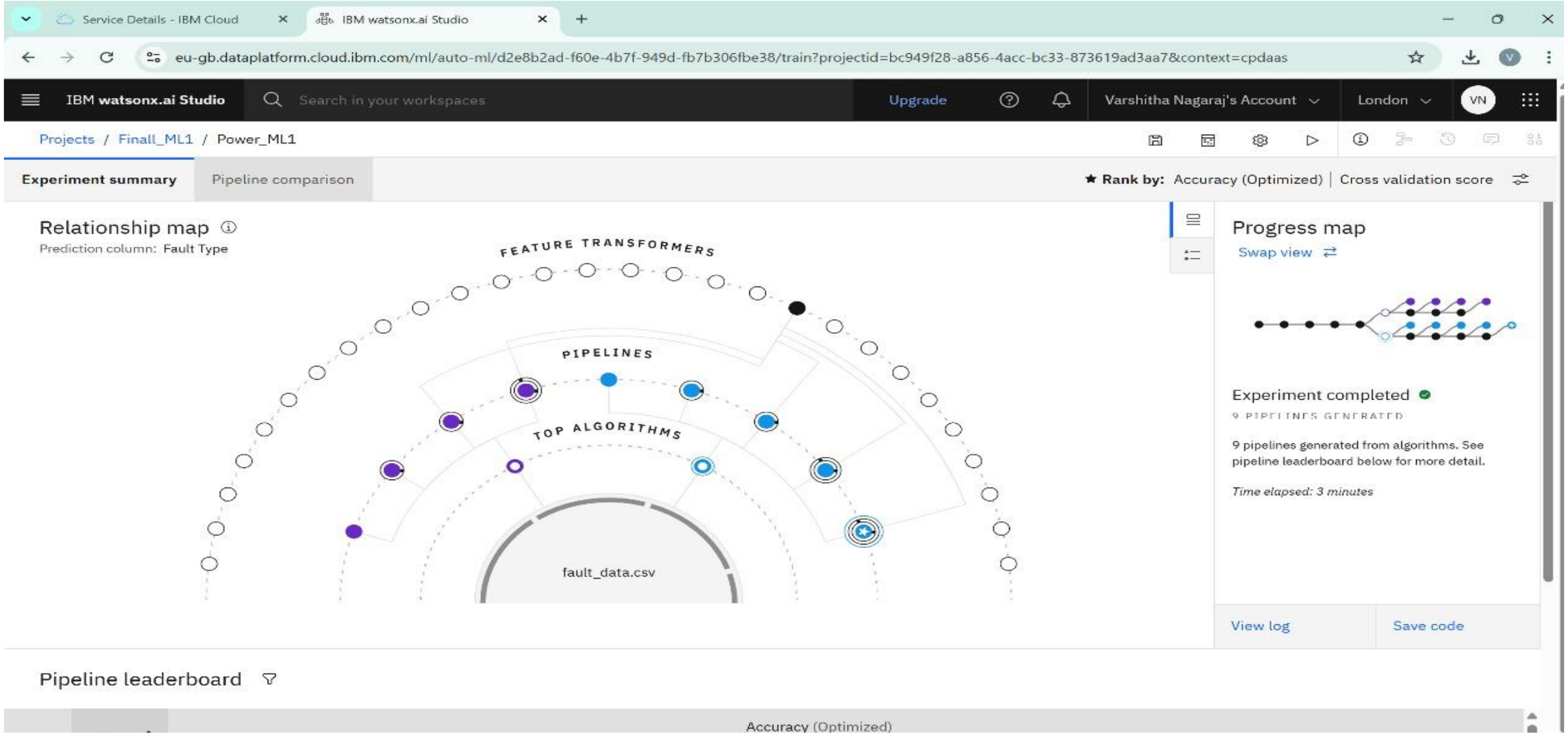
- **Training Process:**

  Supervised learning using labelled fault types.

- **Prediction Process:**

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

RESULT



Service Details - IBM Cloud
IBM watsonx.ai Studio
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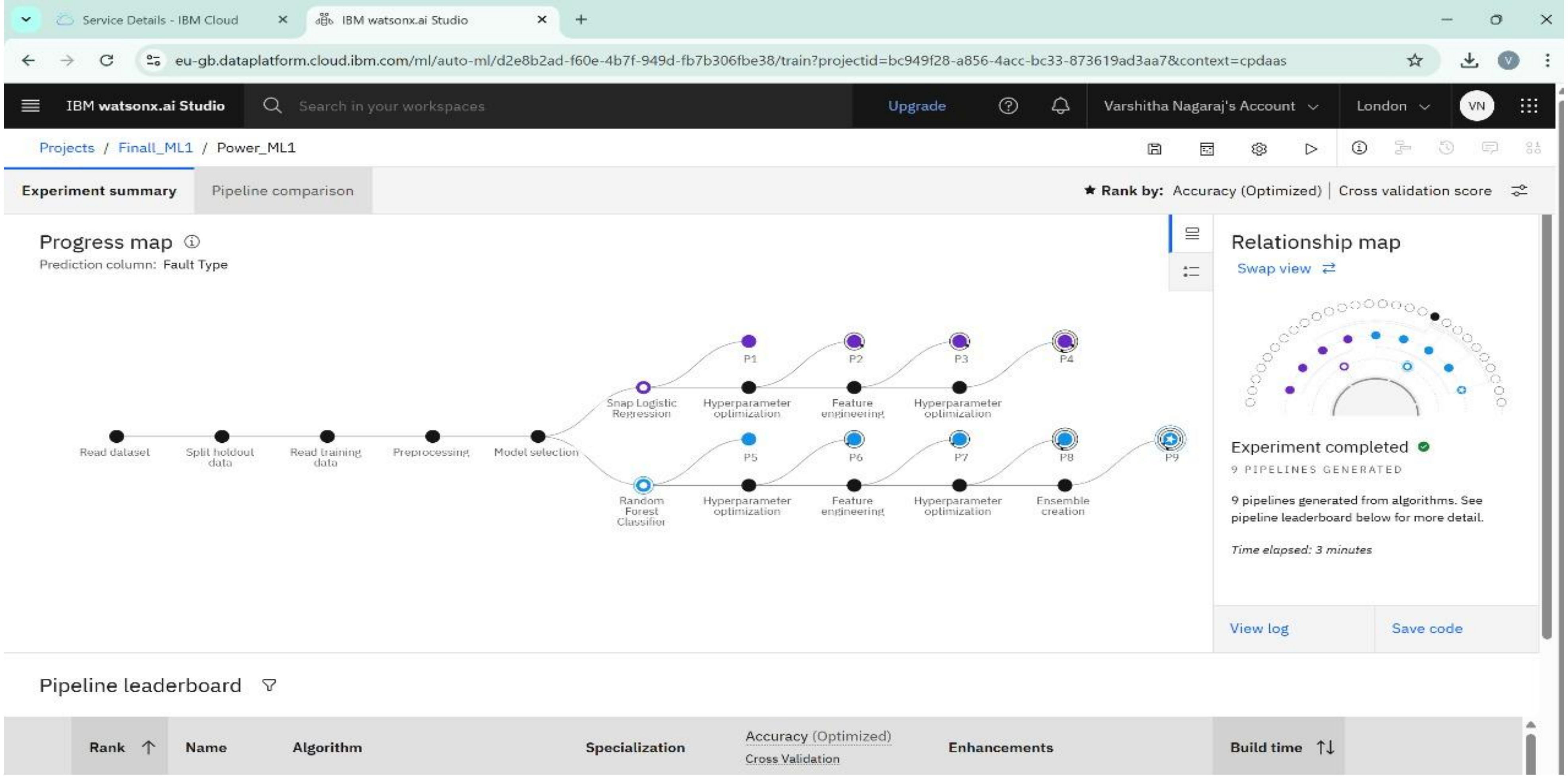
IBM watsonx.ai Studio
Search in your workspaces
Upgrade
Varshitha Nagaraj's Account
London
VN
Projects / Finall_ML1 / Power_ML1
Experiment summary
Pipeline comparison
Rank by: Accuracy (Optimized) | Cross validation score
Relationship map
Prediction column: Fault Type
FEATURE TRANSFORMERS
PIPELINES
TOP ALGORITHMS
fault_data.csv
Progress map
Swap view
Experiment completed
9 PIPELINES GENERATED
9 pipelines generated from algorithms. See pipeline leaderboard below for more detail.
Time elapsed: 3 minutes
View log
Save code
Pipeline leaderboard
Accuracy (Optimized)

RESULT



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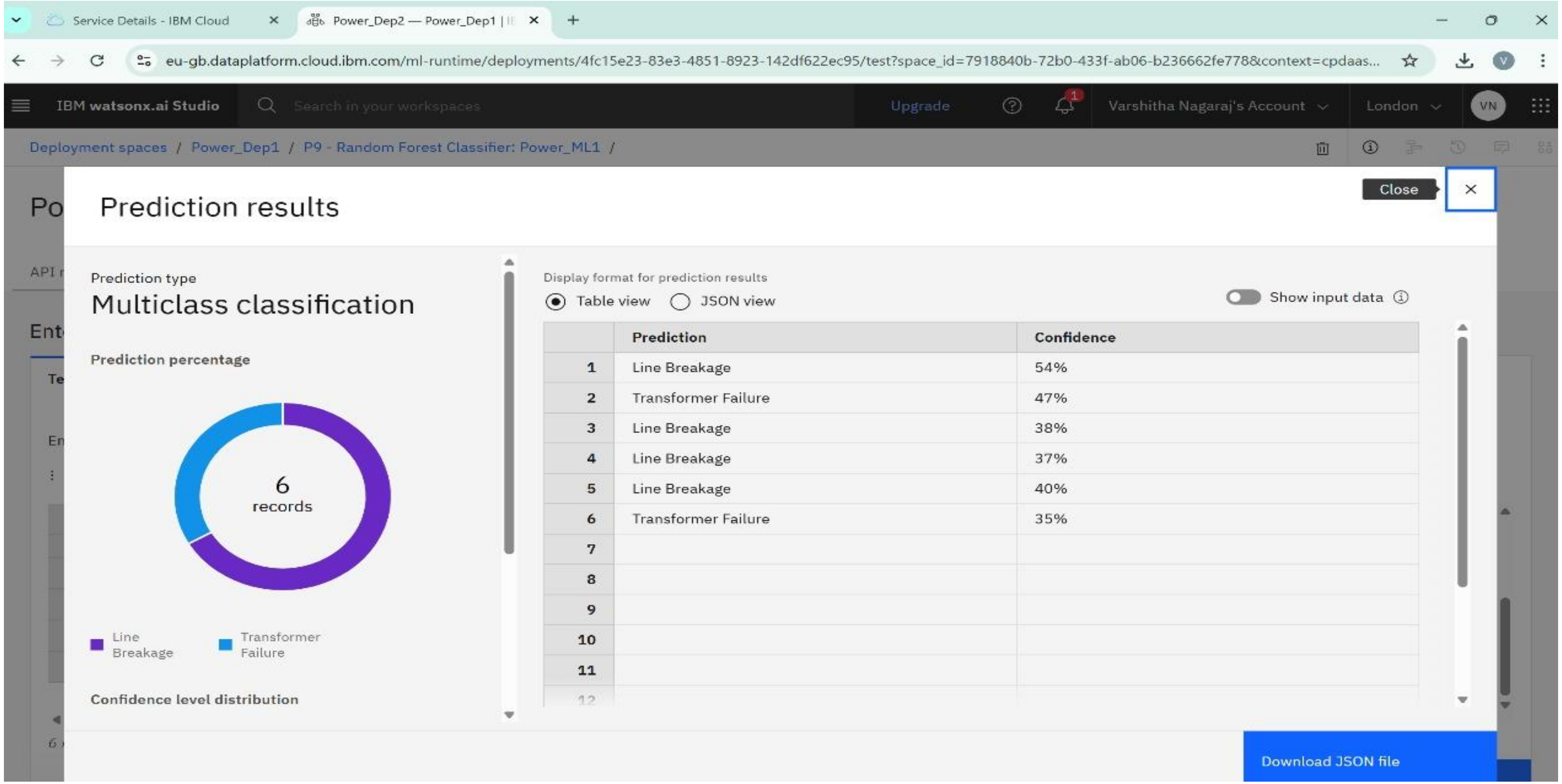
RESULT


Service Details - IBM Cloud
Power_Dep2 — Power_Dep1
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IBM watsonx.ai Studio
Search in your workspaces
Upgrade
Varshitha Nagaraj's Account
London
VN
Deployment spaces / Power_Dep1 / P9 - Random Forest Classifier: Power_ML1 /
Close
Prediction results
Prediction type
Multiclass classification
Prediction percentage
6
records
Line Breakage
Transformer Failure
Confidence level distribution
Display format for prediction results
Table view
JSON view
Show input data
Prediction
Confidence
1 Line Breakage 54%
2 Transformer Failure 47%
3 Line Breakage 38%
4 Line Breakage 37%
5 Line Breakage 40%
6 Transformer Failure 35%
7
8
9
10
11
Download JSON file

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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Lab: Retrieval Augmented Generation with LangChain

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 24 Jul 2025 (GMT)

Learning hours: 20 mins

THANK YOU