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**
- **References**

PROBLEM STATEMENT

Power distribution systems are prone to various types of faults such as line-to-ground, line-to-line, and three-phase faults. These faults can disrupt power supply and reduce system reliability. The challenge lies in accurately detecting and classifying these faults using electrical measurement data (voltage, current, phasors) to differentiate them from normal operating conditions, thereby ensuring the stability of the power grid.

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:**
- **Data Collection:** Use the Kaggle dataset on power system faults.
- **Preprocessing:** Clean and normalize the dataset.
- **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 Power System Fault Detection and Classification. Here's a suggested structure for this section:

- System requirements

  IBM Cloud (Mandatory)

  IBM Watson studio for model development and deployment

  IBM cloud storage for dataset handling

- Library required to build the model

  Pandas – for data manipulation

  NumPy – for numerical operations

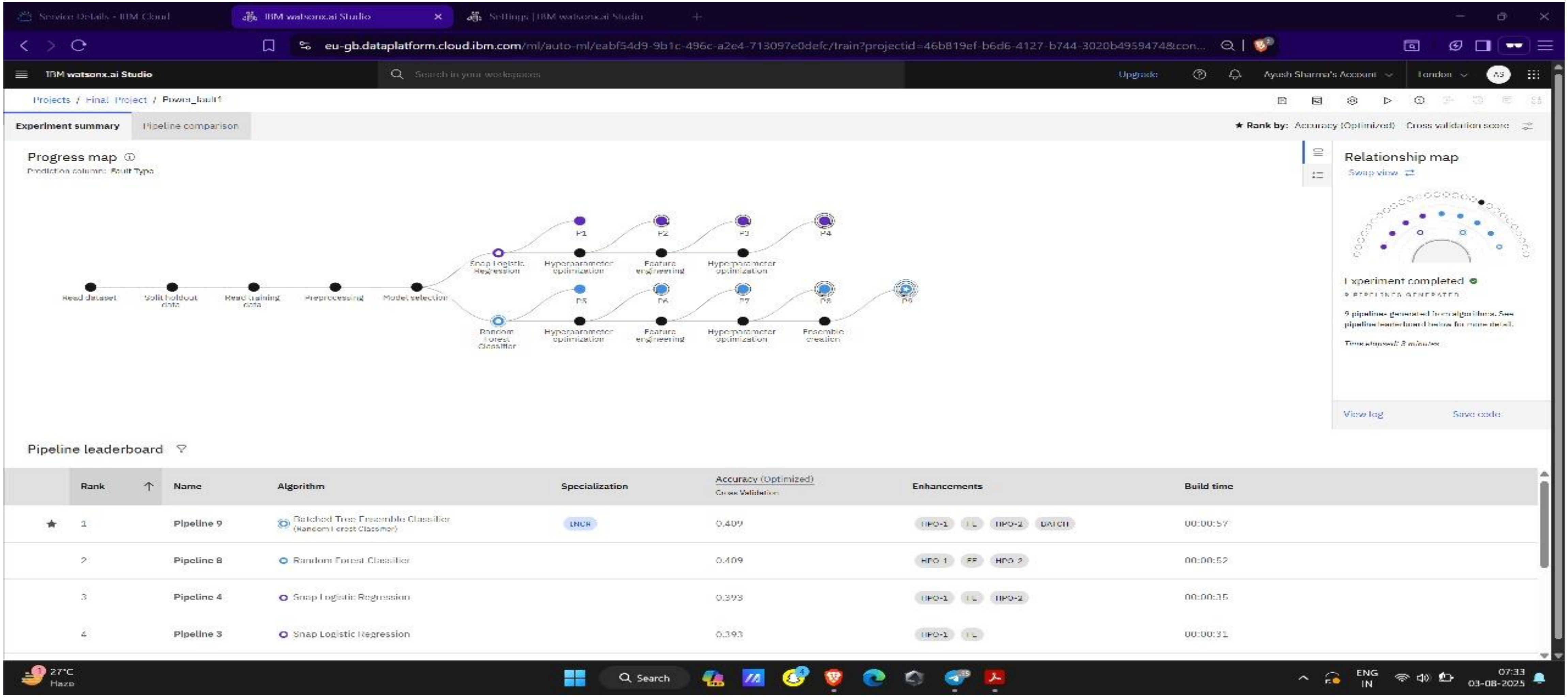
  Scikit-learn – for building and evaluating ML models

  Matplotlib – for visualization

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 labeled fault types
- **Prediction Process:**
  Model deployed on IBM Watson Studio with API endpoint for real-time predictions

RESULT



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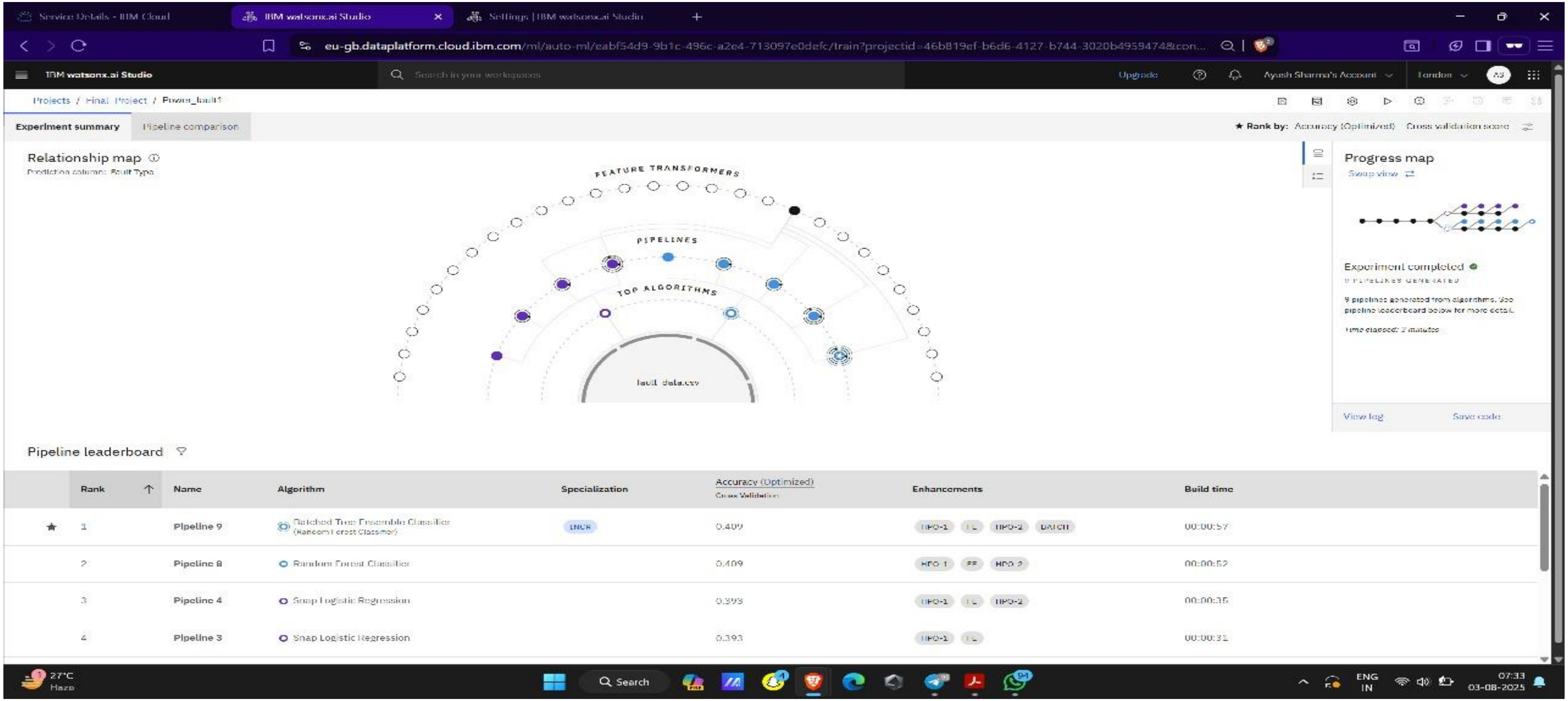
RESULT



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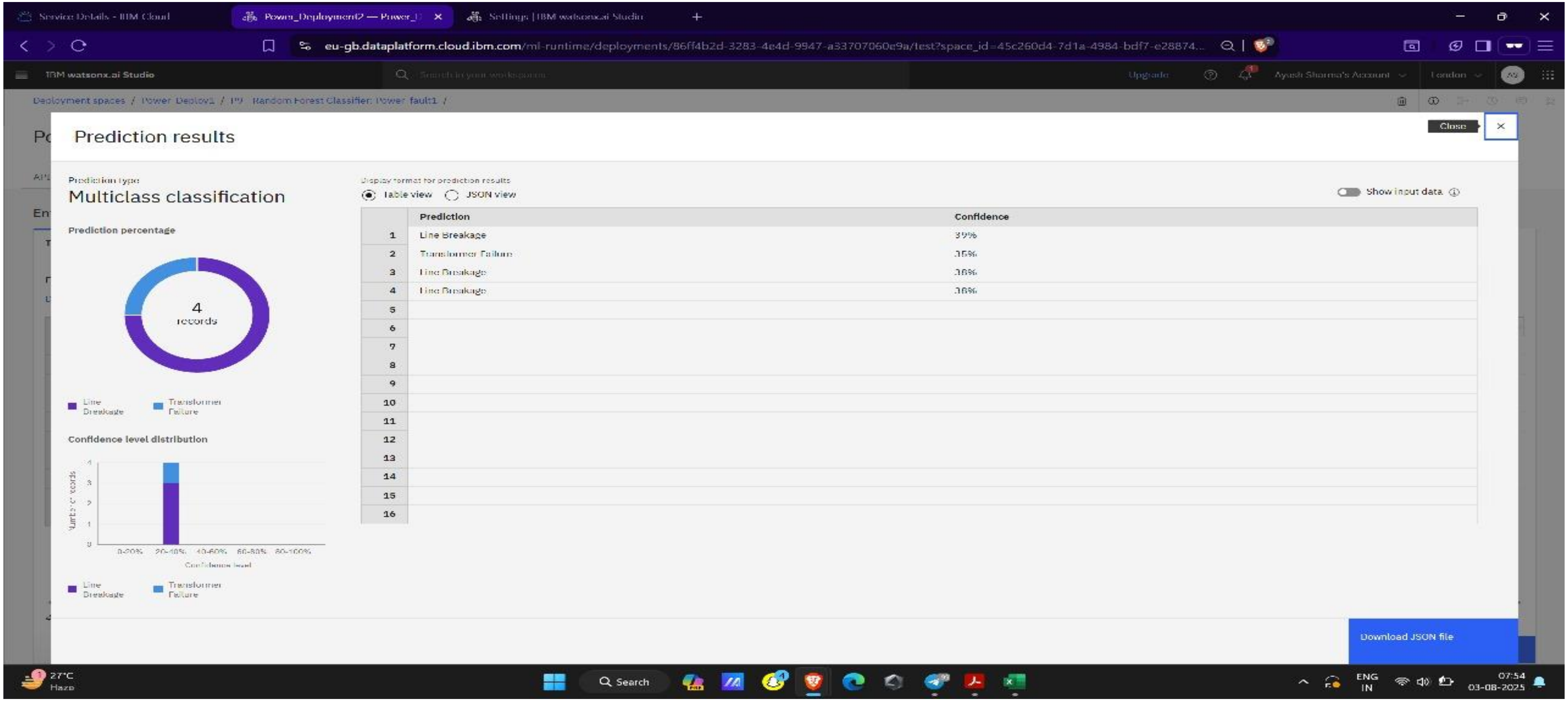
RESULT



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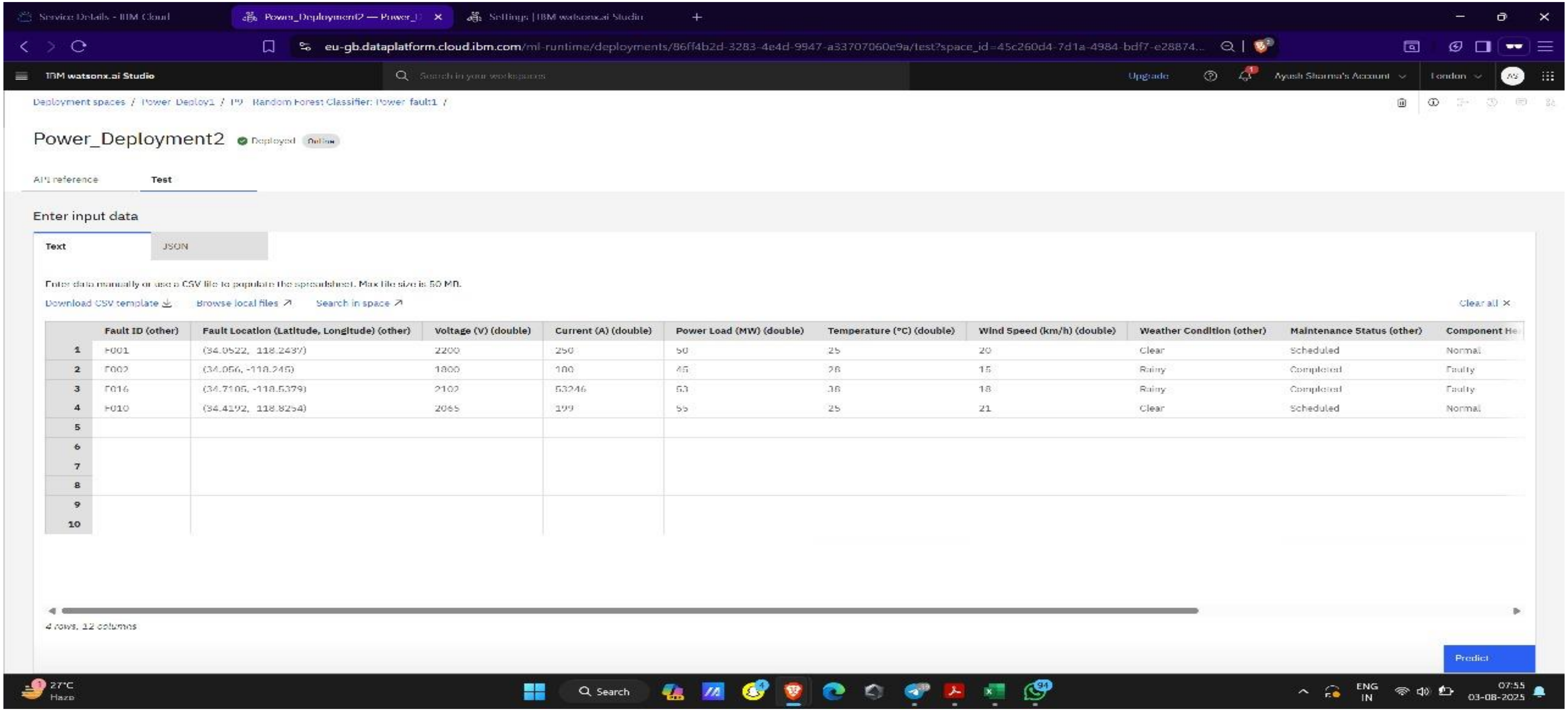
RESULT



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CONCLUSION

- The machine learning model effectively classifies various power system faults, providing accurate and timely fault detection. This improves the reliability and stability of power grids and assists in automating recovery actions. Future improvements can focus on real-time data integration and advanced ensemble methods.

FUTURE SCOPE

- Integrate real-time sensor data using IoT
- Explore deep learning models for better accuracy
- Expand to classify faults in regional and national grids
- Deploy the model on edge devices in substations

REFERENCES

- Kaggle Dataset on Power System Faults
- IBM Watson Studio Documentation
- Research papers on fault classification
- Python Libraries: Scikit-learn, Pandas, Matplotlib

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Learning hours: 20 mins

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