CAPSTONE PROJECT

POWER SYSTEM FAULT DETECTION AND CLASSIFICATION USING MACHINE LEARNING

Presented By:
1. DEV RAJ – GOVERNMENT POLYTECHNIC BARH - AI & ML

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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.

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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)

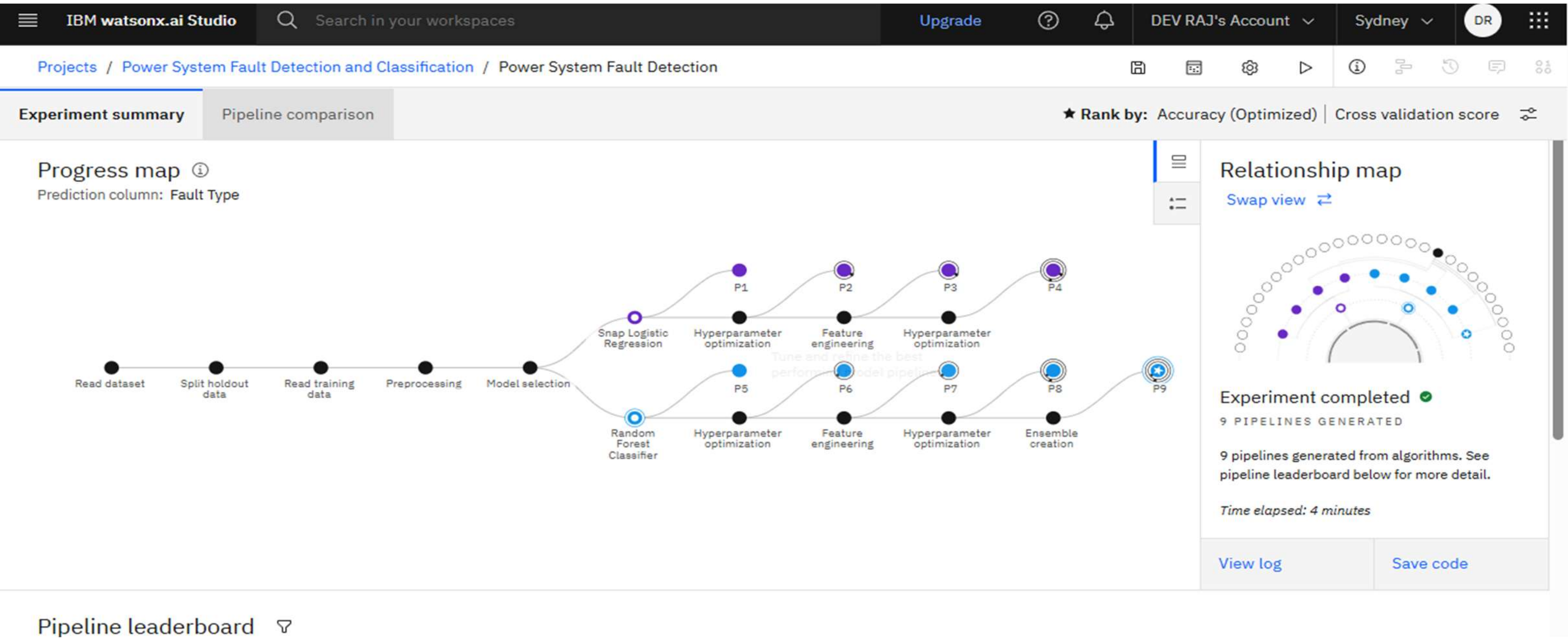
  IBM Watson studio for model development and deployment

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

RESULT



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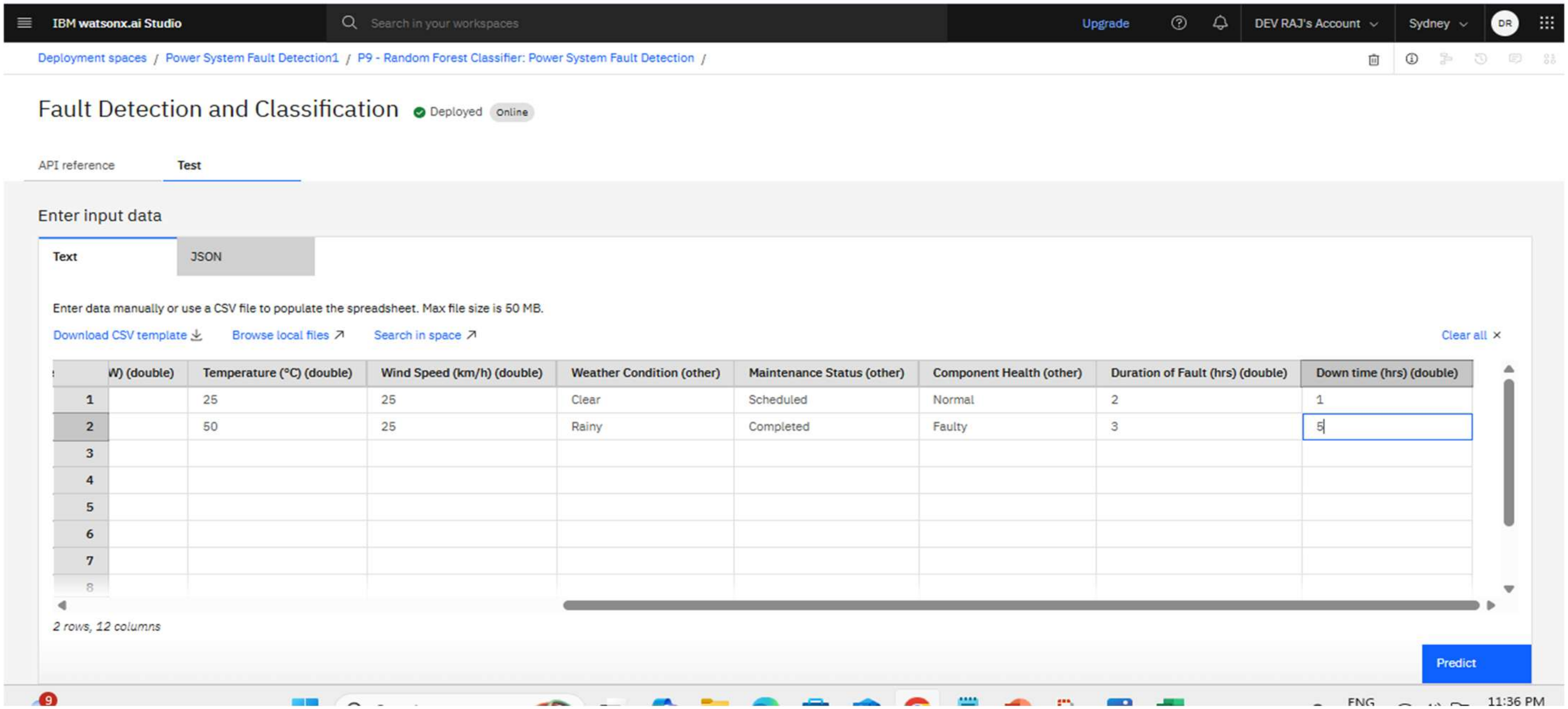
RESULT



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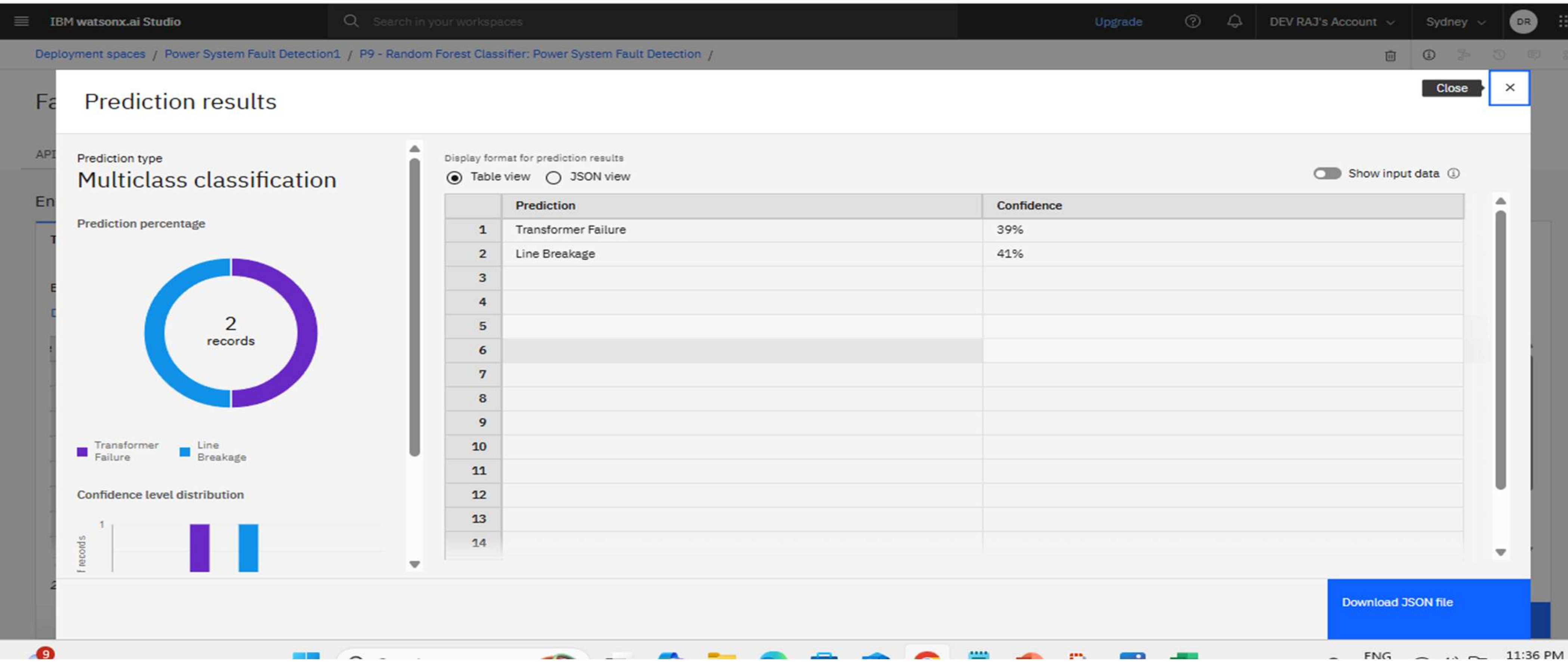
RESULT


IBM watsonx.ai Studio
Search in your workspaces
Upgrade
DEV RAJ's Account
Sydney
Deployment spaces / Power System Fault Detection1 / P9 - Random Forest Classifier: Power System Fault Detection /
Prediction results
Close
Prediction type
Multiclass classification
Prediction percentage
2 records
Transformer Failure
Line Breakage
Confidence level distribution
Display format for prediction results
Table view
JSON view
Show input data
Prediction
Confidence
1 Transformer Failure 39%
2 Line Breakage 41%
Download JSON file
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CONCLUSION

- In this project, a machine learning model was developed to detect and classify power system faults using voltage and current phasor data. The model effectively identified different fault types, such as line-to-ground, line-to-line, and three-phase faults, demonstrating strong accuracy and reliability. Challenges like data noise and class imbalance were addressed through preprocessing and model tuning. The results highlight the importance of accurate fault detection for maintaining grid stability, with potential improvements including real-time deployment and integration of more diverse datasets.

FUTURE SCOPE

- The proposed fault detection model can be further enhanced by integrating real-time data from smart sensors and IoT devices to enable faster response times. Advanced deep learning techniques, such as LSTM or CNNs, could improve accuracy in more complex fault scenarios. Additionally, expanding the dataset to include a wider range of grid conditions and environmental factors would increase the model's robustness. Future work could also focus on developing a complete automated protection system that not only detects and classifies faults but also suggests corrective actions to operators in real time.

REFERENCES

- List and cite relevant sources, research papers, and articles that were instrumental in developing the proposed solution. This could include academic papers on bike demand prediction, machine learning algorithms, and best practices in data preprocessing and model evaluation.

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Completion date: 28 Jul 2025 (GMT) **Learning hours:** 20 mins

THANK YOU

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