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)

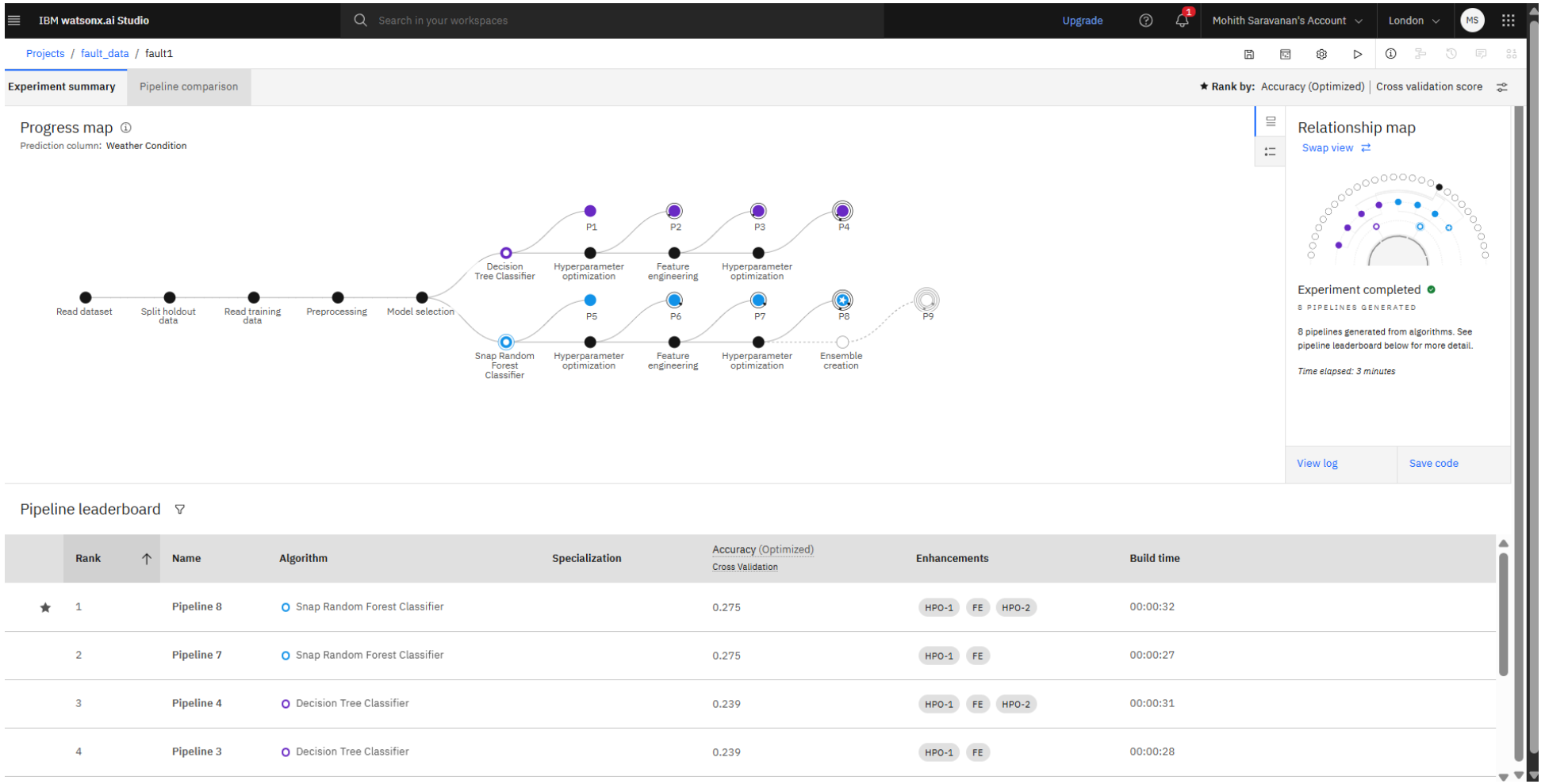
  IBM Watson studio for model development and deployment

  IBM cloud object storage for dataset handling

ALGORITHM & DEPLOYMENT

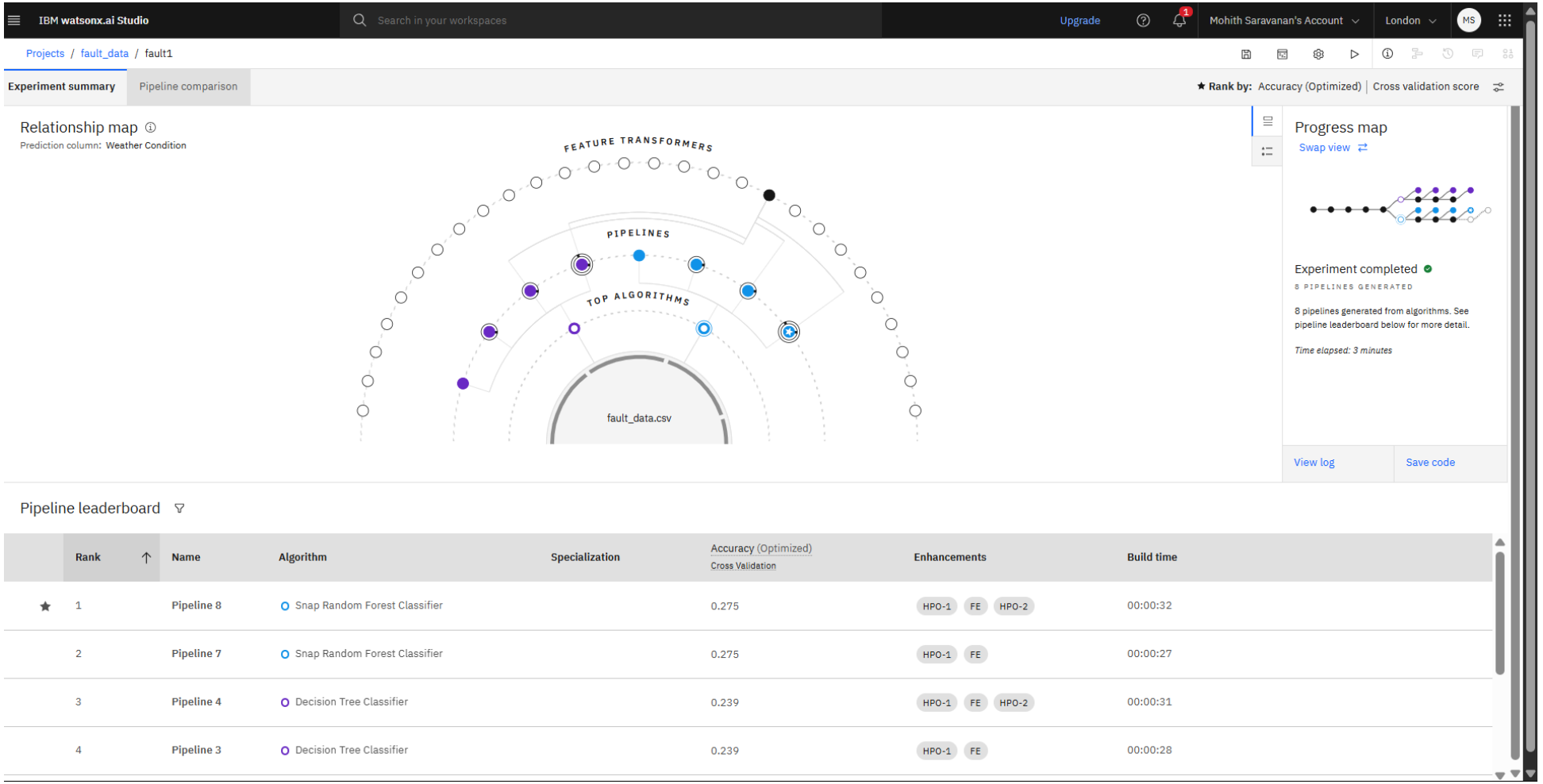
- **Algorithm Selection:**
  Random Forest Classifier (or SVM based on performance)
- **Data Input:**
  Voltage, current, and phasor measurements from the dataset
- **Training Process:**
  Supervised learning using labeled fault types
- **Prediction Process:**
  Model deployed on IBM Watson Studio with API endpoint for real-time predictions

RESULT



	Rank	Name	Algorithm	Specialization	Accuracy (Optimized) Cross Validation	Enhancements	Build time
★	1	Pipeline 8	Snap Random Forest Classifier		0.275	HPO-1 FE HPO-2	00:00:32
	2	Pipeline 7	Snap Random Forest Classifier		0.275	HPO-1 FE	00:00:27
	3	Pipeline 4	Decision Tree Classifier		0.239	HPO-1 FE HPO-2	00:00:31
	4	Pipeline 3	Decision Tree Classifier		0.239	HPO-1 FE	00:00:28

RESULT



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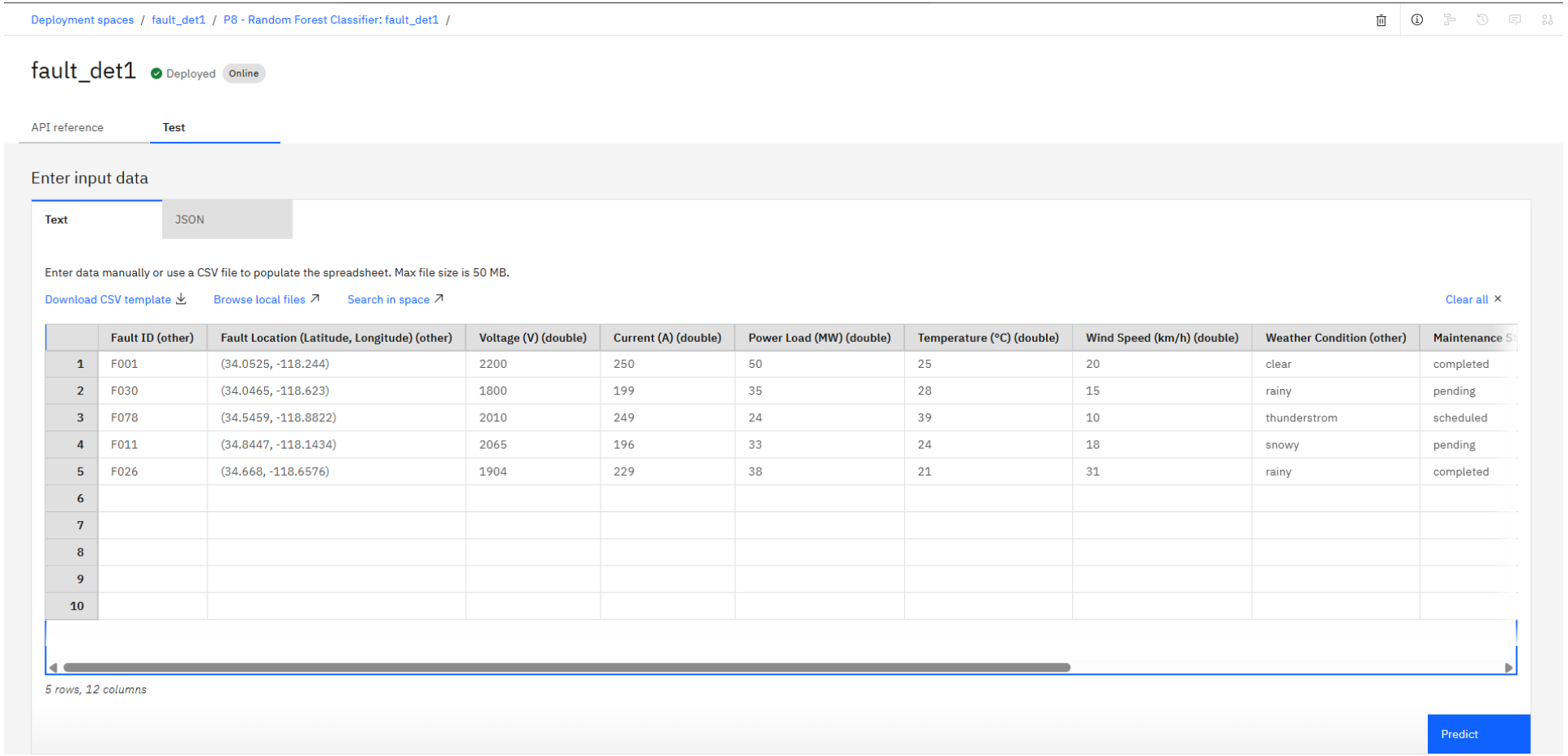
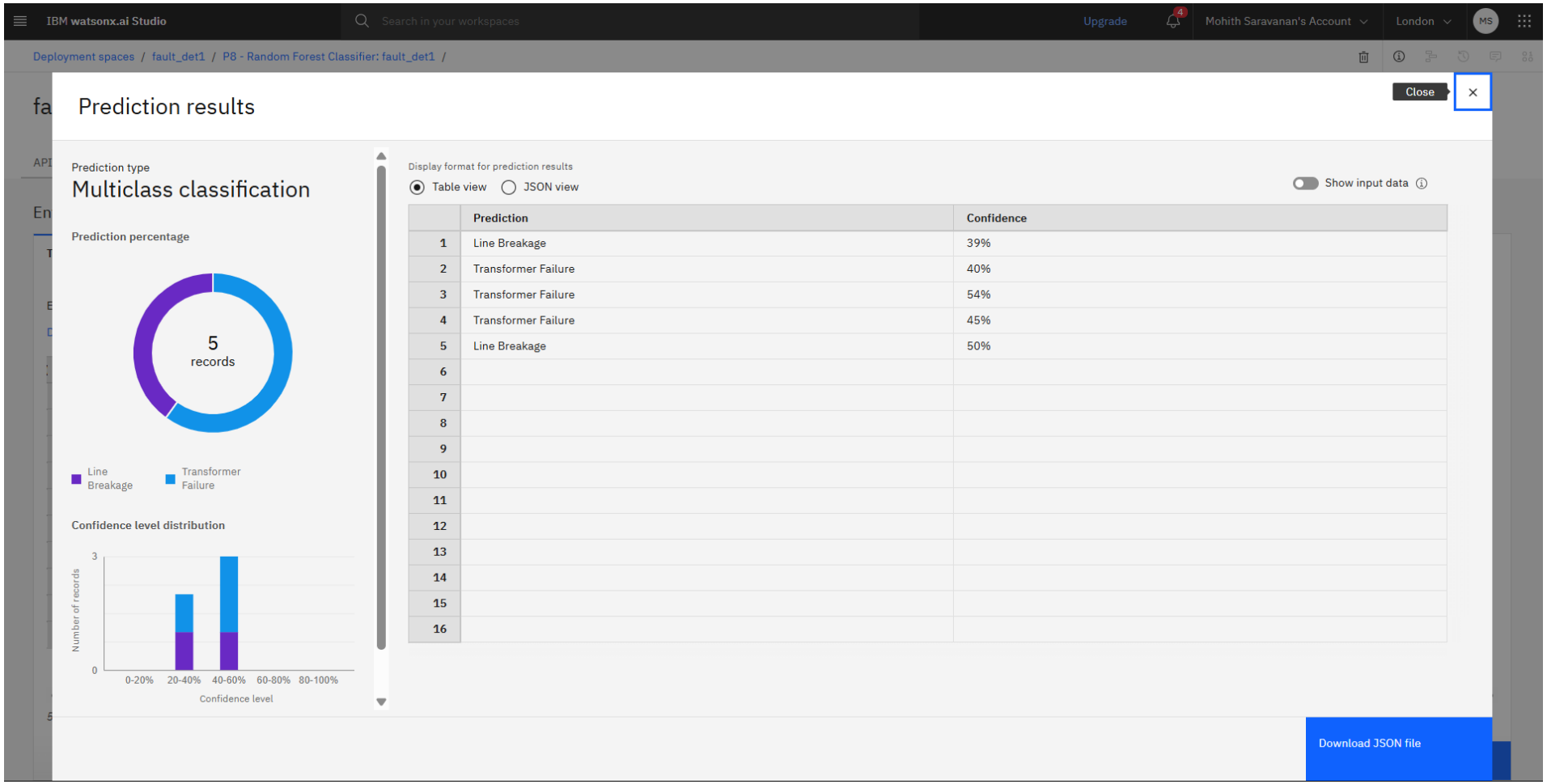
RESULT



	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 S
1	F001	(34.0525, -118.244)	2200	250	50	25	20	clear	completed
2	F030	(34.0465, -118.623)	1800	199	35	28	15	rainy	pending
3	F078	(34.5459, -118.8822)	2010	249	24	39	10	thunderstrom	scheduled
4	F011	(34.8447, -118.1434)	2065	196	33	24	18	snowy	pending
5	F026	(34.668, -118.6576)	1904	229	38	21	31	rainy	completed
6									
7									
8									
9									
10									

RESULT



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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

- Use real-time sensor data instead of static datasets
- Integrate with smart grid systems
- Extend model to handle noisy or missing data scenarios
- Implement edge AI models for faster response

REFERENCES

- Kaggle Dataset: https://www.kaggle.com/datasets/ziya07/power-system-faults-dataset
- IEEE papers on fault classification techniques
- IBM Cloud and Watson Studio documentation

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THANK YOU

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