CAPSTONE PROJECT

PROJECT TITLE

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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

Problem statement No.41 – Power System Fault Detection and Classification

The Challenge:

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

- Data Collection

  Gather voltage, current, power load, and environmental data during normal and faulty conditions.

- Data Preprocessing

  Clean and label the data (Normal, L-G, L-L, 3-Phase faults).

  Normalize and encode features.

- Model Building

  Train a Random Forest Classifier on the labeled data.

  Validate using accuracy, precision, recall.

- Deployment

  Deploy the model on IBM Cloud using Watson Studio.

  Provide a web interface for real-time CSV/JSON input and fault prediction.

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:

- IBM Cloud
- IBM Watson Studio for model Devolopment and deployment
- IBM Cloud Object storage for dataset handling

ALGORITHM & DEPLOYMENT

- Algorithm Selection:

I used a Batched Tree Ensemble Classifier from IBM Watson AutoAI, ideal for multi-class classification based on structured power system data.

- Data Input:

Input features include Voltage, Current, Power Load, Temperature, Wind Speed, Fault ID, and Location.

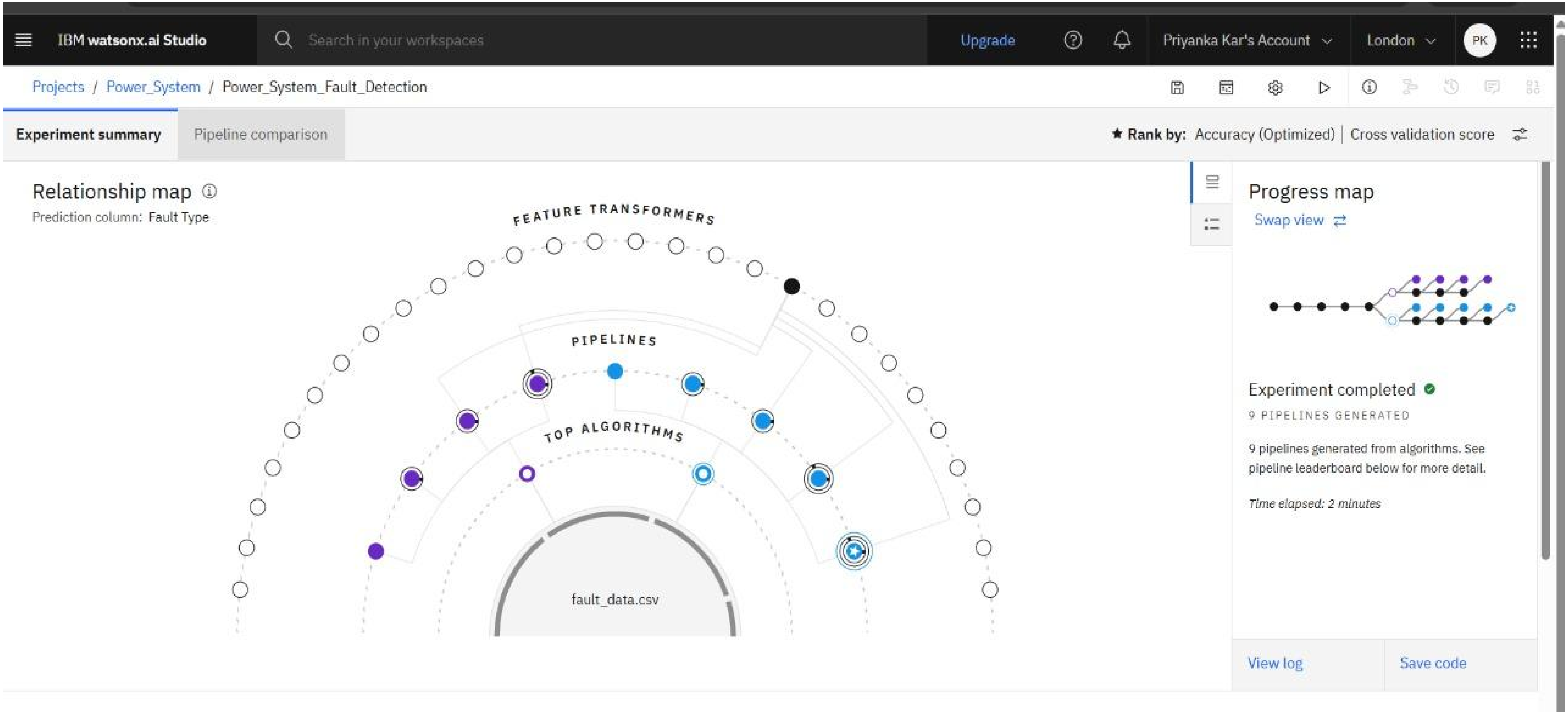
- Training Process:

IBM AutoAI handled data preprocessing, model selection, and hyperparameter tuning automatically using cross-validation.

- Prediction Process:

The trained model was deployed on IBM Cloud via Watson Machine Learning. It takes CSV/JSON input and returns real-time fault type predictions.

RESULT



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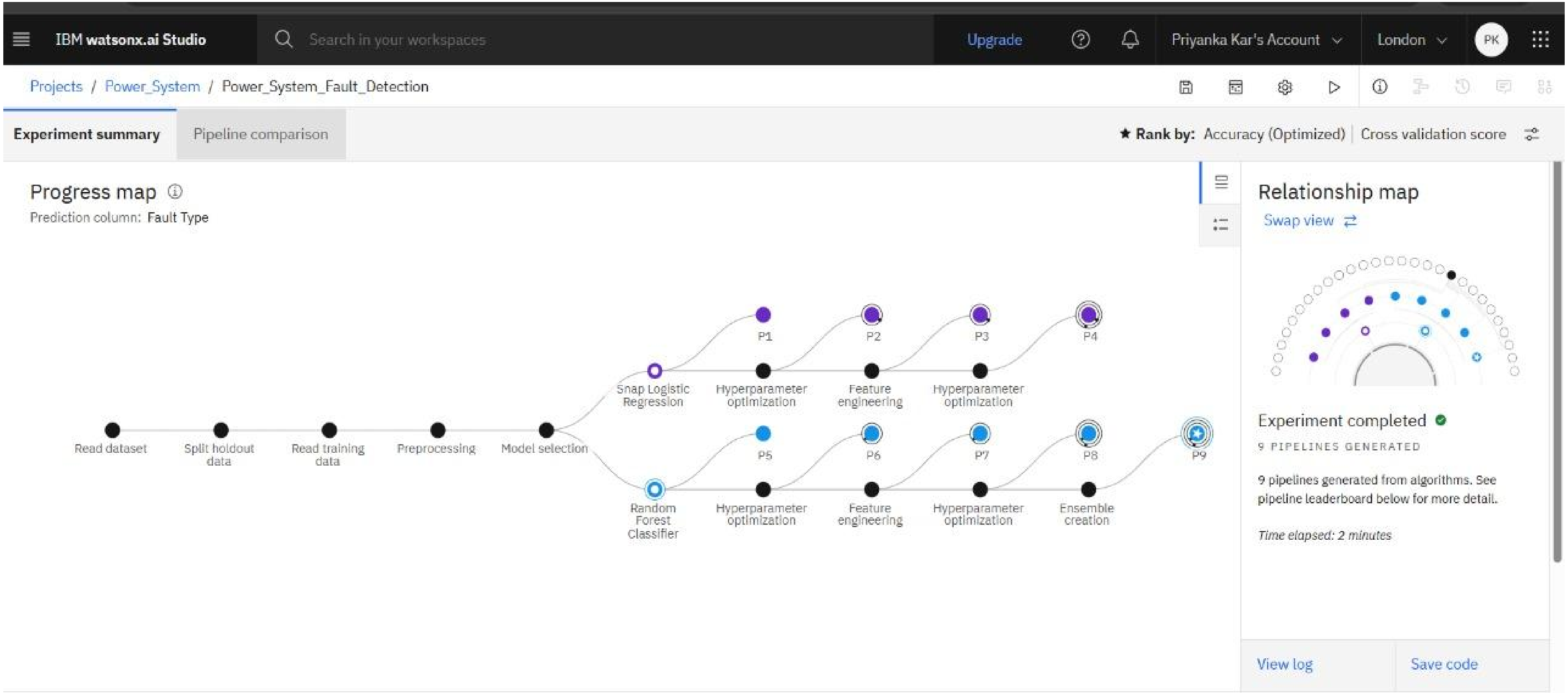
RESULT



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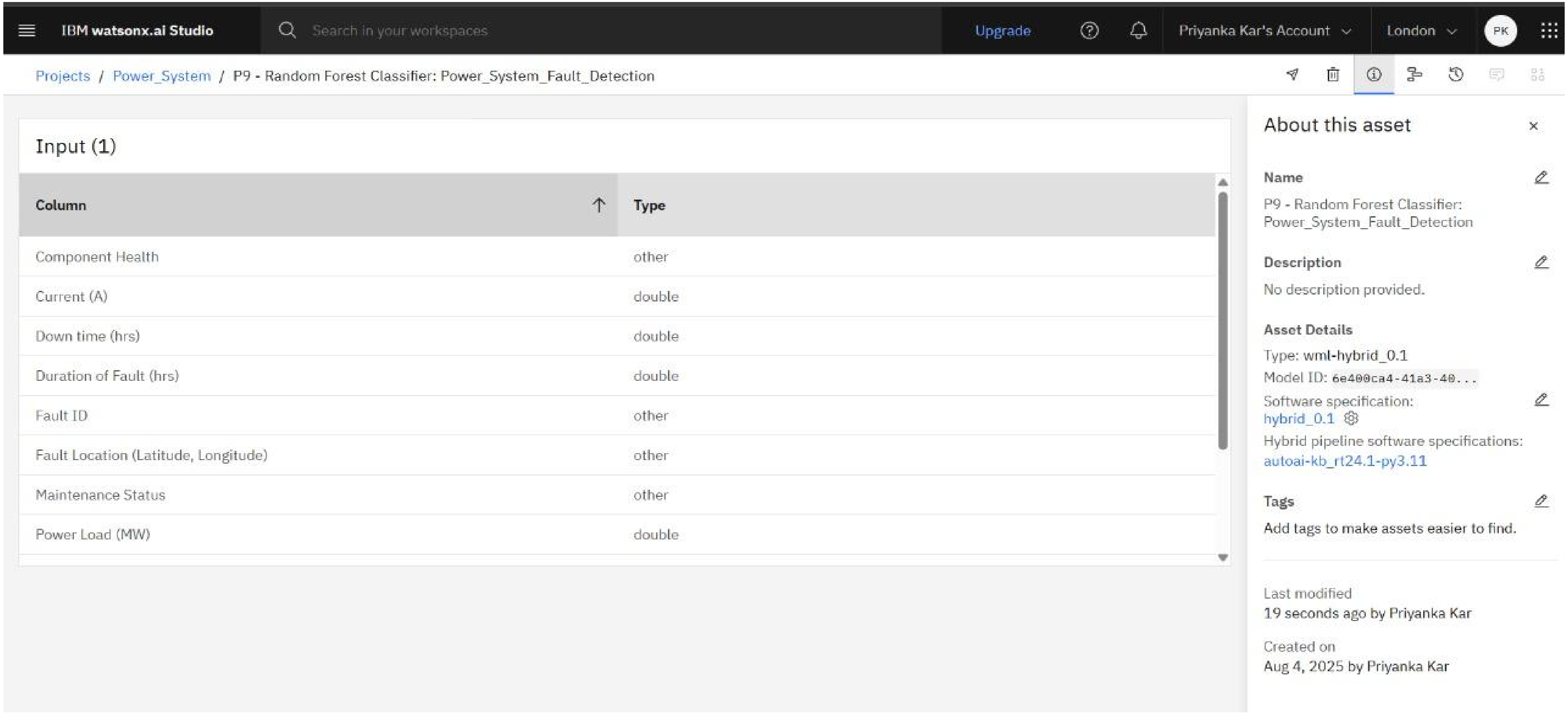
RESULT

Pipeline leaderboard

	Rank	Name	Algorithm	Specialization	Accuracy (Optimized) Cross Validation	Enhancements	Build time
★	1	Pipeline 9	Batched Tree Ensemble Classifier (Random Forest Classifier)	INCR	0.409	HPO-1 FE HPO-2 BATCH	00:00:47
	2	Pipeline 8	Random Forest Classifier		0.409	HPO-1 FE HPO-2	00:00:44
	3	Pipeline 4	Snap Logistic Regression		0.393	HPO-1 FE HPO-2	00:00:32
	4	Pipeline 3	Snap Logistic Regression		0.393	HPO-1 FE	00:00:28

RESULT

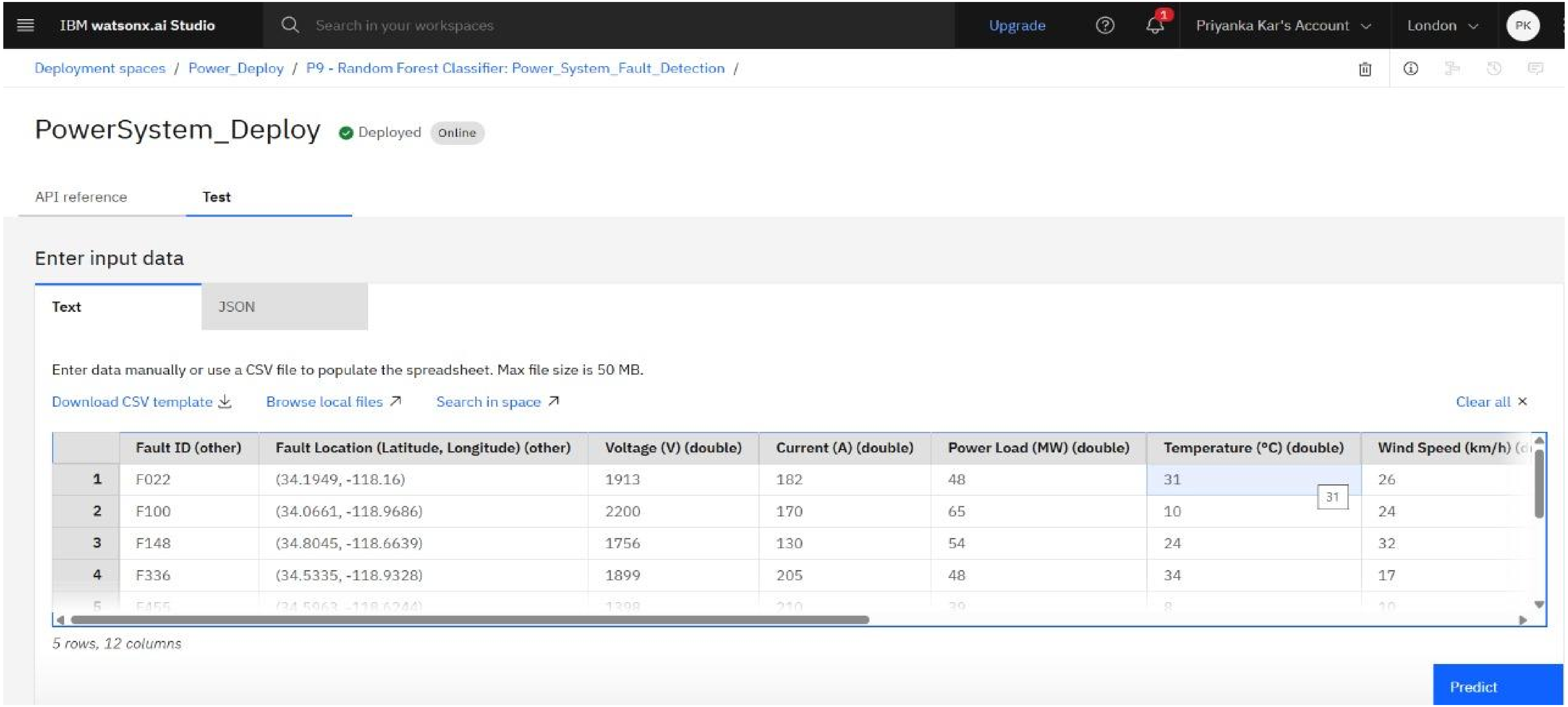


IBM watsonx.ai Studio
Search in your workspaces
Upgrade
Priyanka Kar's Account
London
PK
Projects / Power_System / P9 - Random Forest Classifier: Power_System_Fault_Detection
Input (1)

Column	Type
Component Health	other
Current (A)	double
Down time (hrs)	double
Duration of Fault (hrs)	double
Fault ID	other
Fault Location (Latitude, Longitude)	other
Maintenance Status	other
Power Load (MW)	double

About this asset
Name
P9 - Random Forest Classifier: Power_System_Fault_Detection
Description
No description provided.
Asset Details
Type: wml-hybrid_0.1
Model ID: 6e400ca4-41a3-40...
Software specification:
hybrid_0.1
Hybrid pipeline software specifications:
autoai-kb_rt24.1-py3.11
Tags
Add tags to make assets easier to find.
Last modified
19 seconds ago by Priyanka Kar
Created on
Aug 4, 2025 by Priyanka Kar

RESULT



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RESULT

Prediction results

Close ×

Prediction type

Multiclass classification

Prediction percentage

Transformer Failure | Line Breakage | Overheating

Display format for prediction results

(•) Table view ( ) JSON view

Show input data ⓘ

	Prediction	Confidence
1	Transformer Failure	41%
2	Line Breakage	45%
3	Line Breakage	40%
4	Overheating	37%
5	Overheating	45%
6		
7		
8		
9		
10		
11		

Download JSON file

CONCLUSION

In this project, I developed a machine learning-based solution for efficient fault detection and classification in power distribution systems. Using key electrical parameters such as voltage, current, and power load, I trained a Batched Tree Ensemble Classifier to accurately distinguish between normal operating conditions and various fault types, including line-to-ground, line-to-line, and three-phase faults. The model was deployed on IBM Cloud using Watson Studio, enabling real-time fault prediction through an intuitive interface. This solution ensures faster fault identification, reduces system downtime, and supports the development of a more intelligent and resilient power grid.

FUTURE SCOPE

- Integration of real-time data from smart sensors and IoT devices for live fault monitoring.
- Incorporation of advanced features like frequency deviation, harmonic distortion, and environmental factors.
- Use of deep learning models (e.g., LSTM, CNN) for better performance on time-series fault data.
- Scalability to larger power grids and adaptation for different voltage levels and regions.
- Development of mobile/web dashboards for on-the-go access by field engineers.
- Implementation of auto-alert systems for instant fault notification to grid operators.
- Cloud-based data pipelines for seamless model updates and real-time analytics.

REFERENCES

- IBM Cloud – https://www.ibm.com/cloud
- IBM Watson Studio – https://www.ibm.com/cloud/watson-studio
- IBM AutoAI Documentation – https://www.ibm.com/docs/en/watson-studio

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(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 24 Jul 2025 (GMT)

Learning hours: 20 mins

THANK YOU