# 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 vulnerable to different types of faults, including line-to-ground, line-to-line, and three-phase faults. These disturbances can interrupt power delivery and compromise the reliability of the system. The main challenge is to precisely detect and classify these faults using electrical parameters such as voltage, current, and phasor data. Accurately distinguishing faults from normal operating conditions is crucial for maintaining the stability and efficiency of the power grid.

# Proposed Solution

A machine learning-based approach is proposed to detect and classify power system faults using the given dataset. The model will analyze electrical measurement data to accurately identify the type of fault. This automated fault classification enhances fault detection efficiency and supports faster recovery actions, thereby improving system stability.

- Main steps include:
- Data Collection: Utilize a relevant dataset available on Kaggle.
- Preprocessing: Clean and normalize the data to prepare it for training.
- Model Training: Use a classification algorithm (e.g., Decision Tree, Random Forest, or SVM) to train the model for fault detection.
- Evaluation: Assess the model's performance using metrics like accuracy, precision, recall, and F1-score.

# System Approach

**This section presents the overall strategy and methodology for building and deploying the power system fault detection and classification solution. Below is a proposed framework for implementation:**

**System Requirements:**

**Basic Requirement: IBM Cloud (mandatory)**

**Development Environment: IBM Watson Studio for model development and deployment**

**Data Storage: IBM Cloud Object Storage for managing datasets**

# Algorithm & Deployment

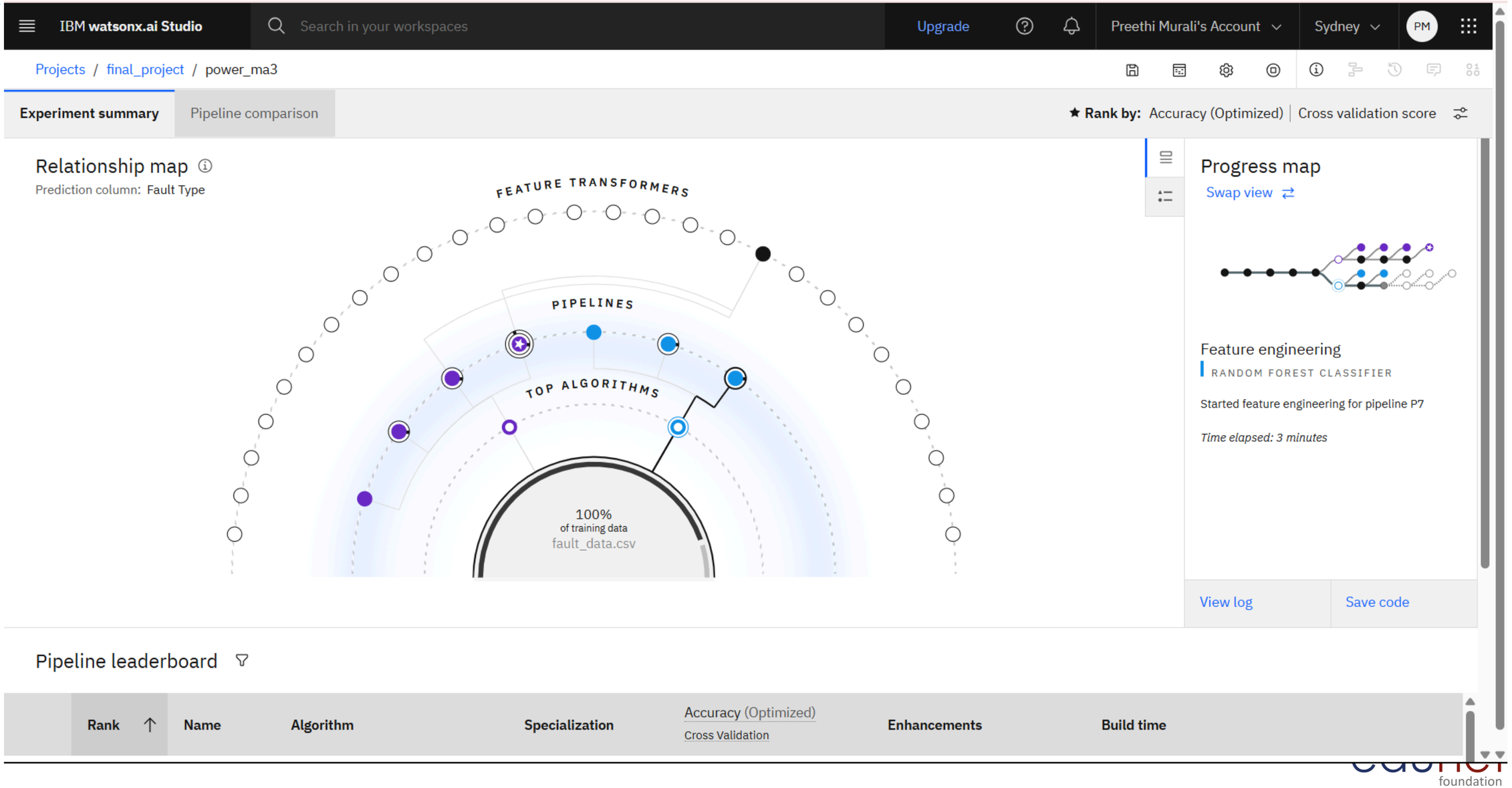
**Algorithm Selection:**
**Random Forest Classifier (or SVM, depending on performance metrics)**

**Data Input:**
**Electrical parameters such as voltage, current, and phasor readings extracted from the dataset**

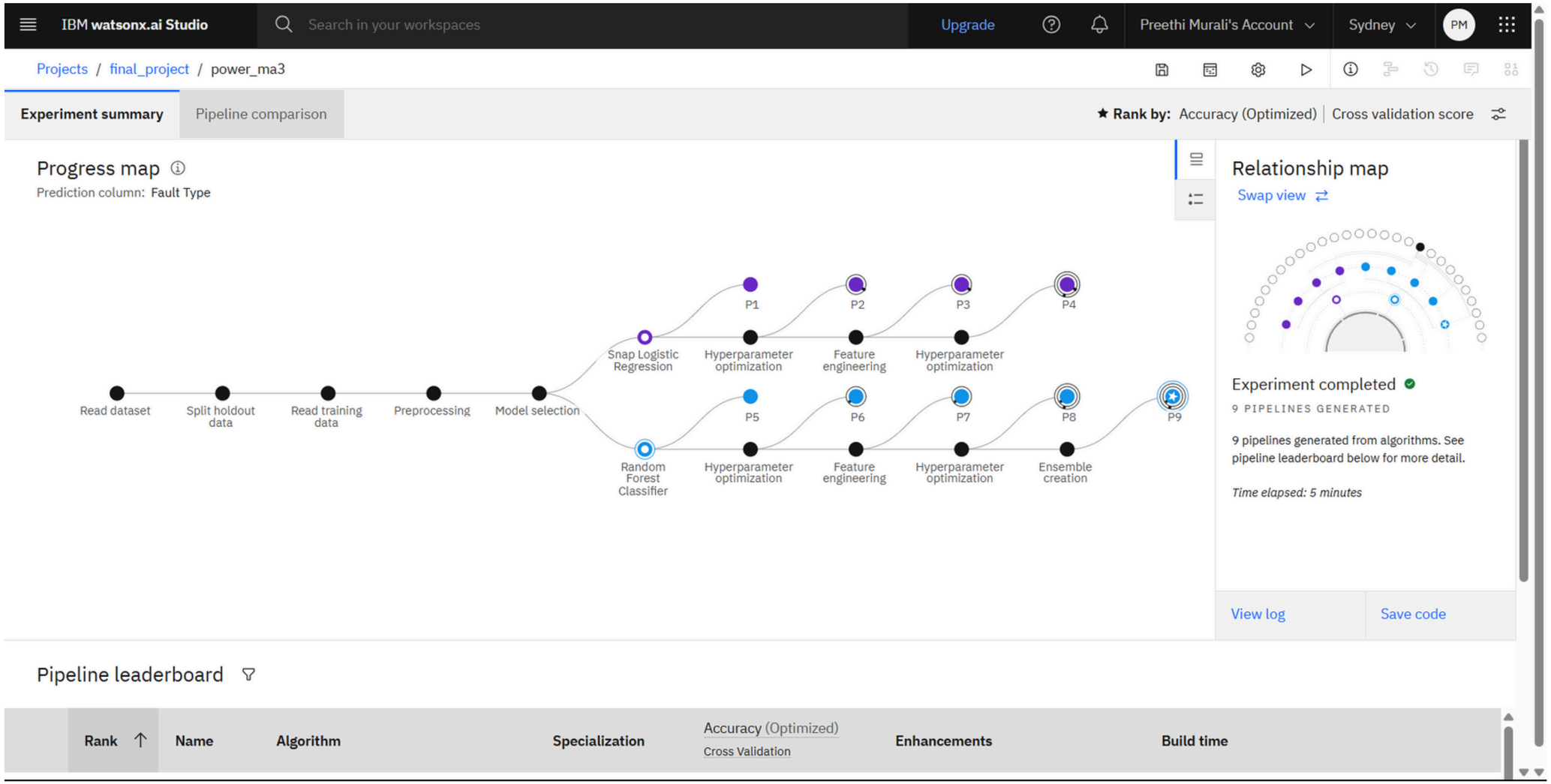
**Training Process:**
**Supervised learning approach using labeled data that corresponds to different types of faults**

**Prediction Process:**
**The trained model is deployed on IBM Watson Studio and integrated with an API endpoint to enable real-time fault predictions**

# Result


IBM watsonx.ai Studio
Search in your workspaces
Upgrade
Preethi Murali's Account
Sydney
PM
Projects / final_project / power_ma3
Experiment summary
Pipeline comparison
Rank by: Accuracy (Optimized) | Cross validation score
Relationship map
Prediction column: Fault Type
FEATURE TRANSFORMERS
PIPELINES
TOP ALGORITHMS
100%
of training data
fault_data.csv
Progress map
Swap view
Feature engineering
RANDOM FOREST CLASSIFIER
Started feature engineering for pipeline P7
Time elapsed: 3 minutes
View log
Save code
Pipeline leaderboard
Rank
Name
Algorithm
Specialization
Accuracy (Optimized)
Cross Validation
Enhancements
Build time

# Result

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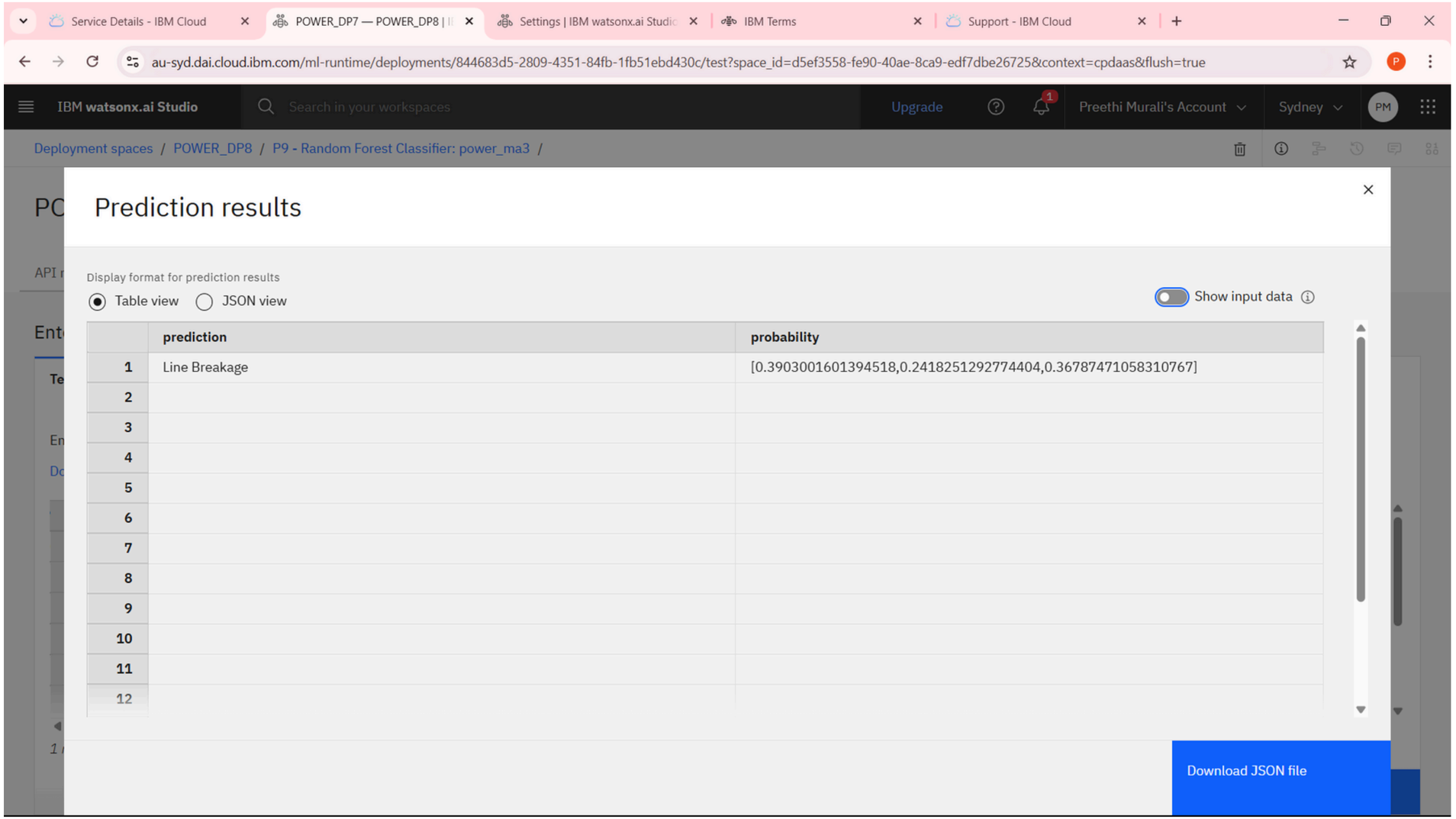
# Result

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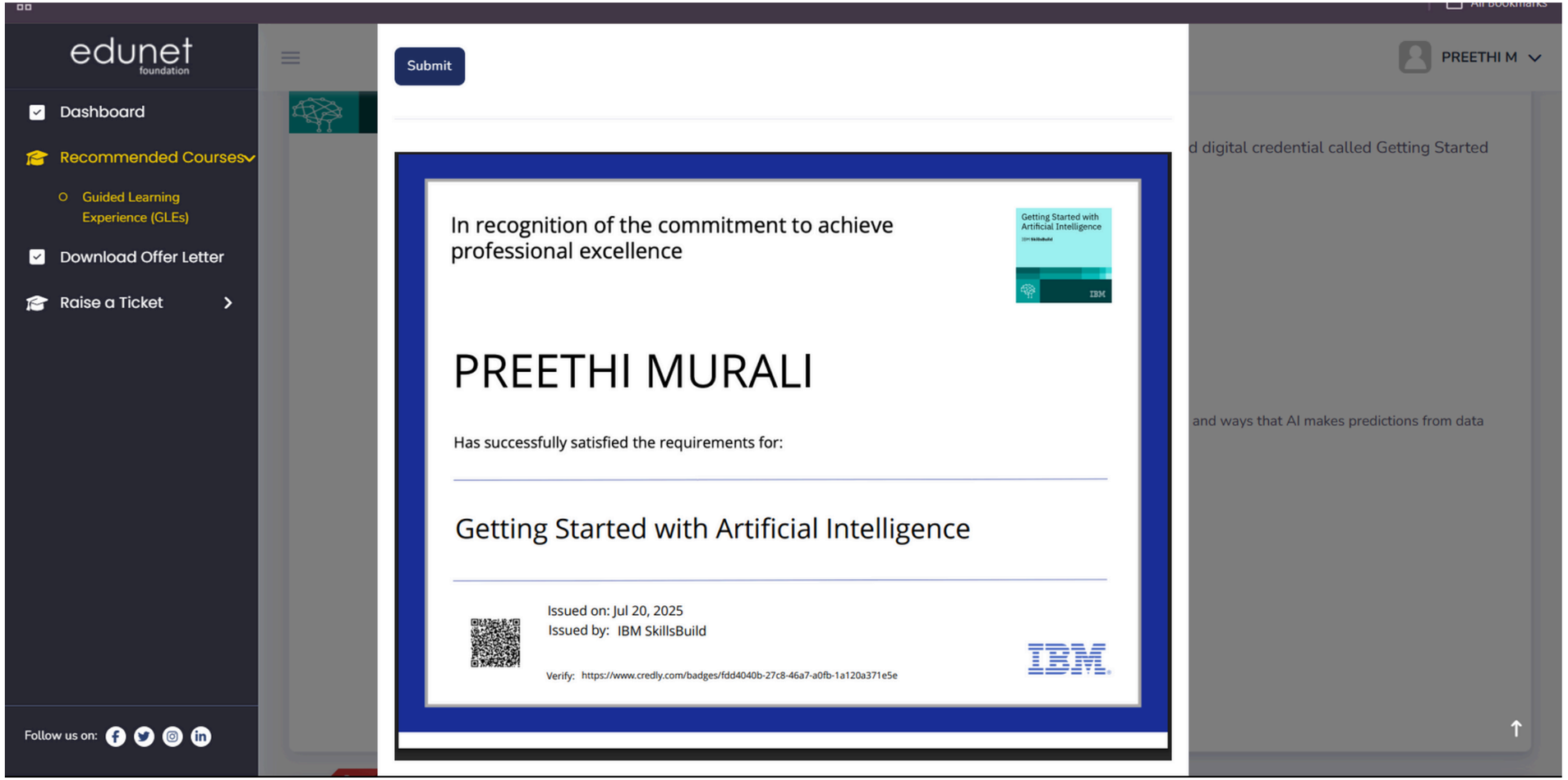
# Conclusion

- This project successfully demonstrates the application of machine learning techniques for accurate and efficient detection and classification of power system faults. By leveraging electrical parameters such as voltage, current, and phasor measurements, the model effectively distinguishes between various fault types. The integration of tools like IBM Watson Studio and cloud-based deployment enables real-time predictions, contributing to quicker response times and improved grid reliability. Overall, the solution offers a scalable and intelligent approach to fault management, which can significantly enhance the stability and resilience of modern power distribution systems.

# Future scope

**This project can be extended by integrating real-time data from smart grids, exploring advanced deep learning models for higher accuracy, and deploying the system on a larger scale. Additionally, user-friendly interfaces and automation can enhance practical implementation in modern power distribution systems.**

# IBM Certifications



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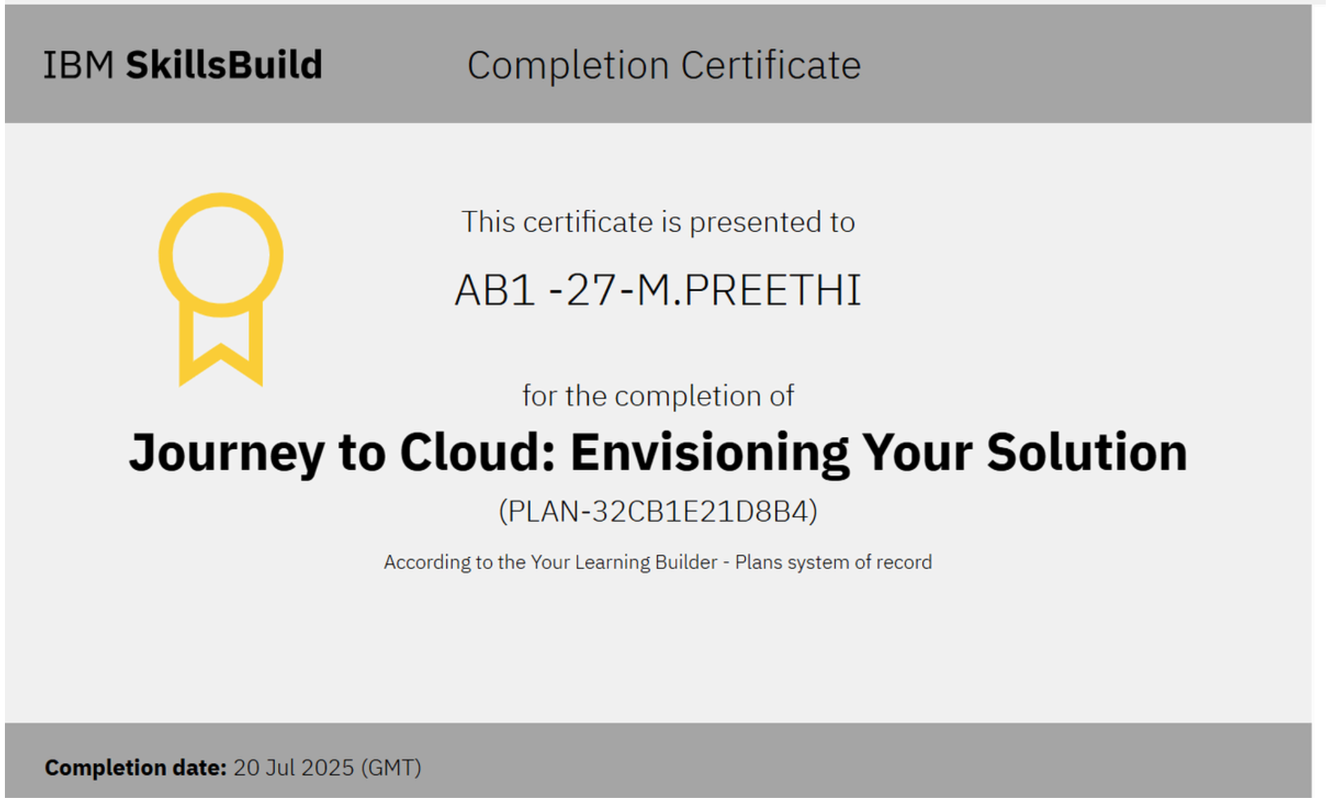

IBM **SkillsBuild** Completion Certificate

This certificate is presented to

AB1 -27-M.PREETHI

for the completion of

**Journey to Cloud: Envisioning Your Solution**

(PLAN-32CB1E21D8B4)

According to the Your Learning Builder - Plans system of record

**Completion date:** 20 Jul 2025 (GMT)

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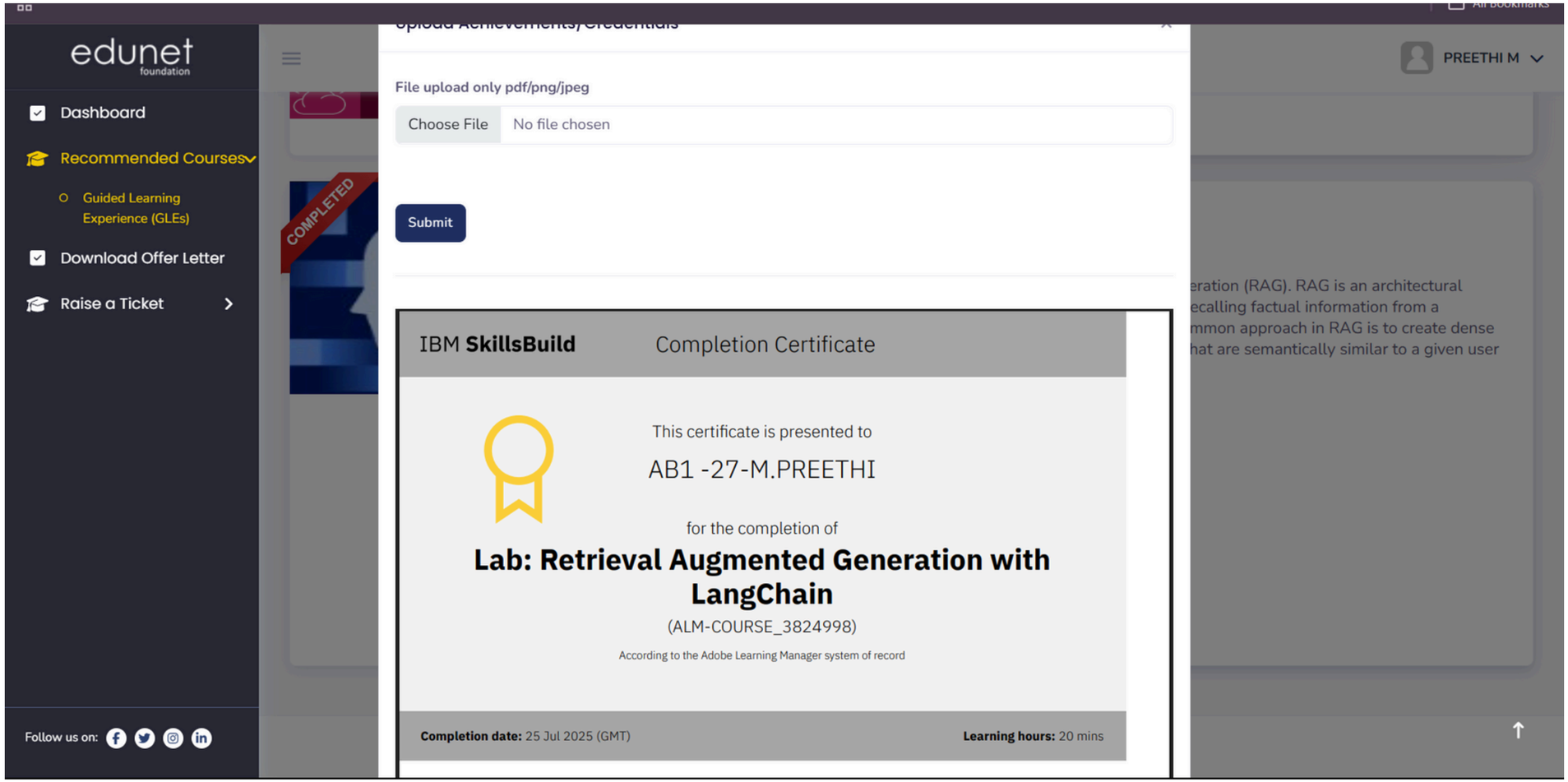


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