CAPSTONE PROJECT

POWER SYSTEM FAULT DETECTION AND CLASSIFICATION

Presented By:

KOTHURI SHIVA KUMAR
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE,WARANGAL [KITSW]
ELECTRICAL AND ELECTRONICS ENGINEERING [EEE]
AICTE STUDENT ID: STU683ecb06dcc261748945670
INTERNSHIP ID: INTERNSHIP_1748937226683eaa0a58abc

edunet foundation

OUTLINE

- Problem Statement
- Proposed System/Solution
- System Development Approach
- Algorithm & Deployment
- Result (Output Image)
- Conclusion
- Future Scope
- References

PROBLEM STATEMENT

Example: Develop a machine learning model to identify and classify various faults in a power distribution system. Based on electrical measurement data (e.g., voltage and current phasors), the model must be able to differentiate between normal operating conditions and different fault conditions (like line-to-ground, line-to-line, or three-phase faults).The goal is to facilitate quick and precise fault detection, which is important for upholding power grid stability and reliability.

PROPOSED SOLUTION

- **Objective**: Develop a machine learning model to classify power system faults accurately and quickly, improving system reliability and enabling faster recovery.
- **Data Collection**:
  - Utilize a publicly available dataset from Kaggle that contains electrical measurements under various fault conditions.
- **Preprocessing**:
  - Clean the dataset to remove noise and inconsistencies.
  - Normalize the data to ensure uniform scaling across features.
- **Model Training**:
  - Train a supervised classification algorithm such as Decision Tree, Random For, or Support Vector Machine (SVM) on the preprocessed data.
  - Use cross-validation to fine-tune hyperparameters and improve generalization.
- **Evaluation**:
  - Assess model performance using standard metrics like accuracy, precision, recall, and F1-score.
  - Ensure the model can generalize well to unseen data for real-time application.
- **Outcome**:
  - A robust, automated fault detection system that supports quicker identification and response to faults in the power grid.

SYSTEM APPROACH

The System Approach defines the overall framework for designing, developing, and deploying the power system fault detection and classification model. It integrates cloud-based tools and machine learning techniques to ensure scalability, reliability, and real-time performance.

- **System Requirements**:
  - **IBM Cloud**: Acts as the primary cloud platform for hosting and managing the entire solution.
  - **IBM Watson Studio**: Used for building, training, and deploying the machine learning model. It provides an interactive environment for data science workflows.
  - **IBM Cloud Object Storage**: Used for storing and managing the power system dataset securely and efficiently, ensuring seamless integration with Watson Studio during training and inference stages.

ALGORITHM & DEPLOYMENT

- **Algorithm Selection**:
  - Use Random Forest Classifier for its accuracy and robustness.
  - Optionally test Support Vector Machine (SVM) for performance comparison.

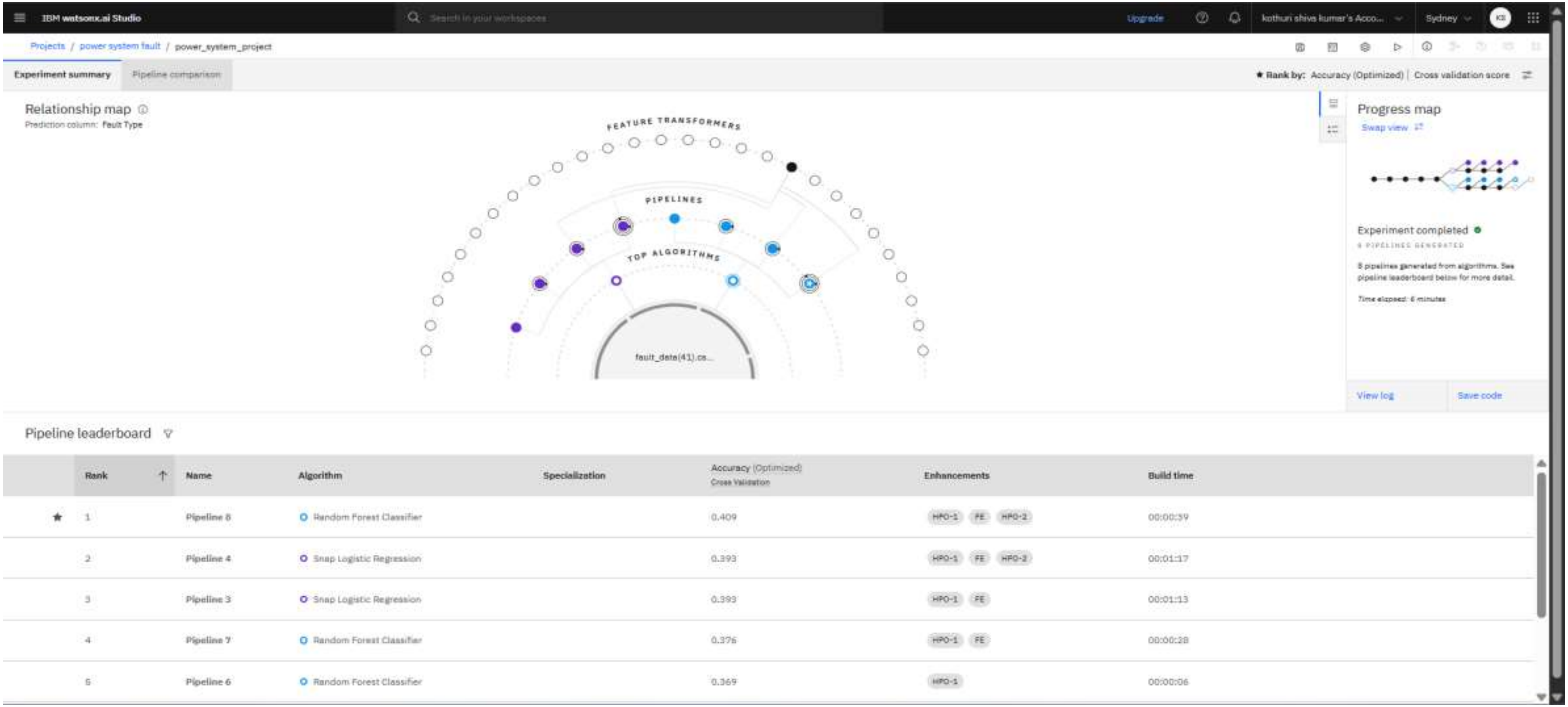
- **Data Input**:
  - Input features include voltage, current, and phasor measurements from the dataset.

- **Training Process**:
  - Apply supervised learning using labeled data representing different fault types.
  - Train the model to recognize patterns and accurately classify fault conditions.

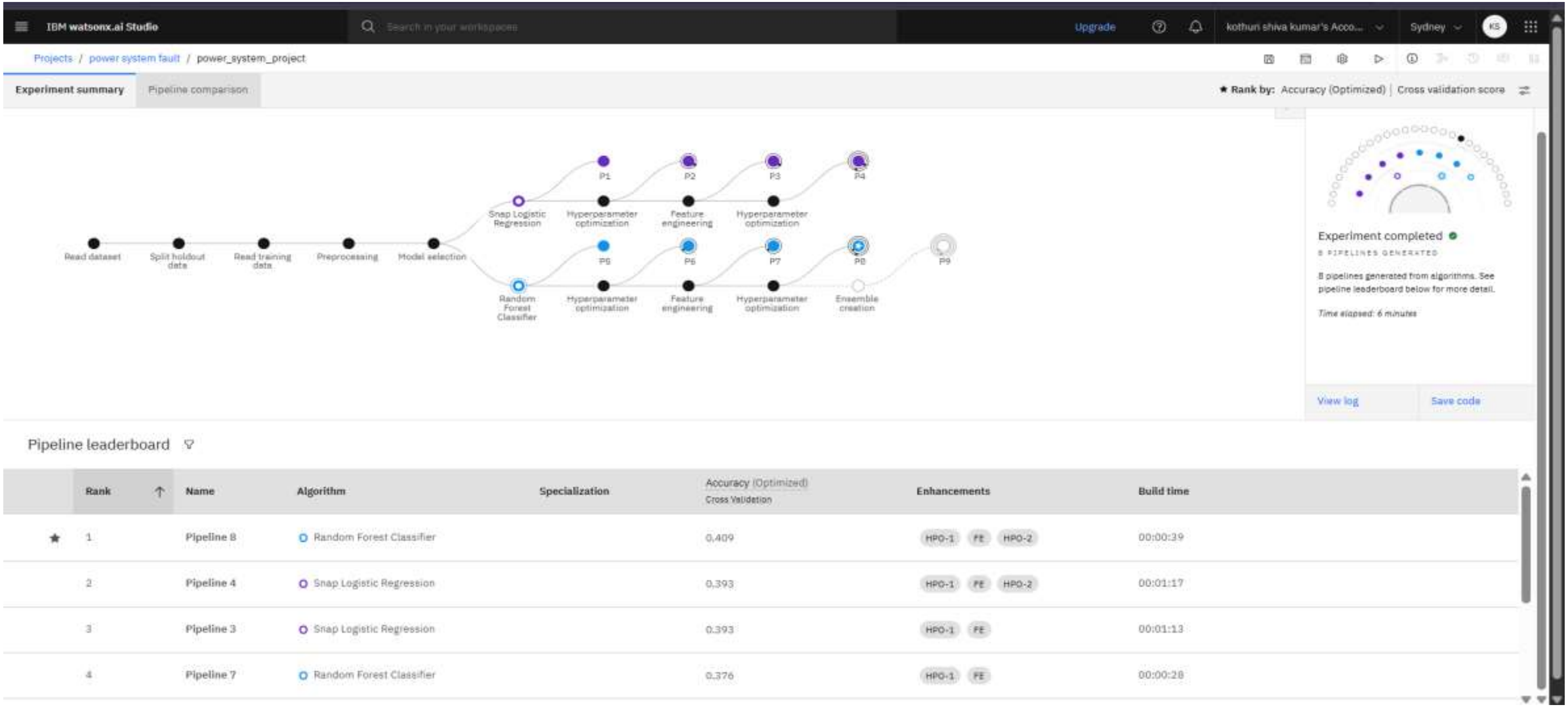
- **Prediction Process**:
  - Deploy the trained model on IBM Watson Studio.
  - Create an API endpoint for real-time fault prediction.
  - Integrate the API with power system monitoring tools for live data analysis.

- **Deployment Outcome**:
  - Enables automated, real-time detection and classification of faults in the power grid.
  - Supports quick decision-making and fault response to enhance system stability.

RESULT

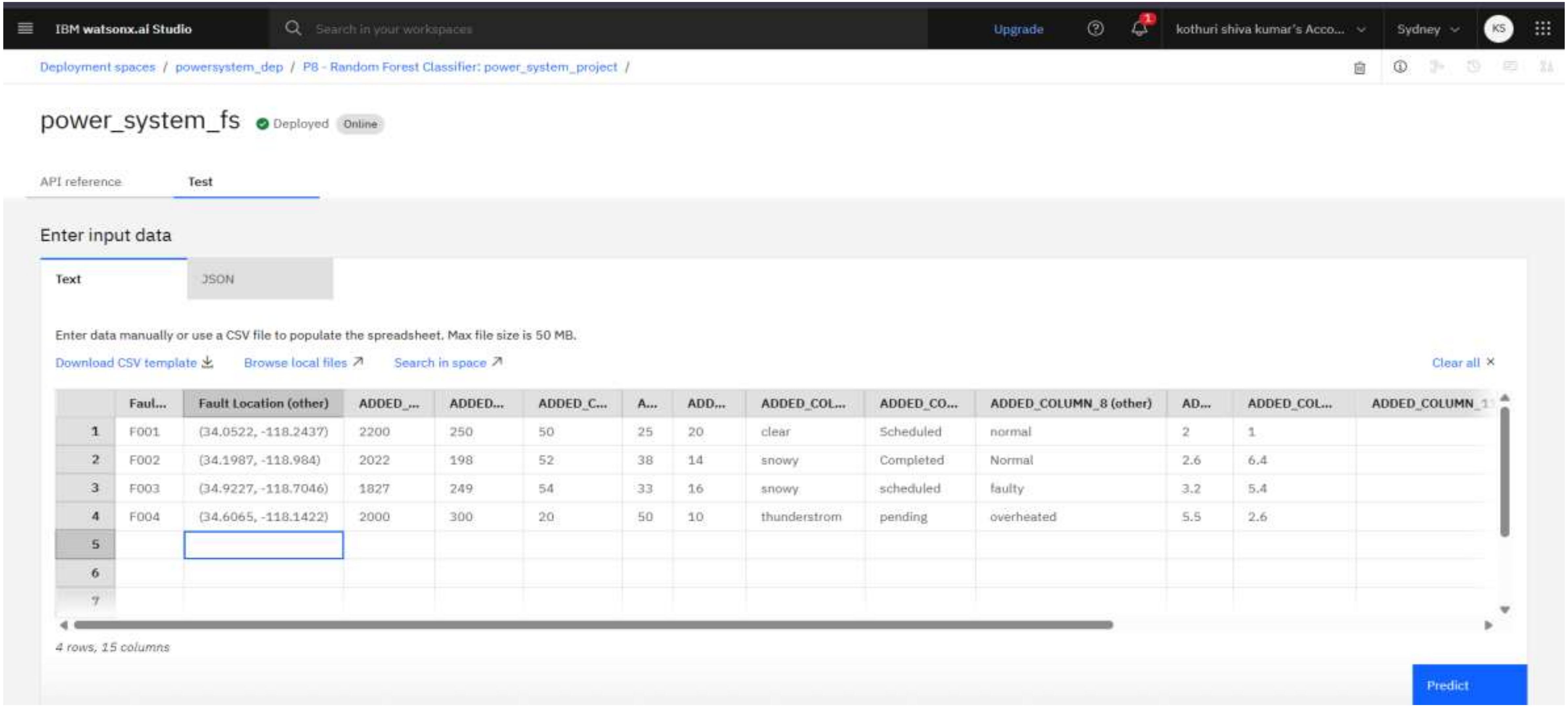

IBM watsonx.ai Studio
Upgrade
Sydney
Projects / power system fault / power_system_project
Experiment summary
Pipeline comparison
Rank by: Accuracy (Optimized) | Cross validation score
Relationship map
Prediction column: Fault Type
FEATURE TRANSFORMERS
PIPELINES
TOP ALGORITHMS
fault_data(41).cs...
Progress map
Swap view
Experiment completed
View log
Save code
Pipeline leaderboard
Rank
Name
Algorithm
Specialization
Accuracy (Optimized)
Cross Validation
Enhancements
Build time
1 Pipeline 8 Random Forest Classifier 0.409 HPO-1 FE HPO-2 00:00:39
2 Pipeline 4 Snap Logistic Regression 0.393 HPO-1 FE HPO-2 00:01:17
3 Pipeline 3 Snap Logistic Regression 0.393 HPO-1 FE 00:01:13
4 Pipeline 7 Random Forest Classifier 0.376 HPO-1 FE 00:00:28
5 Pipeline 6 Random Forest Classifier 0.369 HPO-1 00:00:06

RESULT



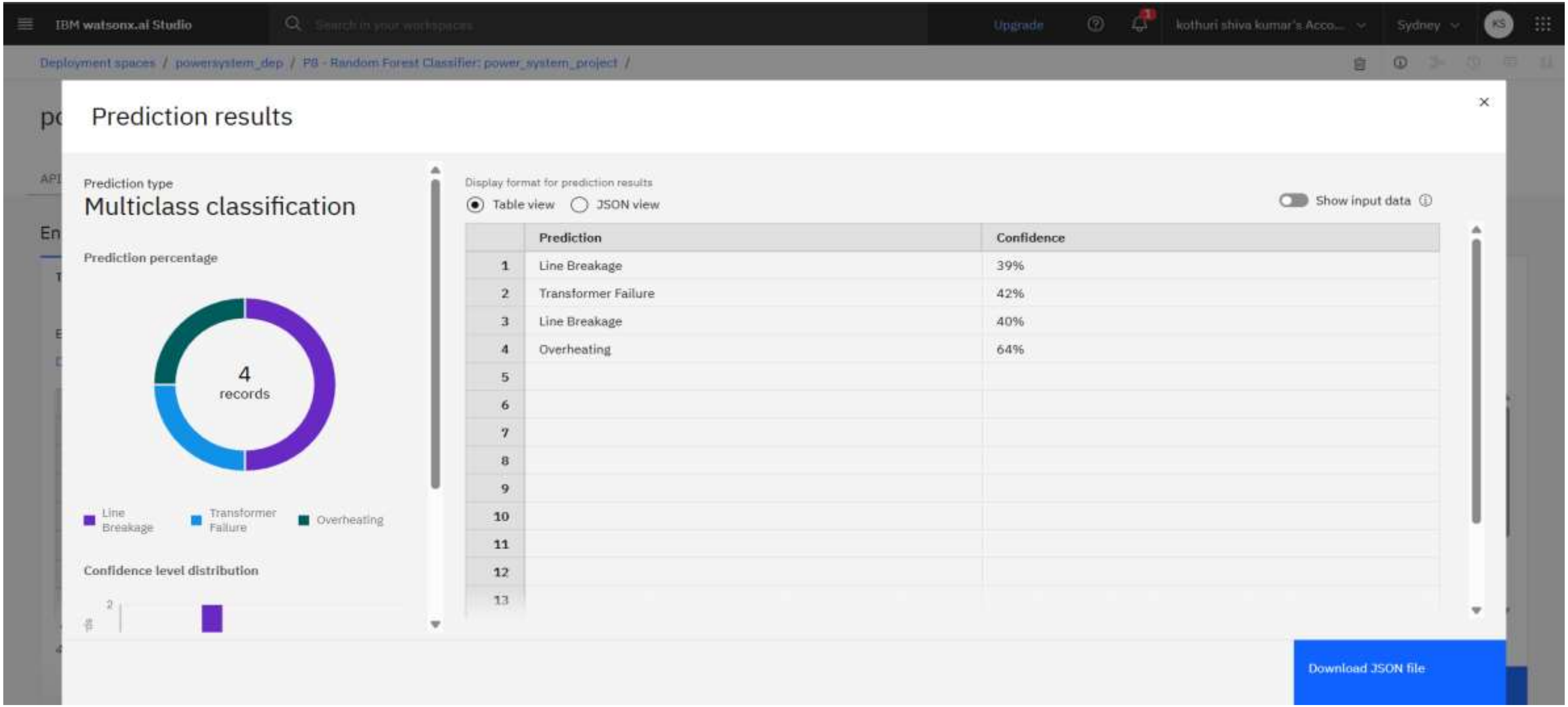
edunet foundation

RESULT



edunet foundation

RESULT


IBM watsonx.ai Studio
Upgrade
kothuri shiva kumar's Acco...
Sydney
Deployment spaces / powersystem_dep / PB - Random Forest Classifier: power_system_project /
Prediction results
Prediction type
Multiclass classification
Prediction percentage
4
records
Line Breakage
Transformer Failure
Overheating
Confidence level distribution
Display format for prediction results
Table view
JSON view
Show input data
Prediction
Confidence
1 Line Breakage 39%
2 Transformer Failure 42%
3 Line Breakage 40%
4 Overheating 64%
5
6
7
8
9
10
11
12
13
Download JSON file

CONCLUSION

Intelligent, data-driven approaches like machine learning provide an effective solution for real-time power system fault detection and classification. By analyzing electrical signals such as voltage and current phasors, the system enhances reliability, minimizes equipment damage, and reduces outage times. The proposed method overcomes the limitations of conventional techniques and contributes significantly to the stability and safety of modern power grids.

FUTURE SCOPE

In the future, the design of the proposed fault detection system can be further developed to address the increasing needs of contemporary power grids. By integrating sophisticated deep learning techniques like Convolutional Neural Networks (CNNs) and Long Short-Term Memory (LSTM) networks, the system can improve the accuracy of fault classification and facilitate accurate fault localization. Integration with IoT-enabled smart grid infrastructure will enable real-time monitoring at scale, with larger geographical coverage and higher sensor density.

REFERENCES

- https://www.kaggle.com/datasets/ziya07/power-system faults-dataset
- IBM Cloud
- Baskar D, Dr Selvam P, “Machine Learning Framework For Power System Fault Detection And Classification ”, 20 issn 2277-8616-2032, 2020.from[Google Scholar](Google Scholar)
- Jamil, M., Sharma, S.K. Singh, R. “Fault detection and classification in electrical power transmission system using artificial neural network.” *SpringerPlus* 4, 334 (2015). https://doi.org/10.1186/s40064-015-1080-x
- K. Moloi and A. O. Akumu, “Power distribution fault diagnostic method based on machine learning technique,” *2019 IEEE PES/IAS Power Africa*, 2019, pp. 238242, doi: 10.1109/PowerAfrica.2019.8928633.

edunet
foundation

IBM CERTIFICATIONS

In recognition of the commitment to achieve professional excellence

Getting Started with Artificial Intelligence

IBM SkillsBuild

IBM

Kothuri Shiva kumar

Has successfully satisfied the requirements for:

Getting Started with Artificial Intelligence

Issued on: Jul 15, 2025

Issued by: IBM SkillsBuild

Verify: https://www.credly.com/badges/9c360a3c-85ab-4424-9c6d-6bb17e6961a6

IBM

IBM CERTIFICATIONS

In recognition of the commitment to achieve professional excellence

Journey to Cloud: Envisioning Your Solution

IBM SkillsBuild

IBM

Kothuri Shiva kumar

Has successfully satisfied the requirements for:

Journey to Cloud: Envisioning Your Solution

Issued on: Jul 18, 2025
Issued by: IBM SkillsBuild

Verify: https://www.credly.com/badges/8702ba51-cf79-46e7-866d-5529afabeee0

IBM

IBM CERTIFICATIONS

IBM **SkillsBuild** Completion Certificate

This certificate is presented to

Kothuri Shiva kumar

for the completion of

Lab: Retrieval Augmented Generation with LangChain

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 24 Jul 2025 (GMT)

Learning hours: 20 mins

THANK YOU