CAPSTONE PROJECT

POWER SYSTEM FAULT DETECTION AND CLASSIFICATION

Presented By:
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OUTLINE

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

PROBLEM STATEMENT

Design a machine learning model that can detect and classify different types of faults in a power distribution system. By using electrical measurement data like voltage and current phasors, the model will learn to tell the difference between normal conditions and various fault types, such as line-to-ground, line-to-line, or three-phase faults. This will help in quickly and accurately identifying faults, which is important for keeping the power grid stable and reliable.

PROPOSED SOLUTION

The goal of the proposed system is to detect and classify faults in a power distribution system using machine learning. By analyzing electrical measurement data such as voltage and current phasors, the system can distinguish between normal operation and various fault types. The solution will involve the following components:

- **Data Collection:** use the Kaggle dataset on power system faults.
- **Data Preprocessing:** clean and normalize the dataset.
- **Model Training:** Train a classification model (e.g., Decision Tree , Random Forest) .
- **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 Power System Fault Detection and Classification prediction system. Here's a suggested structure for this section:

- System requirements
- IBM CLOUD (MANDATORY)
- IBM WATSON STUDIO FOR MODEL DEVELOPMENT AND DEPLOYMENT
- IBM CLOUD OBLECT STORAGE FOR DATASET HANDLING

ALGORITHM & DEPLOYMENT

- In the Algorithm section, describe the machine learning algorithm chosen for predicting Power System Fault Detection and Classification. Here's an example structure for this section:
- **Algorithm Selection:**

  Random forest classification (or SVM based on performance) .
- **Data Input:**

  Voltage, current and phasor measurements from the dataset.
- **Training Process:**

  Supervised learning using labelled fault types.
- **Prediction Process:**

  Model deployed on IBM watsonx studio with API endpoint for real-time prediction.

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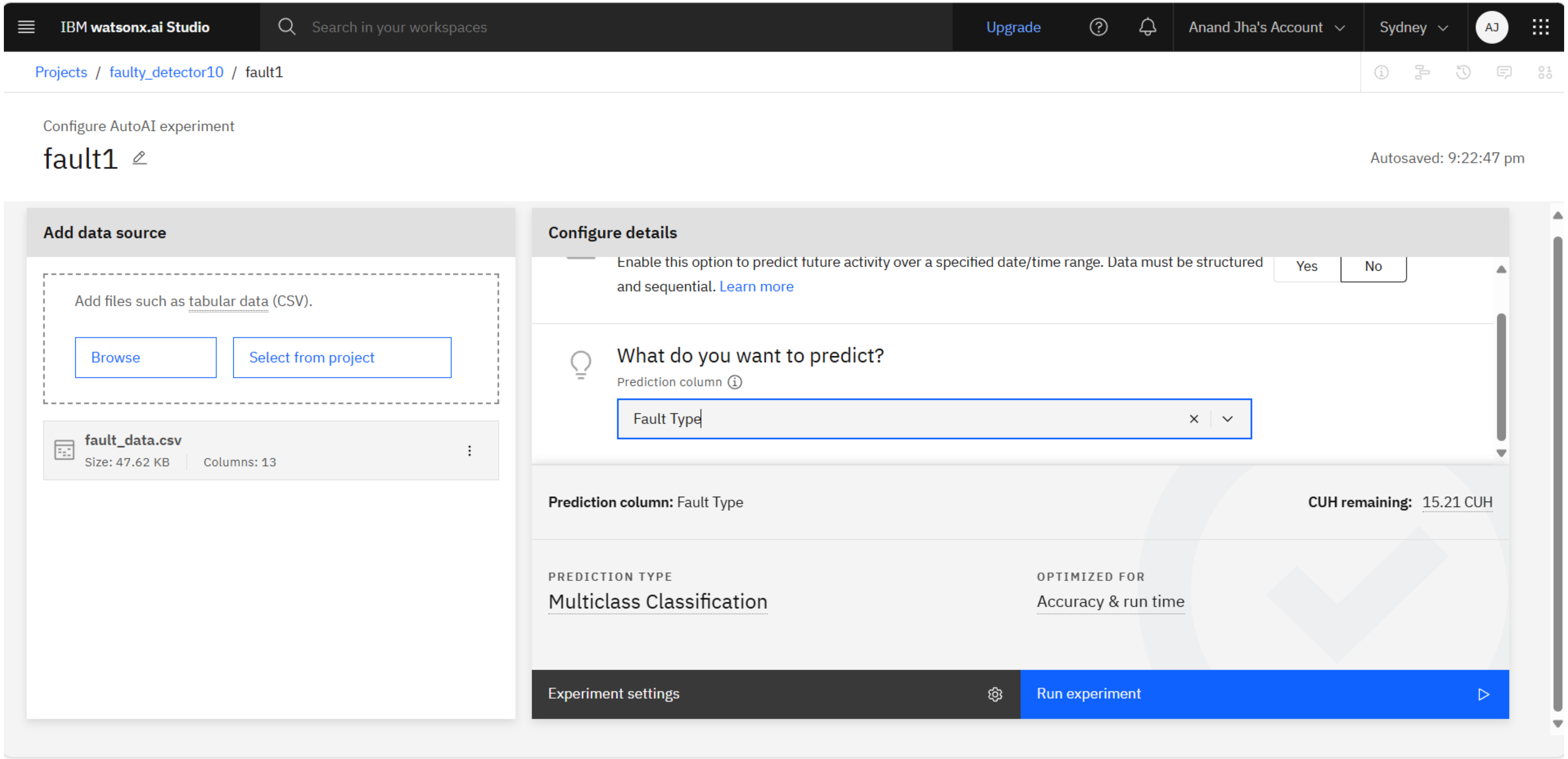
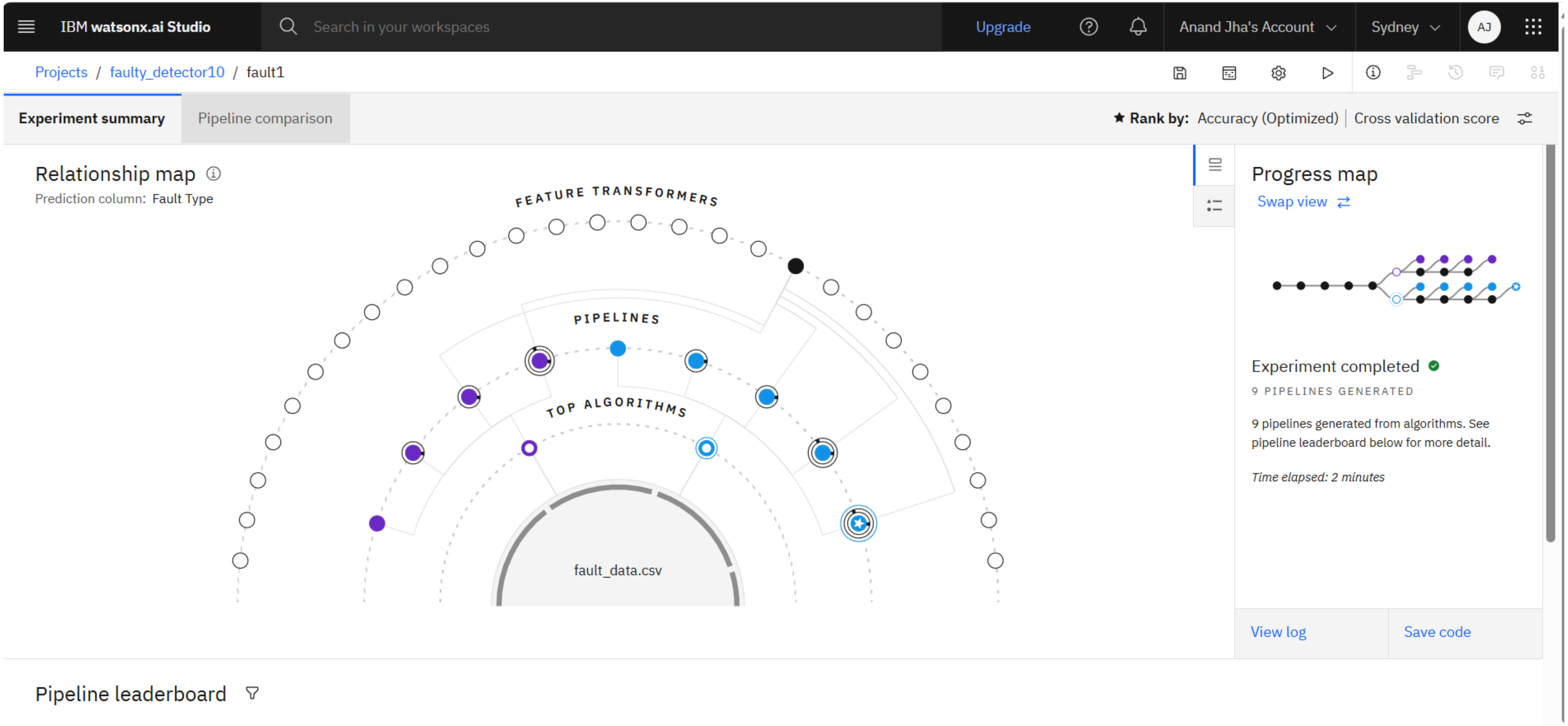
RESULT


IBM watsonx.ai Studio
Search in your workspaces
Upgrade
Anand Jha's Account
Sydney
AJ
Projects / faulty_detector10 / fault1
Configure AutoAI experiment
fault1
Autosaved: 9:22:47 pm
Add data source
Add files such as tabular data (CSV).
Browse
Select from project
fault_data.csv
Size: 47.62 KB
Columns: 13
Configure details
Enable this option to predict future activity over a specified date/time range. Data must be structured and sequential. Learn more
Yes
No
What do you want to predict?
Prediction column
Fault Type
Prediction column: Fault Type
CUH remaining: 15.21 CUH
PREDICTION TYPE
Multiclass Classification
OPTIMIZED FOR
Accuracy & run time
Experiment settings
Run experiment

RESULT



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Search in your workspaces
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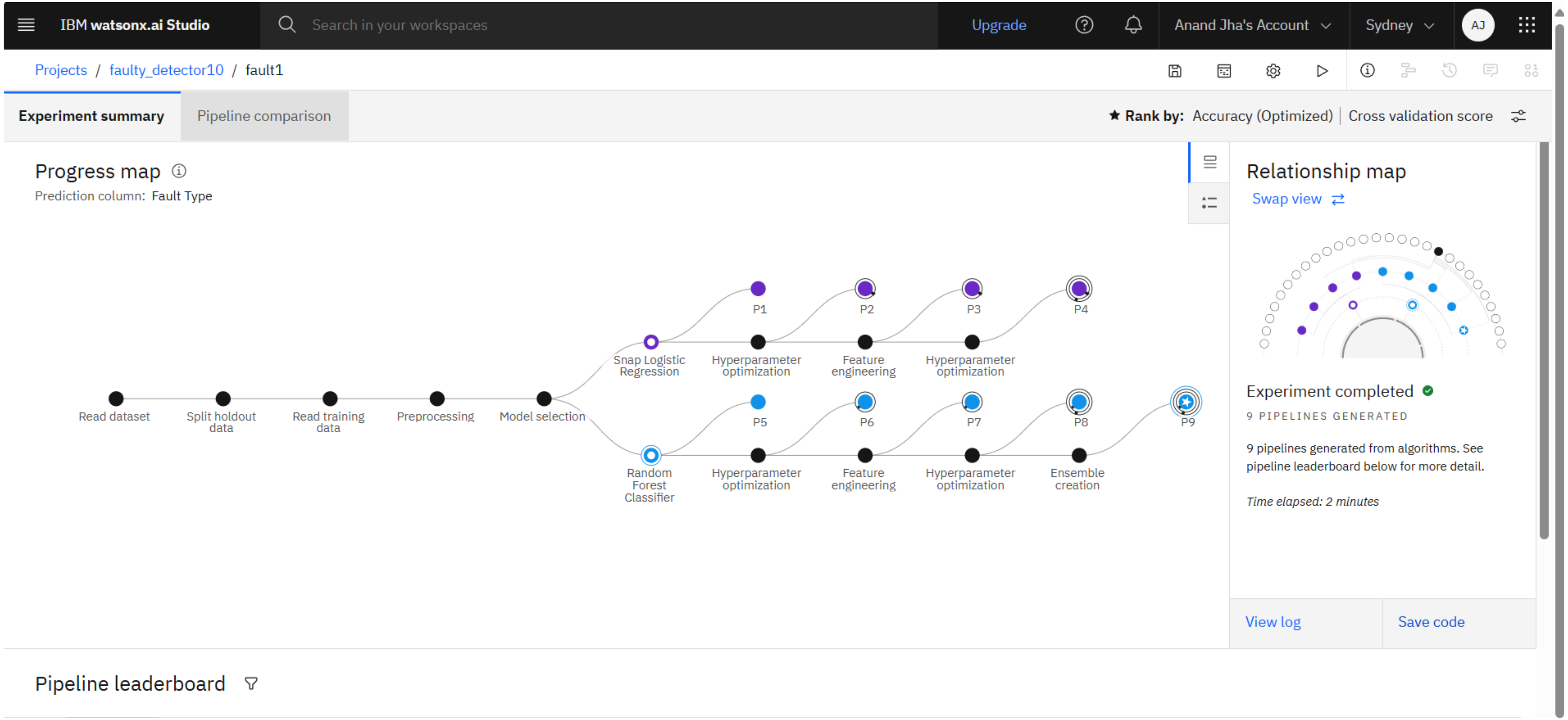
Projects / faulty_detector10 / fault1
Experiment summary
Pipeline comparison
Rank by: Accuracy (Optimized) | Cross validation score
Relationship map
Prediction column: Fault Type
FEATURE TRANSFORMERS
PIPELINES
TOP ALGORITHMS
fault_data.csv
Progress map
Swap view
Experiment completed
9 PIPELINES GENERATED
9 pipelines generated from algorithms. See pipeline leaderboard below for more detail.
Time elapsed: 2 minutes
View log
Save code
Pipeline leaderboard

RESULT



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AJ
Projects / faulty_detector10 / fault1
Experiment summary
Pipeline comparison
Rank by: Accuracy (Optimized) | Cross validation score
Progress map
Prediction column: Fault Type
Read dataset
Split holdout data
Read training data
Preprocessing
Model selection
Snap Logistic Regression
Random Forest Classifier
Hyperparameter optimization
Feature engineering
Hyperparameter optimization
Hyperparameter optimization
Feature engineering
Hyperparameter optimization
Ensemble creation
P1
P2
P3
P4
P5
P6
P7
P8
P9
Relationship map
Swap view
Experiment completed
9 PIPELINES GENERATED
9 pipelines generated from algorithms. See pipeline leaderboard below for more detail.
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Save code
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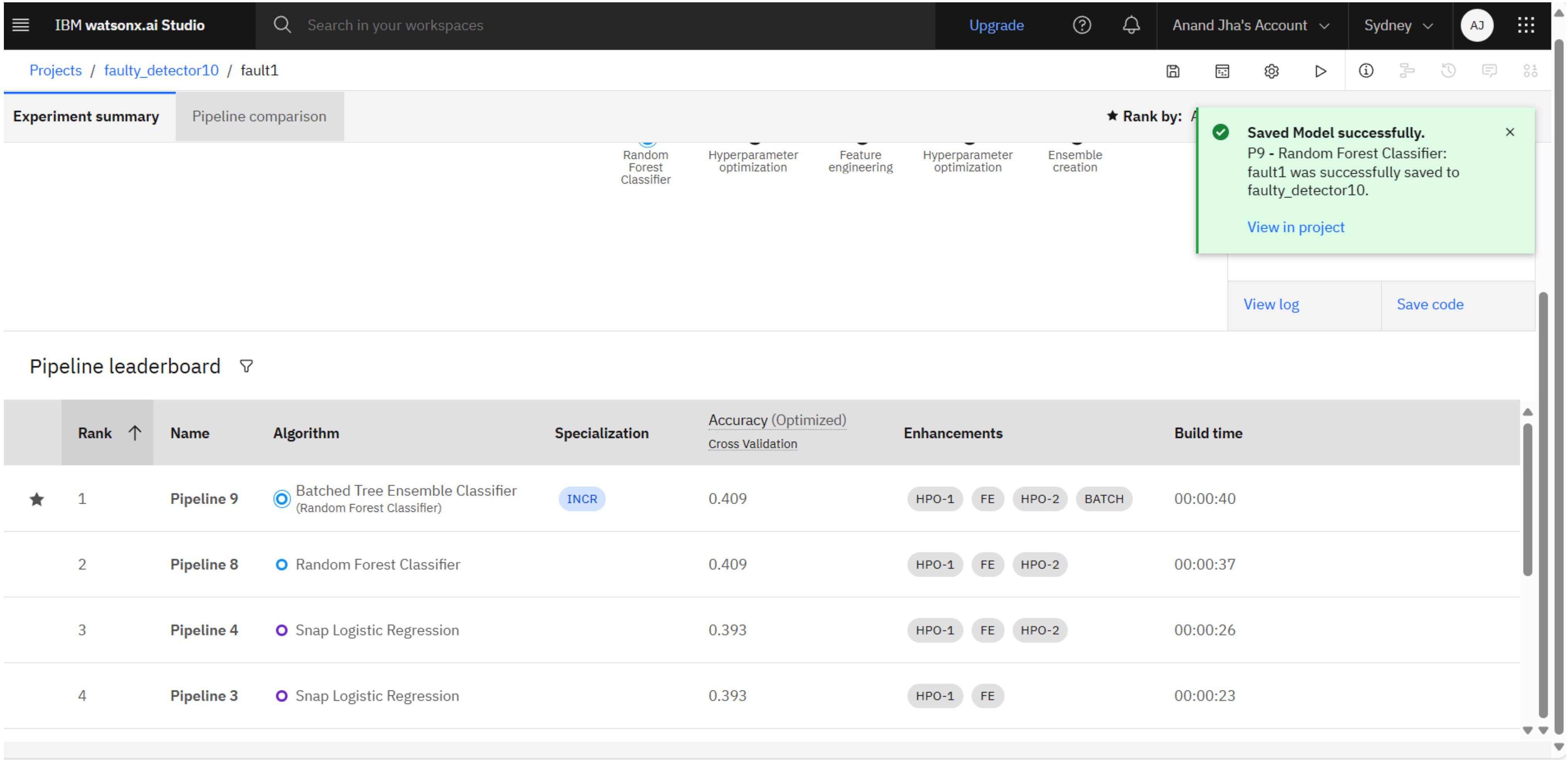
RESULT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Search in your workspaces
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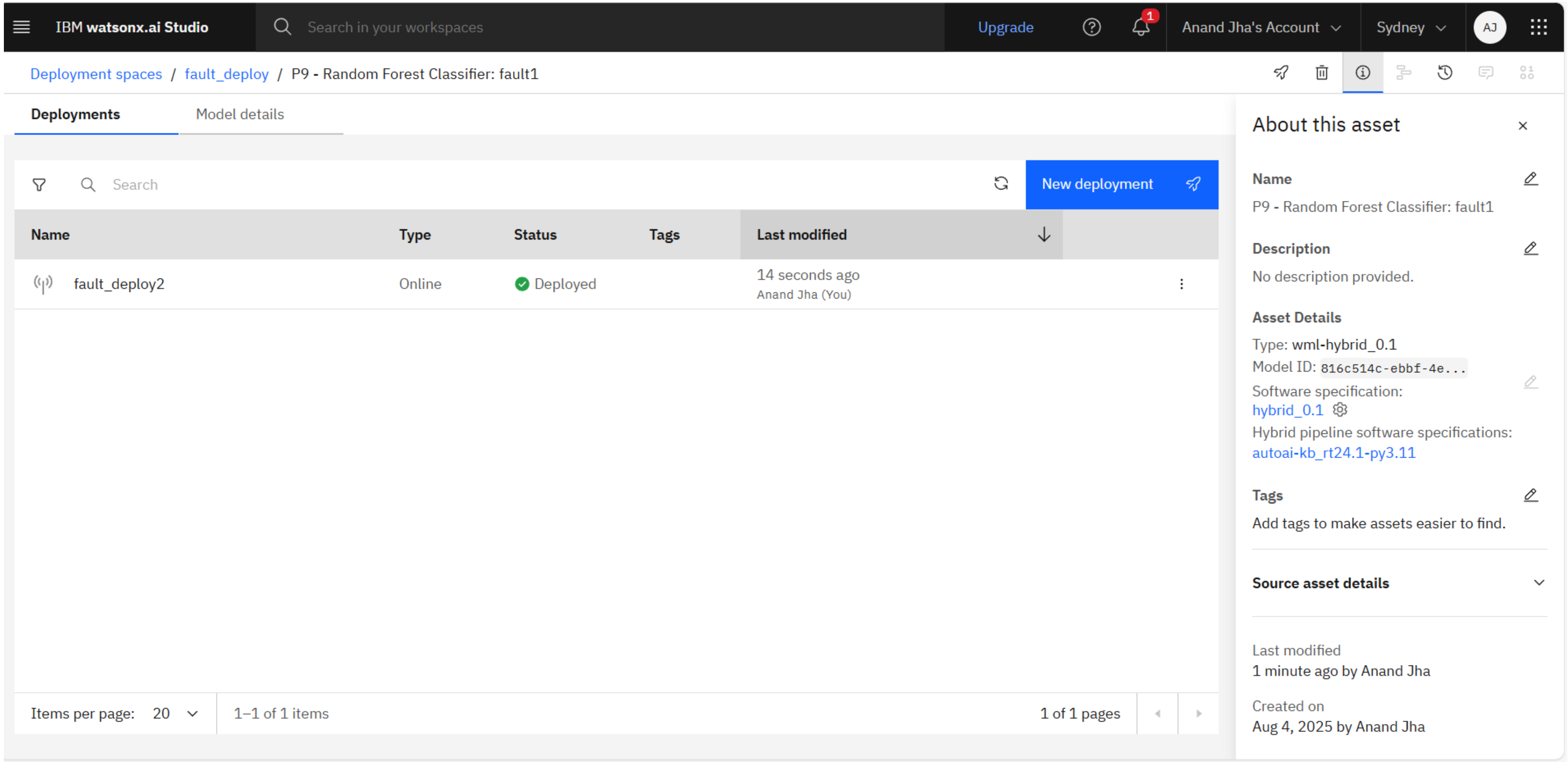
AJ
Projects / faulty_detector10 / fault1
Experiment summary
Pipeline comparison
Rank by:
Random Forest Classifier
Hyperparameter optimization
Feature engineering
Hyperparameter optimization
Ensemble creation
Saved Model successfully.
P9 - Random Forest Classifier: fault1 was successfully saved to faulty_detector10.
View in project
View log
Save code
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 00:00:40
2 Pipeline 8 Random Forest Classifier 0.409 HPO-1 FE HPO-2 00:00:37
3 Pipeline 4 Snap Logistic Regression 0.393 HPO-1 FE HPO-2 00:00:26
4 Pipeline 3 Snap Logistic Regression 0.393 HPO-1 FE 00:00:23

RESULT



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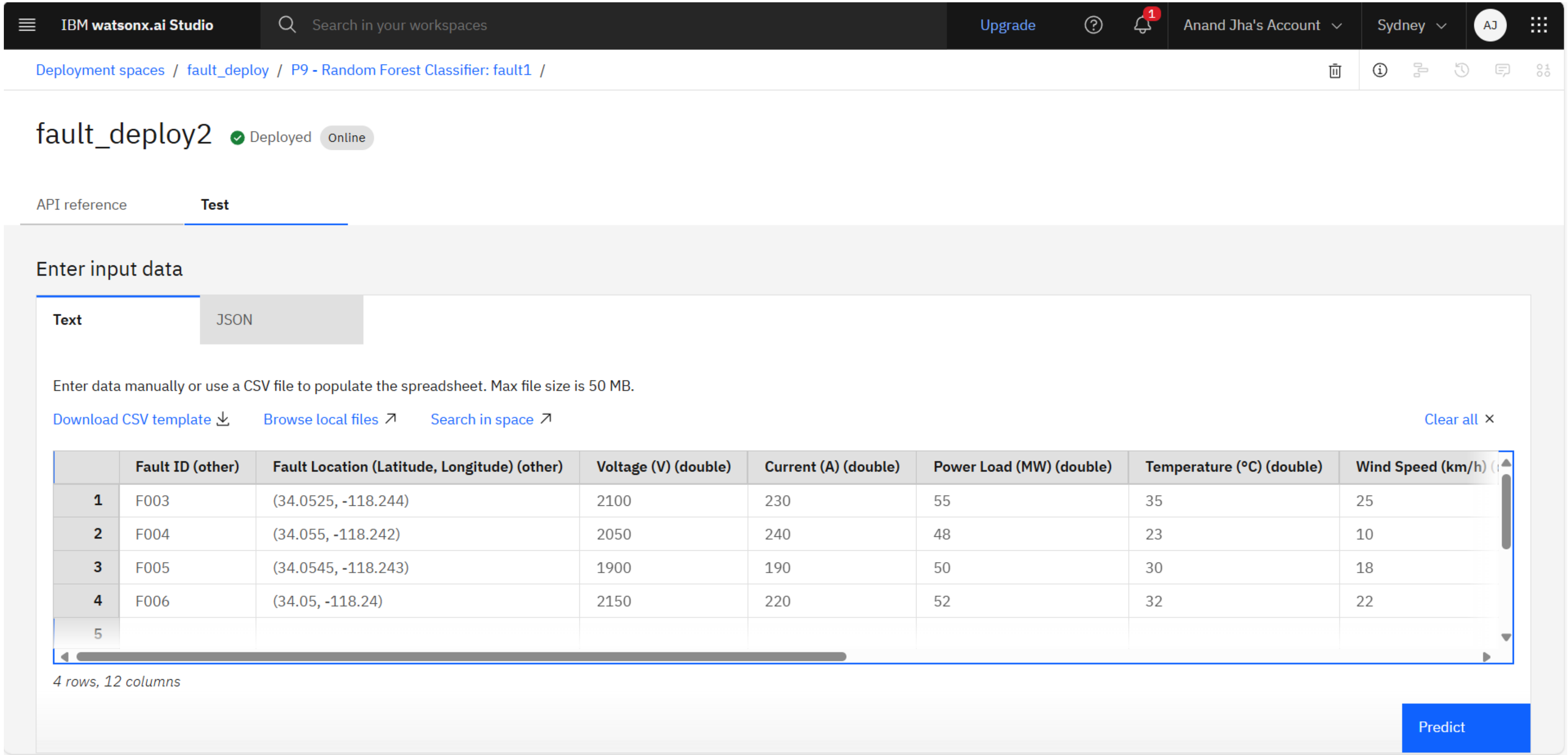
RESULT


IBM watsonx.ai Studio
Search in your workspaces
Upgrade
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Sydney
AJ
Deployment spaces / fault_deploy / P9 - Random Forest Classifier: fault1 /
fault_deploy2
Deployed
Online
API reference
Test
Enter input data
Text
JSON
Enter data manually or use a CSV file to populate the spreadsheet. Max file size is 50 MB.
Download CSV template
Browse local files
Search in space
Clear all
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)
1 | F003 | (34.0525, -118.244) | 2100 | 230 | 55 | 35 | 25
2 | F004 | (34.055, -118.242) | 2050 | 240 | 48 | 23 | 10
3 | F005 | (34.0545, -118.243) | 1900 | 190 | 50 | 30 | 18
4 | F006 | (34.05, -118.24) | 2150 | 220 | 52 | 32 | 22
5
4 rows, 12 columns
Predict

RESULT

Prediction results

Close ×

Display format for prediction results

(•) Table view ( ) JSON view

Show input data ⓘ

	prediction	probability
1	Overheating	[0.2910821979617533,0.37123284986298116,0.33768495217526545]
2	Line Breakage	[0.5449969393042704,0.27473275868914016,0.18027030200658925]
3	Transformer Failure	[0.35086020700535114,0.27274207234586495,0.37639772064878374]
4	Line Breakage	[0.3460042759167417,0.3280694101262557,0.32592631395700233]
5		
6		
7		
8		
9		
10		
11		

Download JSON file

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CONCLUSION

- The machine learning model effectively identifies and classifies power system faults , improving the fault search time.
- This contribute as a more stable and reliable power grid.

FUTURE SCOPE

- Use real-time sensor data instead of static dataset
- Integrate with smart grid system
- Future systems can automatically isolate faults and restore power quickly.
- It can be upgraded to predict faults before they happen, reducing power outages.
- The model can keep learning from new data to handle new fault types and changes in the grid.

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REFERENCES

- Kaggle document : -https://www.kaggle.com/datasets/ziya07/power-system faults-dataset
- IBM CLOUD and watsonx documentation
- **Razaque & Rizwan (2021)** – Applied ML algorithms in smart grids for fault detection.
- **Abdullah et al. (2020)** – Reviewed various ML methods for fault detection in power systems.

IBM CERTIFICATIONS

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This certificate is presented to

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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