CAPSTONE PROJECT

PREDICTIVE MAINTENANCE OF INDUSTRIAL MACHINERY 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

Develop a predictive maintenance model for a fleet of industrial machines to anticipate failures before they occur. This project will involve analyzing sensor data from machinery to identify patterns that precede a failure. The goal is to create a classification model that can predict the type of failure (e.g., tool wear, heat dissipation, power failure) based on real-time operational data. This will enable proactive maintenance, reducing downtime and operational costs.

PROPOSED SOLUTION

- Develop a predictive maintenance model for a fleet of industrial machines to anticipate failures before they occur. This project will involve analyzing sensor data from machinery to identify patterns that precede a failure.
- **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

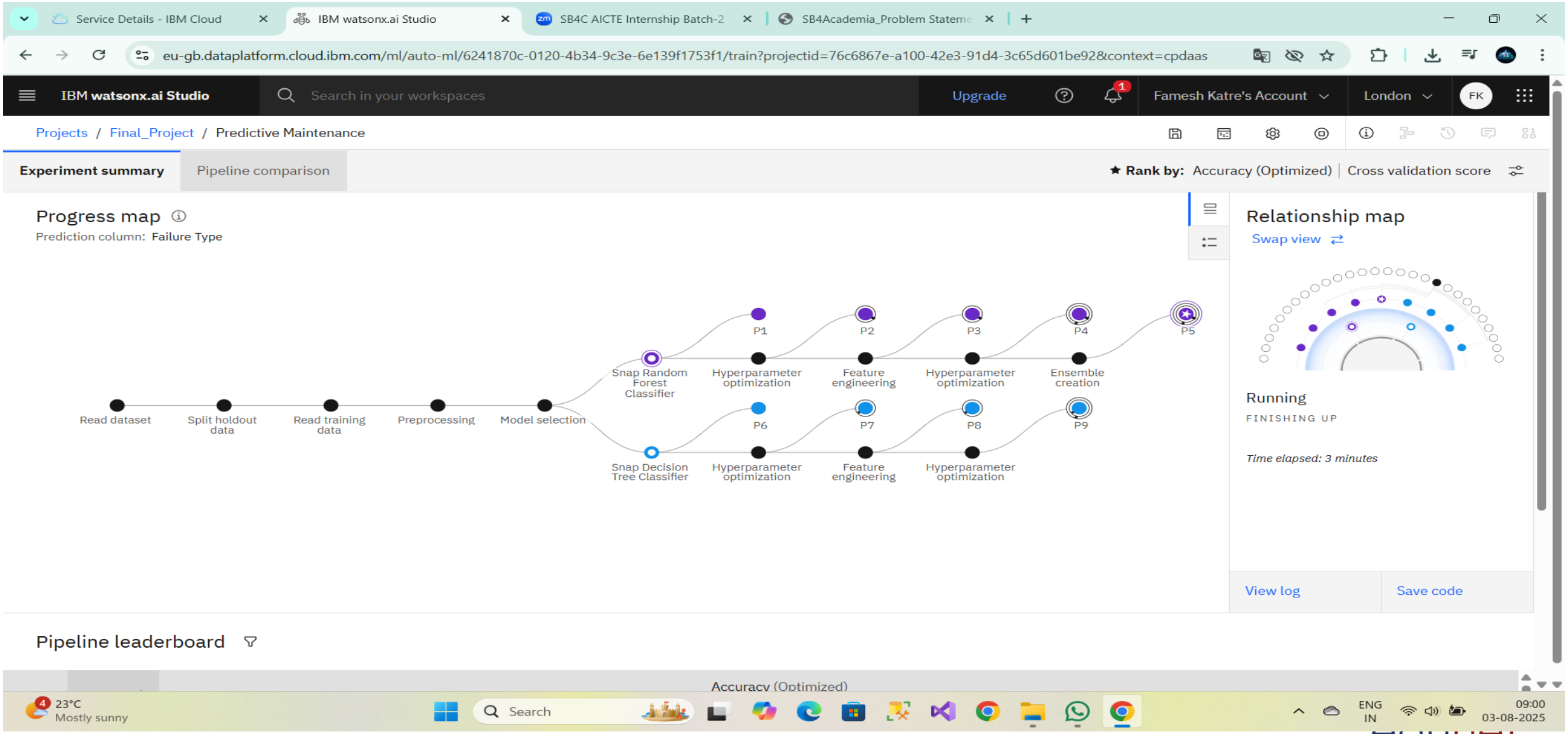
The "System Approach" section outlines the overall strategy and methodology for developing and implementing the rental bike prediction system. Here's a suggested structure for this section:

- System requirements :
- IBM Cloud (mandatory)
- IBM Watsonx studio model development and deployment
- IBM Cloud object storage for dataset handling
- Library required to build the model

ALGORITHM & DEPLOYMENT

- In the Algorithm section, describe the machine learning algorithm chosen for predicting bike counts. Here's an example structure for this section:
- **Algorithm Selection:**
- Random Forest Classifier (or SVM based on performance).
- **Data Input:**
- Air tem, Process tem, and Tool wear 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


Service Details - IBM Cloud
IBM watsonx.ai Studio
SB4C AICTE Internship Batch-2
SB4Academia_Problem Stateme
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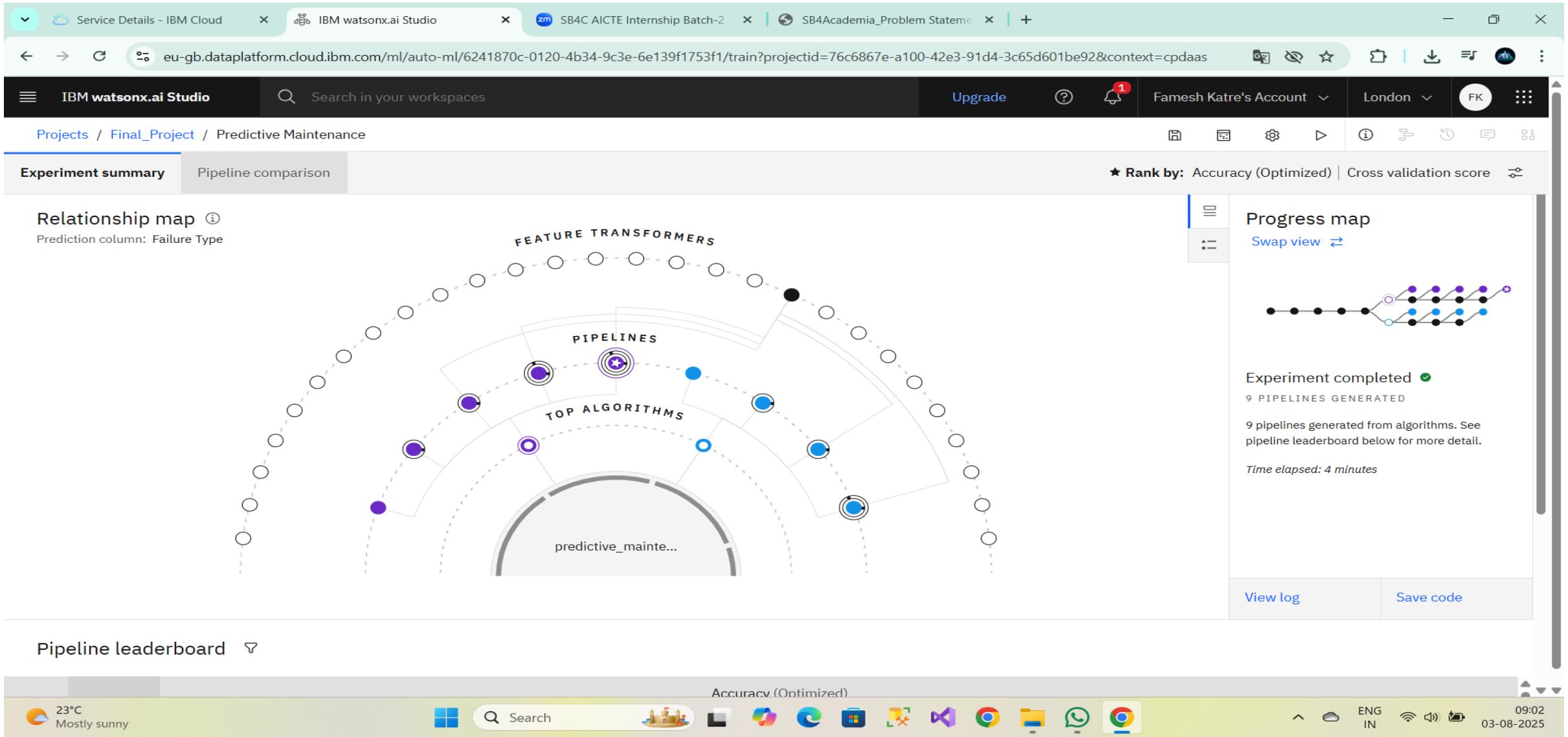
IBM watsonx.ai Studio
Search in your workspaces
Upgrade
Famesh Katre's Account
London
FK
Projects / Final_Project / Predictive Maintenance
Experiment summary
Pipeline comparison
Rank by: Accuracy (Optimized) | Cross validation score
Progress map
Prediction column: Failure Type
Read dataset
Split holdout data
Read training data
Preprocessing
Model selection
Snap Random Forest Classifier
Snap Decision Tree Classifier
P1
P2
P3
P4
P5
P6
P7
P8
P9
Hyperparameter optimization
Feature engineering
Hyperparameter optimization
Ensemble creation
Hyperparameter optimization
Feature engineering
Hyperparameter optimization
Relationship map
Swap view
Running
FINISHING UP
Time elapsed: 3 minutes
View log
Save code
Pipeline leaderboard
Accuracy (Optimized)
23°C
Mostly sunny
Search
ENG
IN
09:00
03-08-2025

RESULT


Service Details - IBM Cloud
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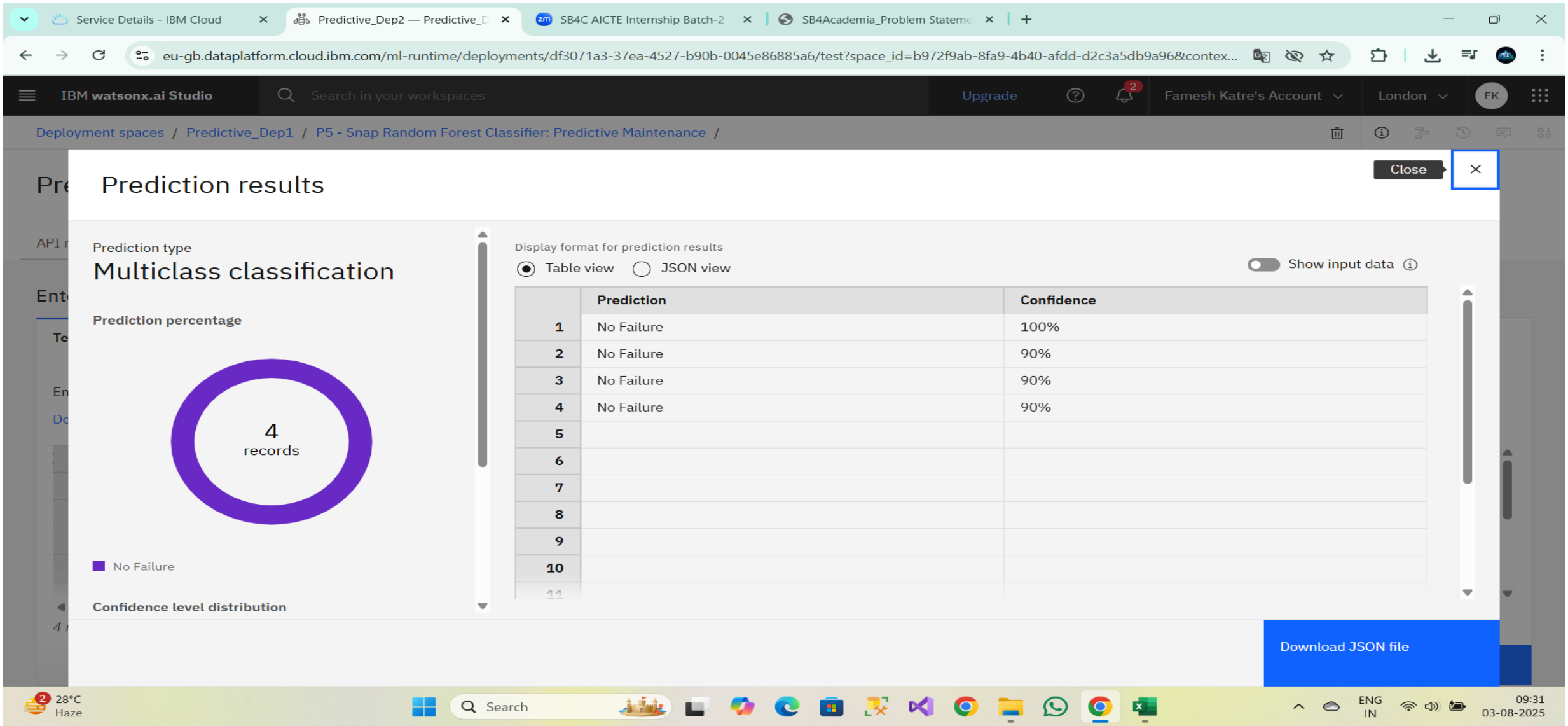
Projects / Final_Project / Predictive Maintenance
Experiment summary
Pipeline comparison
Rank by: Accuracy (Optimized) | Cross validation score
Relationship map
Prediction column: Failure Type
FEATURE TRANSFORMERS
PIPELINES
TOP ALGORITHMS
predictive_mainte...
Progress map
Swap view
Experiment completed
9 PIPELINES GENERATED
9 pipelines generated from algorithms. See pipeline leaderboard below for more detail.
Time elapsed: 4 minutes
View log
Save code
Pipeline leaderboard
Accuracy (Optimized)
23°C
Mostly sunny
Search
ENG
IN
09:02
03-08-2025

RESULT


Service Details - IBM Cloud
Predictive_Dep2 — Predictive_D
SB4C AICTE Internship Batch-2
SB4Academia_Problem Statem
eu-gb.dataplatform.cloud.ibm.com/ml-runtime/deployments/df3071a3-37ea-4527-b90b-0045e86885a6/test?space_id=b972f9ab-8fa9-4b40-afdd-d2c3a5db9a96&contex...
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London
FK
Deployment spaces / Predictive_Dep1 / P5 - Snap Random Forest Classifier: Predictive Maintenance /
Prediction results
Close
Prediction type
Multiclass classification
Prediction percentage
4
records
No Failure
Confidence level distribution
Display format for prediction results
Table view
JSON view
Show input data
Prediction
Confidence
1 No Failure 100%
2 No Failure 90%
3 No Failure 90%
4 No Failure 90%
5
6
7
8
9
10
Download JSON file
28°C
Haze
Search
ENG
IN
09:31
03-08-2025

CONCLUSION

- The project successfully demonstrates the application of machine learning to predictive maintenance of industrial machinery. By utilizing real-time sensor data (such as air temperature, process temperature, and tool wear), the model efficiently classifies fault types, enabling early detection of potential machine failures. The deployment on IBM Watson Studio with an API endpoint enables real-time predictions, which can reduce operational downtime and maintenance costs.

FUTURE SCOPE

- **Edge Deployment:** Shift the model to edge computing devices for faster on-site predictions without latency.
- **Scalability:** Extend the system to support various industries (automotive, manufacturing, energy) and a larger fleet of machines.
- **Anomaly Detection:** Integrate unsupervised learning for detecting previously unseen or rare failure patterns

REFERENCES

- Kaggle Dataset – Predective maintance Dataset
- IBM Cloud & Watson Studio Documentation

IBM CERTIFICATIONS

In recognition of the commitment to achieve professional excellence

Getting Started with Artificial Intelligence
IBM SkillsBuild

IBM

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Has successfully satisfied the requirements for:

Getting Started with Artificial Intelligence

Issued on: Jul 16, 2025
Issued by: IBM SkillsBuild

Verify: https://www.credly.com/badges/f12e06f3-f0c2-43c3-aa55-2b4dfdfb3a9f

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Lab: Retrieval Augmented Generation with LangChain

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 16 Jul 2025 (GMT)

Learning hours: 20 mins

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THANK YOU

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