MAINTANENCE MODEL

PREDICTIVE MAINTENANCE OF INDUSTRIAL MACHINERY

Presented By:

SRI PRIYA DHARSHINI M
RAJALAKSHMI INSTITUTE OF TECHNOLOGY
COMPUTER SCIENCE AND ENGINEERING

OUTLINE

- **Problem Statement**
- **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

Data Collection:
Used Kaggle's "Machine Predictive Maintenance Classification" dataset.
Included sensor data like air temperature, process temperature, speed, torque, tool wear, and failure types.
Data Processing:
Uploaded the dataset into IBM watsonx.ai Studio.
AutoML handled preprocessing such as missing values, scaling, and label encoding.
Model Training:
Used AutoML to test multiple algorithms (e.g., Logistic Regression, Random Forest, XGBoost).
Automatically selected the best model based on accuracy and F1-score.
Model Evaluation:
Evaluated using Accuracy, Confusion Matrix, and F1-score.
Verified the model's ability to predict different failure types reliably.
Deployment:
Saved the final model within watsonx.ai Studio.
Can be deployed as an API to integrate with maintenance dashboards or real-time systems.

SYSTEM APPROACH

- Platform: IBM Cloud Lite
- Main Tool: IBM watsonx.ai Studio
- Dataset Used: Kaggle – Machine Predictive Maintenance Classification
- Link:https://www.kaggle.com/datasets/shivamb/machine-predictive-maintenance-classification
- Process:Upload data to watsonx.ai
- Use AutoML inside watsonx.ai to train and test model
- Evaluate model metrics and insights

ALGORITHM & DEPLOYMENT

- **Tool Used**: IBM watsonx.ai Studio
- **Algorithm**:
- AutoML tested models like Logistic Regression, Snao Random Forest classifier, etc.
- Best model selected based on highest accuracy/F1-score.
- **Training Process:**
- Data split into training and test sets automatically.
- Preprocessing (like scaling or encoding) handled by AutoML.
- **Evaluation**:
- Metrics: Accuracy, F1 Score, Confusion Matrix.
- Visual results shown in watsonx.ai experiment output.
- **Deployment**:Model saved in IBM Cloud workspace.
- Can be deployed as API for integration with real-time systems.

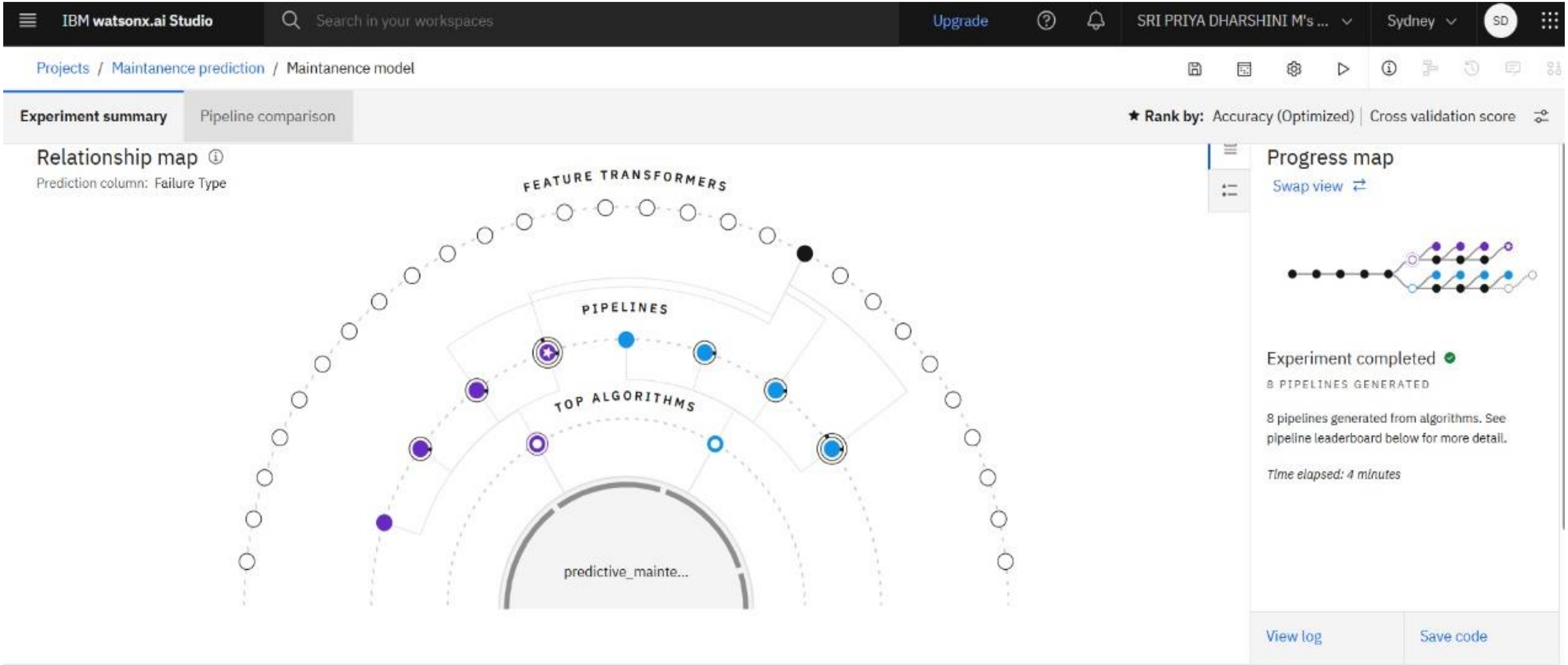
RESULT

Snap Random Forest model was selected by watsonx.ai AutoML. It achieved up to 100% prediction confidence for certain failure types and 87% for others. The training completed in under 4 minutes, and the model showed high accuracy and reliable performance on test data..

GITHUB REPOSITORY:

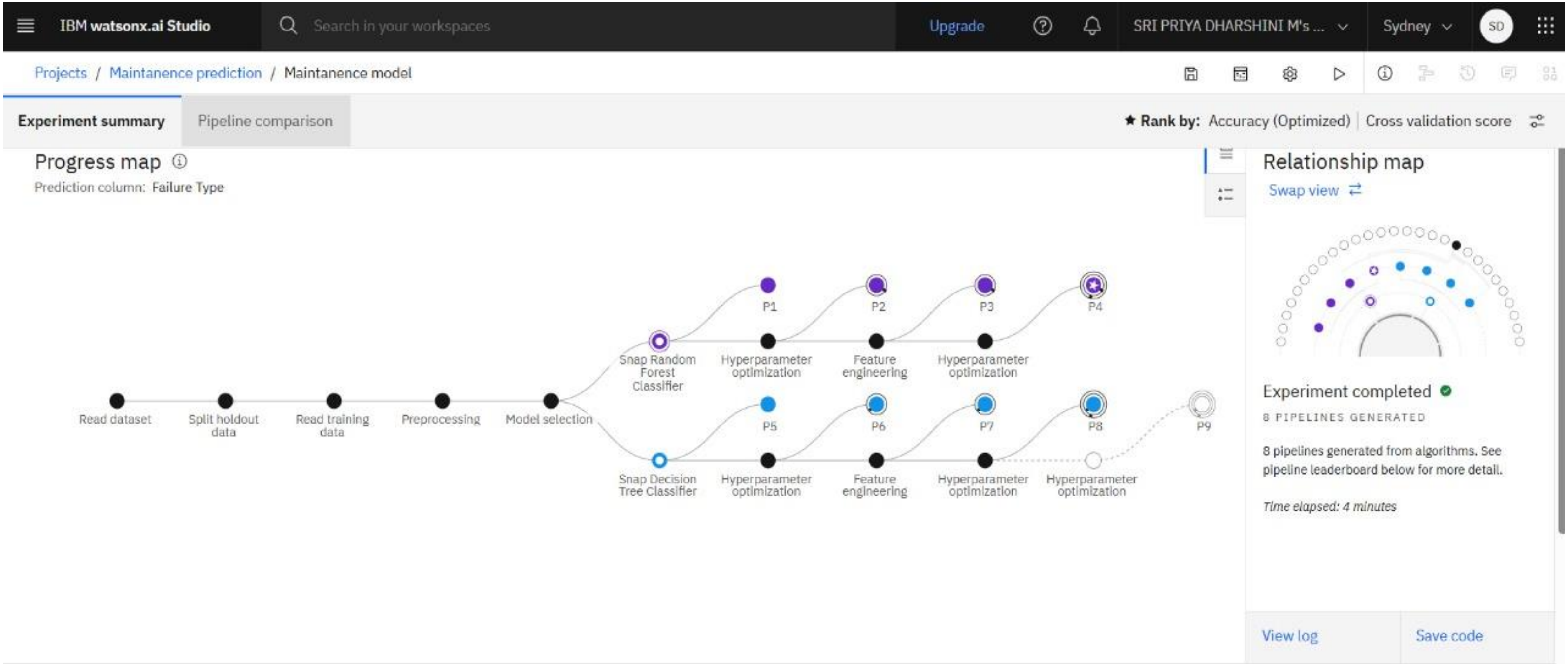
https://github.com/SriPriya240906

EXPERIMENTAL SUMMARY:



edunet foundation

PIPELINE COMPARISON:



PIPELINE LEADERBOARD:

Pipeline leaderboard

	Rank	Name	Algorithm	Specialization	Accuracy (Optimized) Cross Validation	Enhancements	Build time	
★	1	Pipeline 4	Snap Random Forest Classifier		0.995	HPO-1 FE HPO-2	00:00:41	Save as
	2	Pipeline 3	Snap Random Forest Classifier		0.995	HPO-1 FE	00:00:34	
	3	Pipeline 8	Snap Decision Tree Classifier		0.994	HPO-1 FE HPO-2	00:01:17	
	4	Pipeline 2	Snap Random Forest Classifier		0.994	HPO-1	00:00:08	

MACHINE PREDICTION:(Input data given)

IBM watsonx.ai Studio

Search in your workspaces

Upgrade

SRI PRIYA DHARSHINI M's...

Sydney

SD

Deployment spaces / Maintanence prediction 1 / P4 - Snap Random Forest Classifier: Maintanence model /

Machine prediction

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

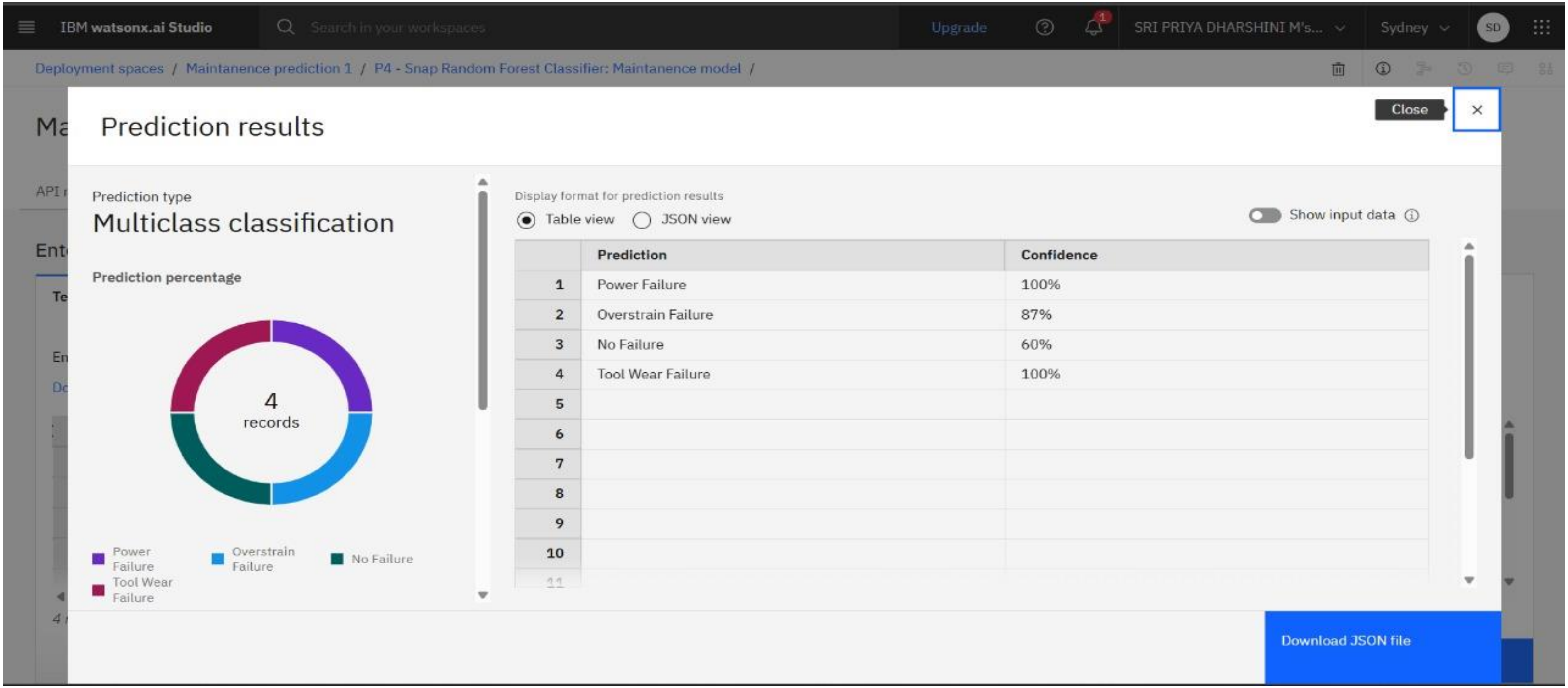
Clear all ×

	Type (other)	Air temperature [K] (double)	Process temperature [K] (double)	Rotational speed [rpm] (double)	Torque [Nm] (double)	Tool wear [min] (double)	Target (double)
1	L	298.9	309.1	2861	4.6	143	1
2	L	298.3	308.2	1282	60.7	216	1
3	L	298.7	309.9	1505	45.7	144	0
4	L	298	308.5	1421	37.7	220	1

4 rows, 9 columns

Predict

RESULTS :



edunet foundation

CONCLUSION

- Developed a predictive model using IBM watsonx.ai to classify machine failures based on sensor data.
- The AutoML tool selected the best model with high accuracy and completed training quickly.
- The solution helps reduce downtime by enabling proactive maintenance.
- Challenges included data formatting and understanding AutoML workflow.
- Future improvements include real-time deployment for live failure detection.

FUTURE SCOPE

- **Incorporate Additional Data Sources:**

Integrate real-time sensor data from IoT devices, including vibration, sound, and environmental conditions to improve prediction accuracy.

Algorithm Optimization:

Fine-tune hyperparameters and explore advanced models like ensemble methods, neural networks, or anomaly detection to enhance performance.

Real-Time Monitoring with Edge Computing:

Deploy the model on edge devices close to machinery for faster local predictions without relying on constant cloud access.

Scalability and System Expansion:

Expand the system to cover more types of industrial equipment and adapt it across multiple manufacturing units..

Integration with Maintenance Systems:

Connect predictions to automated maintenance scheduling tools or dashboards for immediate action and alert generation.

Adoption of Advanced AI Techniques:

Use techniques like deep learning, reinforcement learning, or federated learning to handle complex failure patterns and improve learning from distributed data.

REFERENCES

1.Shivam Bansal. Machine Predictive Maintenance Classification Dataset, Kaggle.

https://www.kaggle.com/datasets/shivamb/machine-predictive-maintenance-classification

2.IBM watsonx.ai Documentation – Train, evaluate, and deploy models using AutoML and notebooks.

https://www.ibm.com/products/watsonx-ai

IBM CERTIFICATIONS

In recognition of the commitment to achieve professional excellence

Getting Started with Artificial Intelligence

SRI PRIYA DHARSHINI M

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/18371b5c-f5cd-43dc-83eb-5ca9a7cec81b

IBM

IBM CERTIFICATIONS


In recognition of the commitment to achieve professional excellence

SRI PRIYA DHARSHINI M

Has successfully satisfied the requirements for:

Journey to Cloud: Envisioning Your Solution

Issued on: Jul 17, 2025
Issued by: IBM SkillsBuild

Verify: https://www.credly.com/badges/65c94056-bb80-4bb1-91b1-aed81634e658

IBM

edunet foundation

IBM CERTIFICATIONS

IBM **SkillsBuild** Completion Certificate

This certificate is presented to

SRI PRIYA DHARSHINI M

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