CAPSTONE PROJECT

PREDICTIVE MAINTENANCE OF INDUSTRIAL MACHINERY

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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

- The proposed system aims to build a **Predictive Maintenance Model** that uses historical and real-time sensor data from industrial machines to **predict potential failures** such as:
- Tool wear
- Heat dissipation issues
- Power failure
- By identifying failure patterns early, the system allows for **proactive maintenance**, minimizing **unexpected downtime** and **repair costs**, and improving machine reliability.

SYSTEM APPROACH

- System Requirement : Window 10/11,8GB RAM
- Technology Used :IBM Cloud Lite Version

ALGORITHM & DEPLOYMENT

Modeling Process:

1.Data Preprocessing:

- •Clean null/missing values
- •Feature engineering (e.g., moving averages, thresholds)
- •Label encoding for failure types

2.Model Selection:

- •**Random Forest Classifier** for prediction
- •**Evaluation Metrics:** Accuracy, F1-score, Precision, Recall

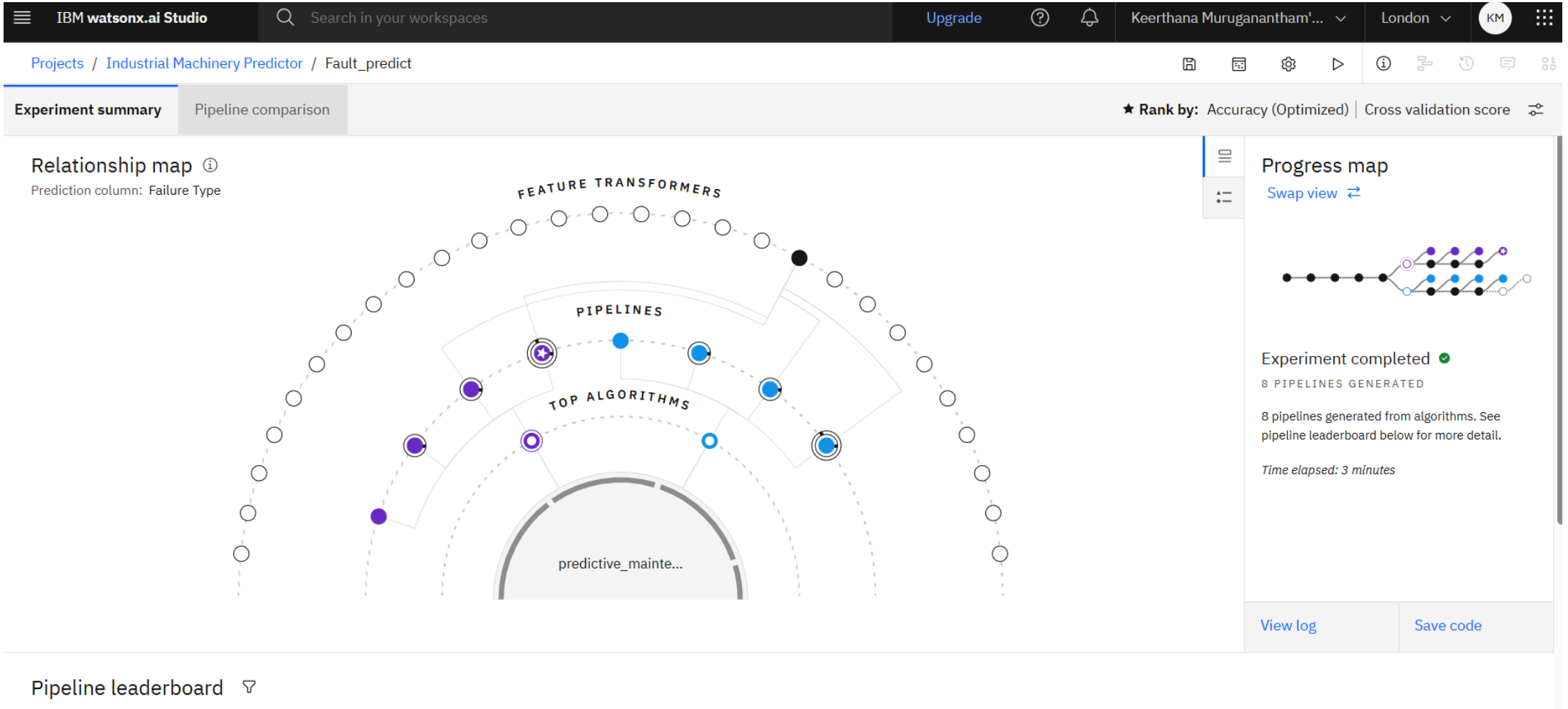
3.Training & Validation:

- •Split dataset (train/test)
- •Apply cross-validation
- •Tune hyperparameters using GridSearchCV

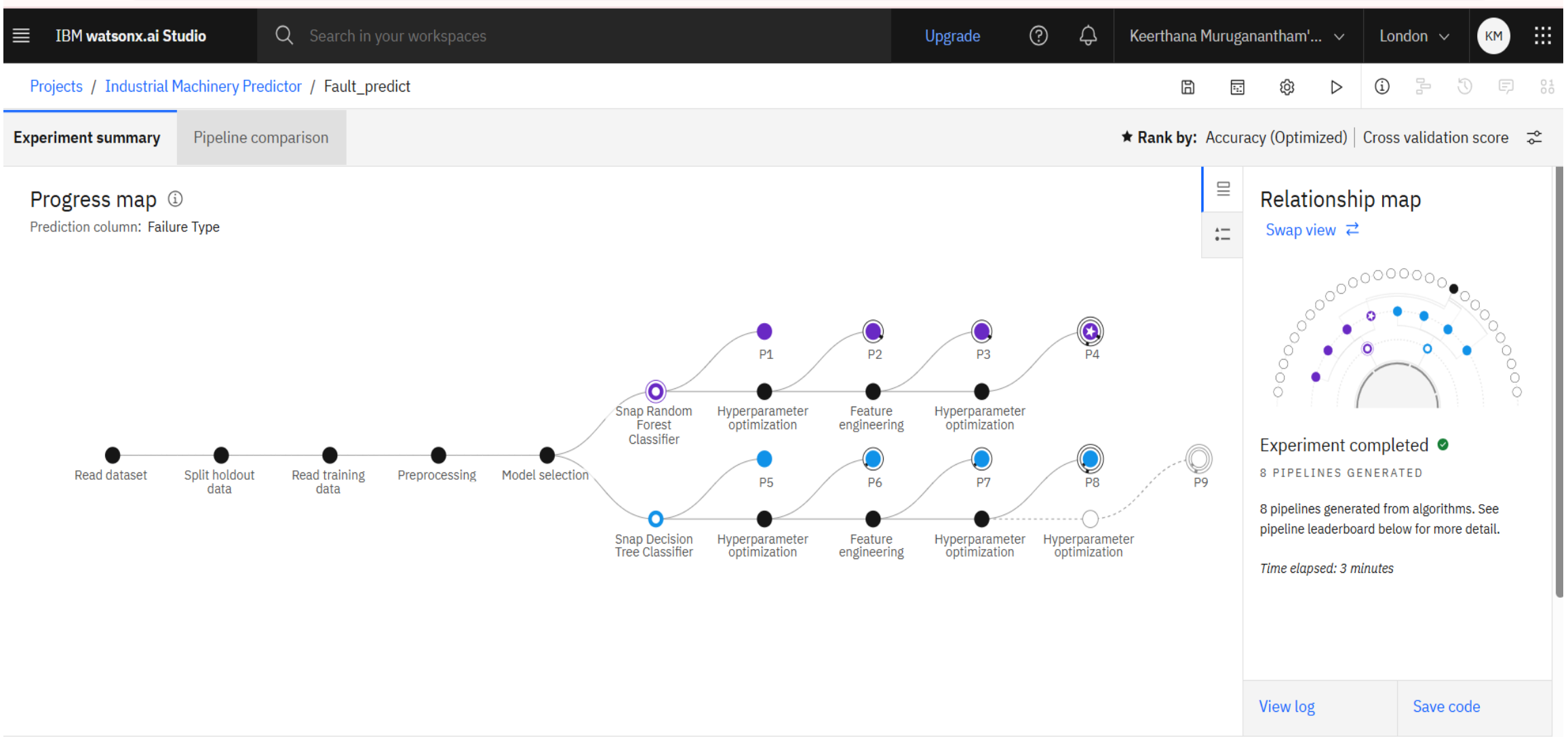
4.Deployment:

- •Export trained model using joblib
- •Create REST API using Flask for real-time prediction
- •Interface for maintenance teams to receive alerts

RESULT



RESULT



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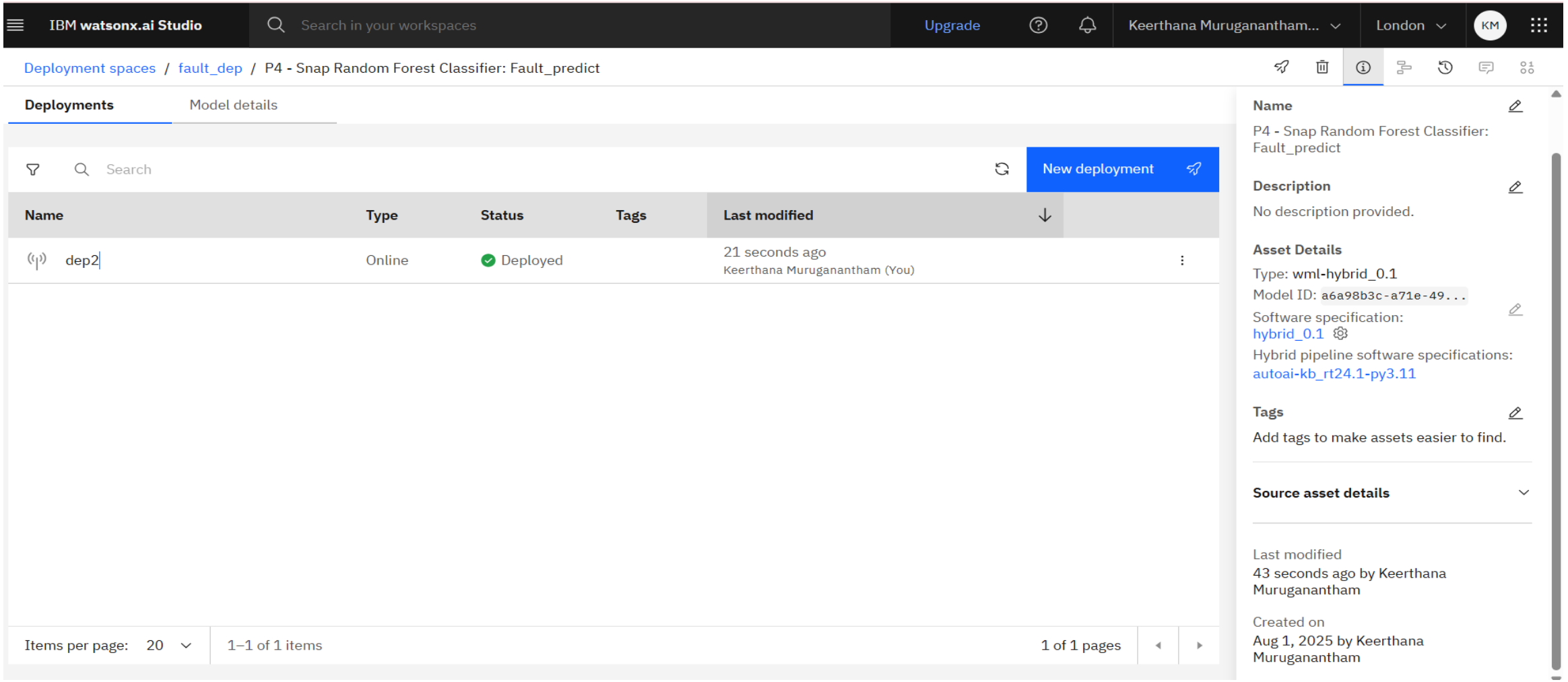
RESULT

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	00:00:32	
	3	Pipeline 8	Snap Decision Tree Classifier		0.994	HPO-1 FE HPO-2	00:00:30	
	4	Pipeline 2	Snap Random Forest Classifier		0.994	HPO-1	00:00:08	

RESULT



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RESULT

Prediction results

Prediction type

Multiclass classification

Prediction percentage

No Failure

Confidence level distribution

Display format for prediction results

(•) Table view ( ) JSON view

Show input data

	Prediction	Confidence
1	No Failure	100%
2		
3		
4		
5		
6		
7		
8		
9		
10		

Download JSON file

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CONCLUSION

- Predictive maintenance minimizes downtime by using sensor data and classification algorithms (e.g., Random Forest, XGBoost) to accurately forecast failures and trigger timely alerts for better efficiency

FUTURE SCOPE

- Develop a mobile app for maintenance alerts
- Integrate with ERP systems for automated maintenance requests

REFERENCES

- Scikit-learn documentation: https://scikit-learn.org/
- Kaggle: Predictive Maintenance datasets
- Research papers on predictive maintenance in IEEE Xplore
- TensorFlow: https://www.tensorflow.org/
- Python Flask for Deployment: https://flask.palletsprojects.com/

IBM CERTIFICATIONS

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THANK YOU

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