CAPSTONE PROJECT

PROJECT TITLE

Presented By:

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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

Industrial machines are susceptible to various types of failures such as tool wear, heat dissipation, or power failure. These failures often go undetected until a breakdown occurs, resulting in significant downtime, increased maintenance costs, and loss of productivity. The challenge is to anticipate such failures before they happen by analyzing real-time sensor data from machines, identifying critical warning patterns, and categorizing potential failure types.

PROPOSED SOLUTION

- We propose a **Machine Learning-based Predictive Maintenance system** using **IBM Watson Studio on IBM Cloud Lite**, trained on historical sensor data to classify upcoming failures. This enables proactive maintenance scheduling, significantly reducing unexpected breakdowns and costs.
- **Solution Components:**
- Data collection & preprocessing (sensor readings, operational settings, failure labels)
- Exploratory data analysis (EDA) for failure pattern identification
- Feature engineering and balancing techniques
- Model building using classification algorithms (e.g., Random Forest, XGBoost)
- Deployment on IBM Watson Machine Learning

SYSTEM APPROACH

- **IBM Cloud Lite**
- Watson Studio
- IBM Cloud Object Storage
- Watson Machine Learning
- **Python**: Data processing & modeling
- **Pandas, NumPy, Scikit-learn, Seaborn, Matplotlib**: ML ecosystem
- **Kaggle Dataset**: Machine Predictive Maintenance Classification

ALGORITHM & DEPLOYMENT

- **Algorithm Chosen**: Random Forest Classifier (for high interpretability and robustness)

  Other Algorithms Compared: XGBoost, Logistic Regression

- **Steps:**

- **Input Features**: Air temp, process temp, rotation speed, torque, tool wear

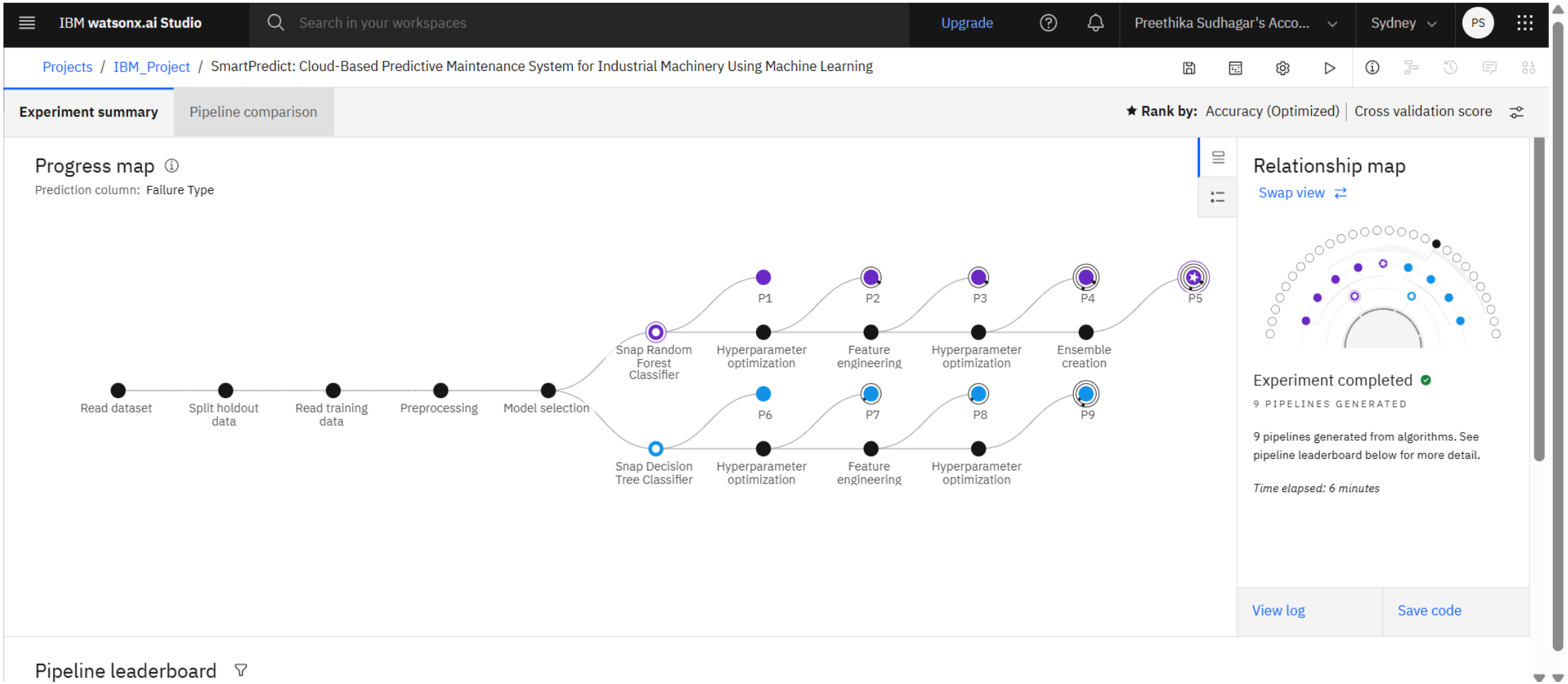
- **Target**: Machine failure type (No failure, Tool wear, Power failure, Overstrain, Random failures, etc.)

- **Model Training**: Trained on 70% data, validated on 30%

- **Evaluation Metrics**: Accuracy, Precision, Recall, Confusion Matrix

- **Deployment**: Deployed as a REST API using Watson Machine Learning on IBM Cloud Lite

RESULT



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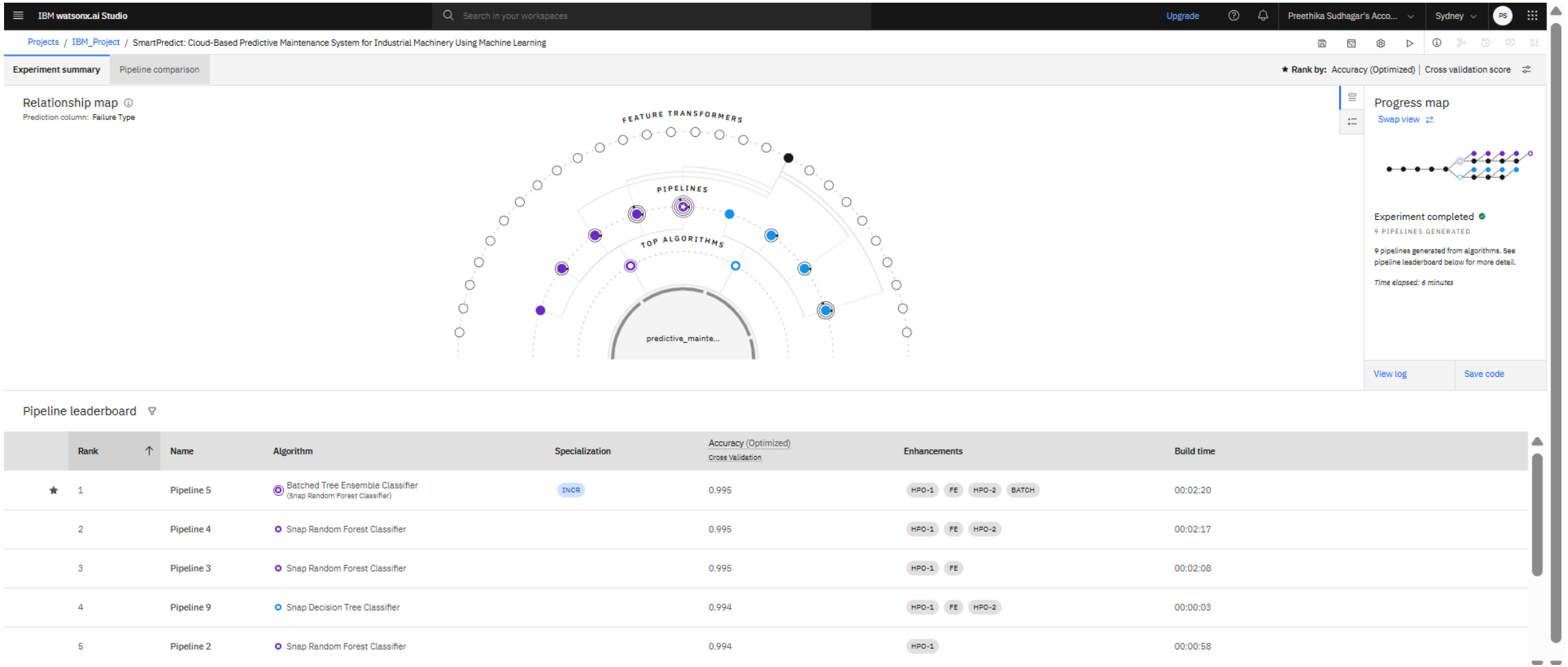
RESULT



	Rank	Name	Algorithm	Specialization	Accuracy (Optimized) Cross Validation	Enhancements	Build time
★	1	Pipeline 5	Batched Tree Ensemble Classifier (Snap Random Forest Classifier)	INCR	0.995	HPO-1 FE HPO-2 BATCH	00:02:20
	2	Pipeline 4	Snap Random Forest Classifier		0.995	HPO-1 FE HPO-2	00:02:17
	3	Pipeline 3	Snap Random Forest Classifier		0.995	HPO-1 FE	00:02:08
	4	Pipeline 9	Snap Decision Tree Classifier		0.994	HPO-1 FE HPO-2	00:00:03
	5	Pipeline 2	Snap Random Forest Classifier		0.994	HPO-1	00:00:58

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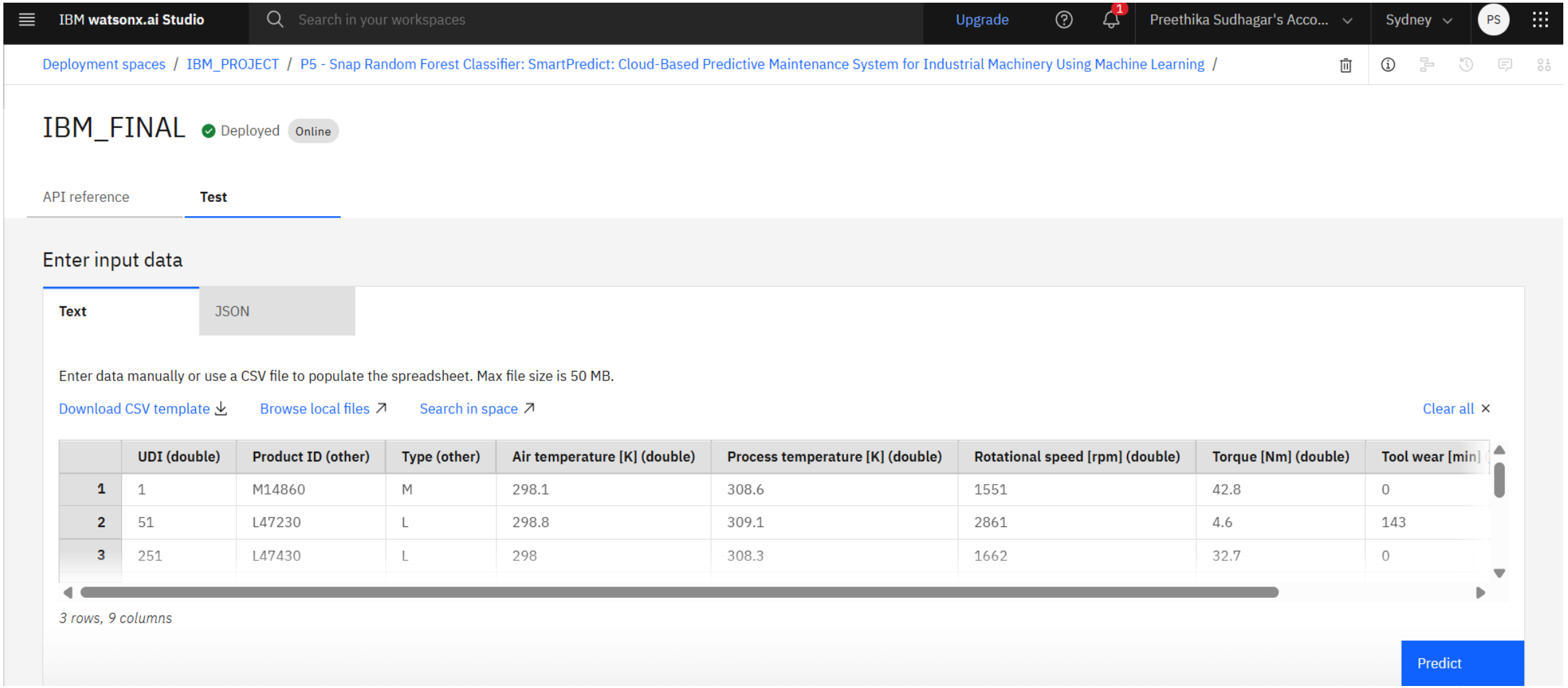
RESULT



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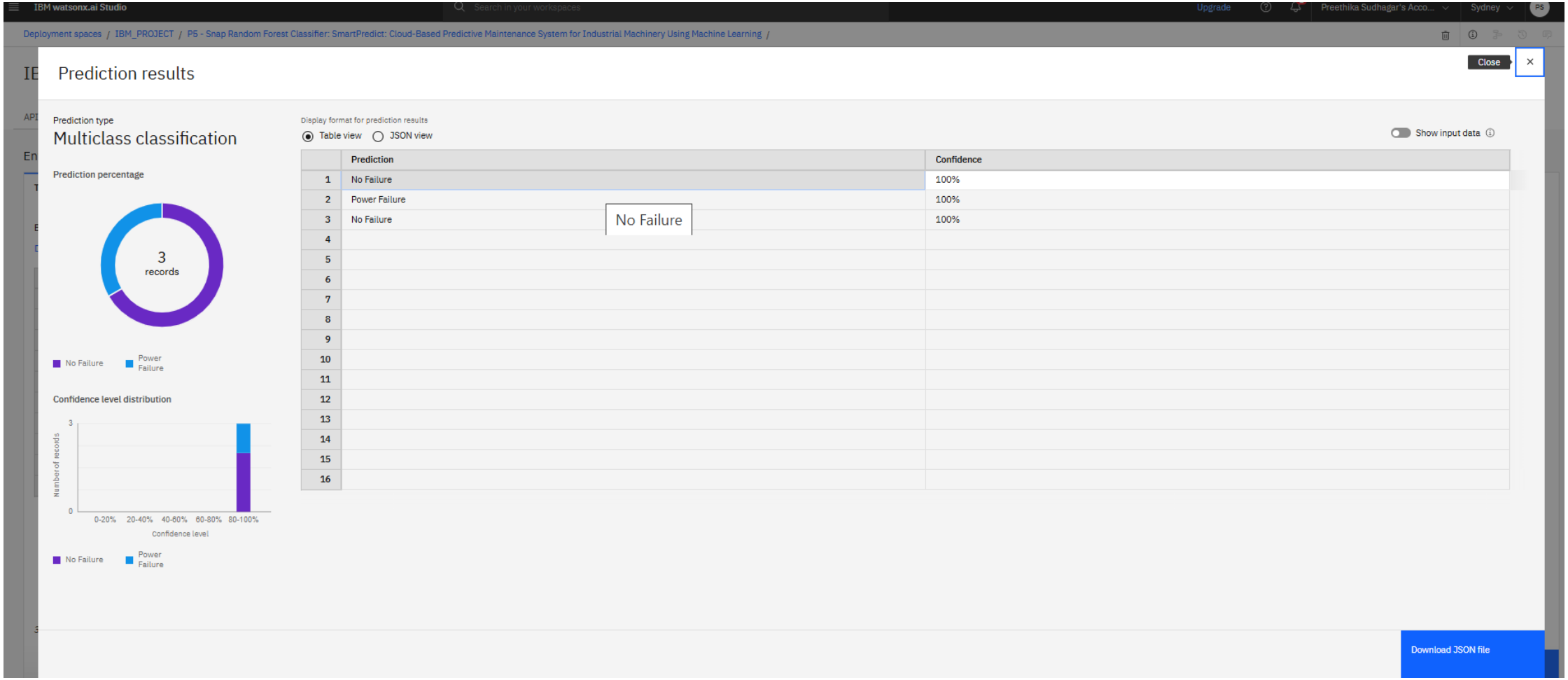
RESULT



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CONCLUSION

- Our predictive model efficiently forecasts failure types based on sensor data. Integration into real-time systems will help reduce machine downtime, increase productivity, and lower maintenance costs. IBM Cloud Lite facilitated easy deployment and model serving through Watson Studio and Object Storage.

FUTURE SCOPE

- Real-time streaming data integration (IBM IoT Platform)
- Edge computing for on-site analytics
- Deep learning models (LSTM) for sequential sensor trends
- Integration with enterprise maintenance management systems (CMMS)

REFERENCES

- Kaggle Dataset: Machine Predictive Maintenance
- IBM Cloud Documentation
- Research on Machine Learning for Predictive Maintenance
- Scikit-learn and Pandas official documentation

IBM CERTIFICATIONS

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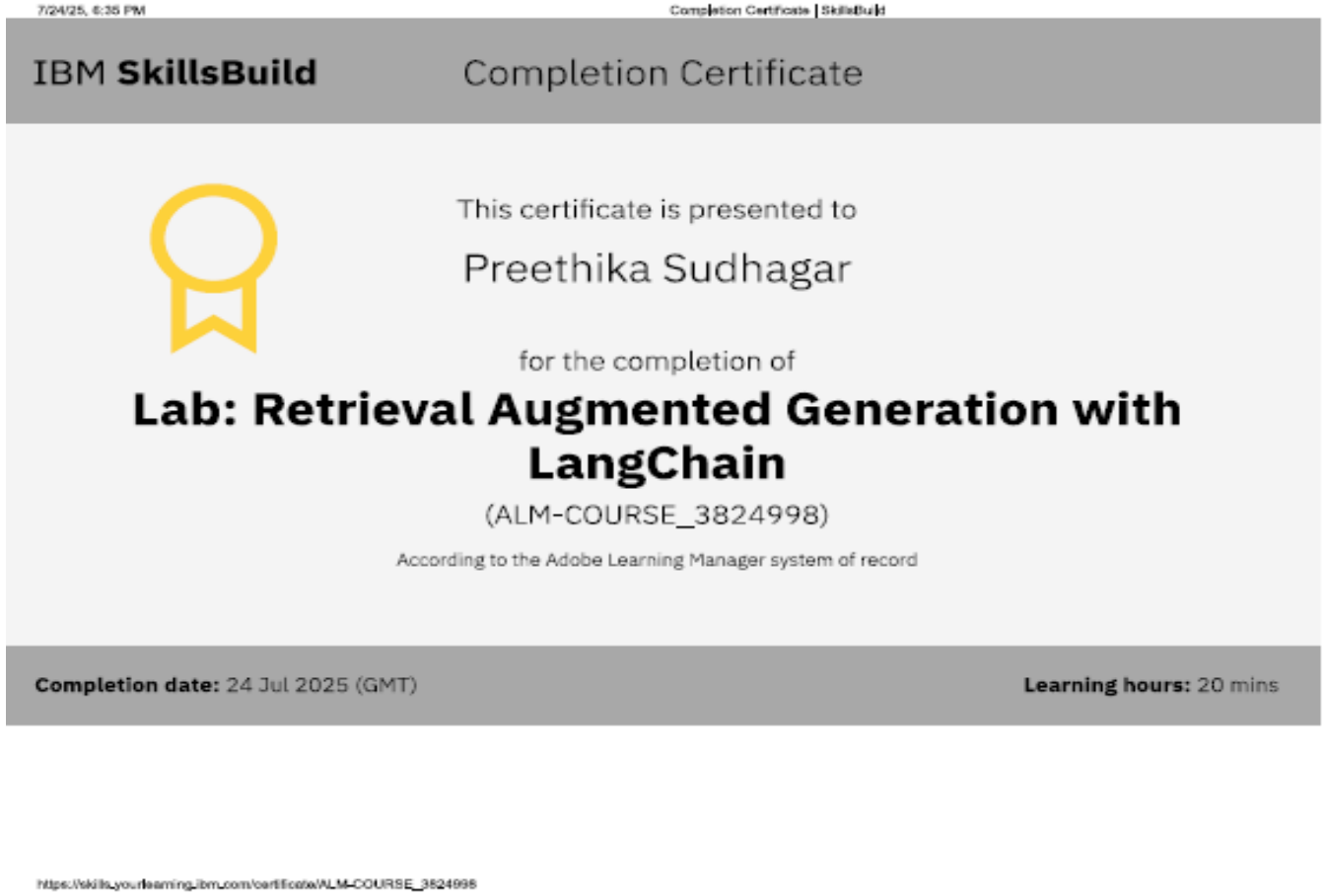

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THANK YOU

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