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

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

- We propose a machine learning-based predictive maintenance system that:
- Analyzes real-time sensor data (temperature, torque, speed, tool wear)
- Identifies early signs of potential machine failure
- Predicts the type of failure likely to occur
- Enables proactive maintenance, minimizing downtime and cost

SYSTEM APPROACH

The "System Approach" section outlines the overall strategy and methodology for developing and implementing the Predictive Maintenance of Industrial Machinery. Here's a suggested structure for this section:

System requirements:

- IBM Watson Studio – For building, training, and testing models
- IBM Cloud Object Storage – To store datasets
- IBM AutoAI / Jupyter Notebooks – For automated or custom model creation
- IBM Watson Machine Learning – For model deployment

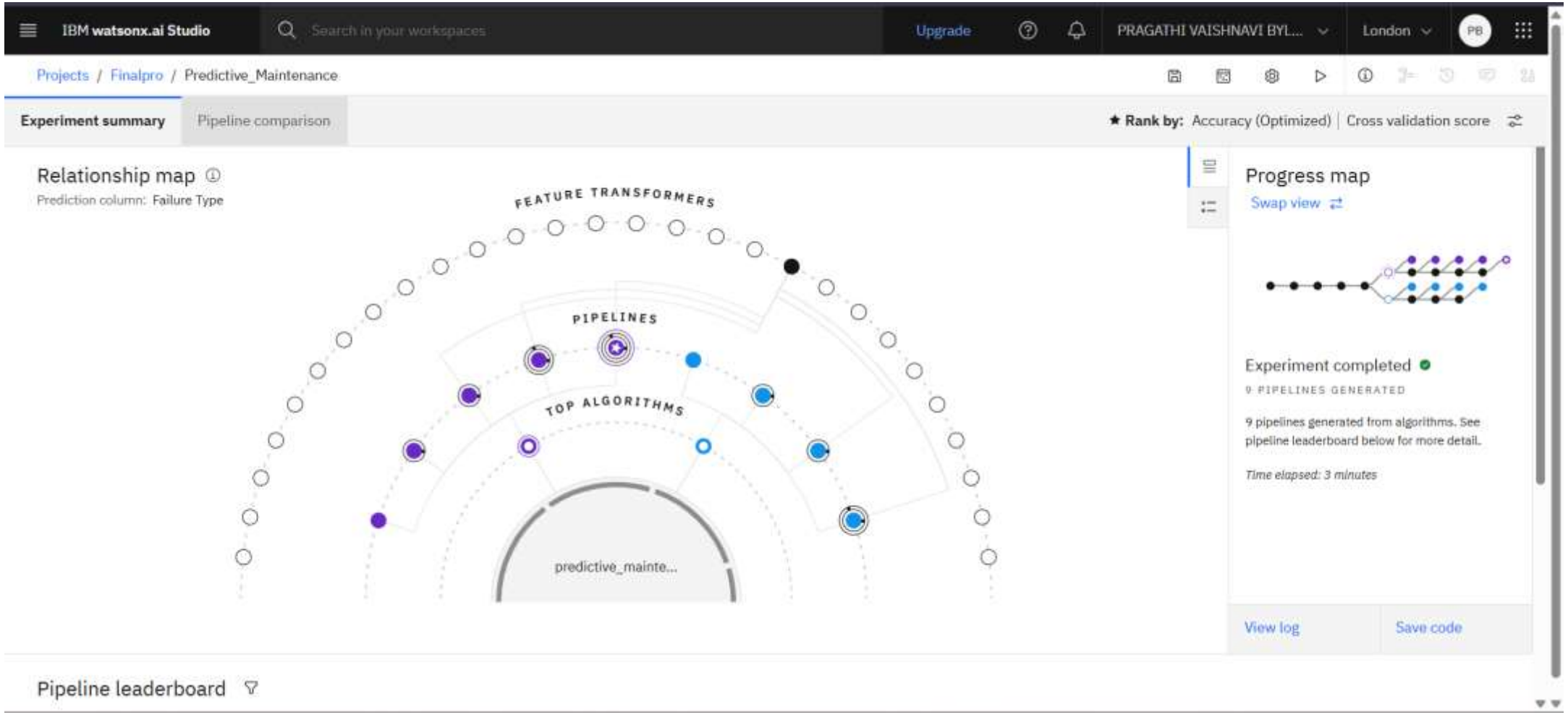
ALGORITHM & DEPLOYMENT

- For predicting the type of failure based on sensor data, the following machine learning classification algorithms were explored:
- Random Forest Classifier: Gave high accuracy and robustness to overfitting
- XGBoost: Offered optimized performance on structured tabular data
- Logistic Regression: Used for baseline comparison
- Support Vector Machines (SVM): Evaluated for precision and generalization
- The final model was selected based on highest accuracy, F1-score, and precision-recall balance.

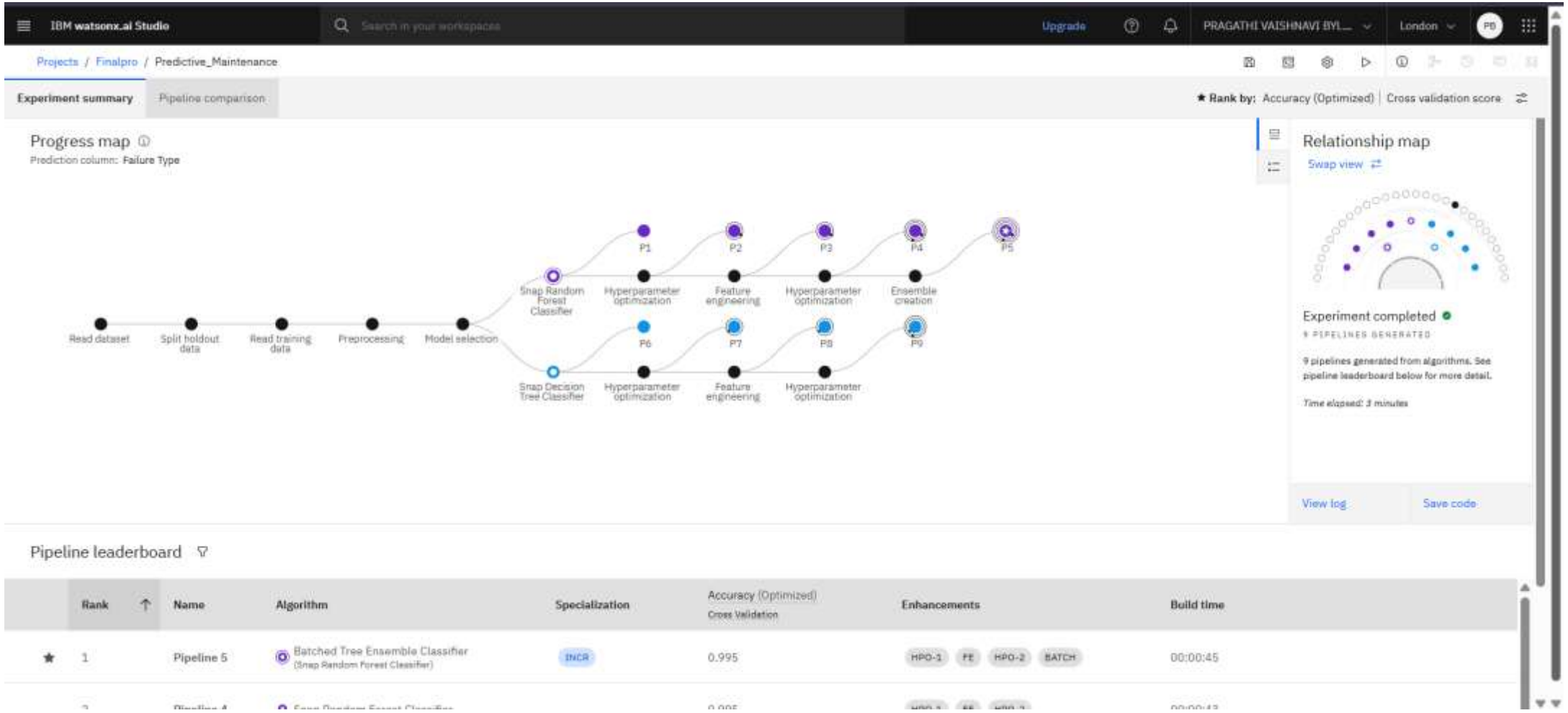
Deployment:

- Model was deployed using IBM Watson Machine Learning
- Dataset Upload: Uploaded the Kaggle dataset to IBM Cloud Object Storage
- Notebook Development: Used Jupyter Notebooks inside IBM Watson Studio

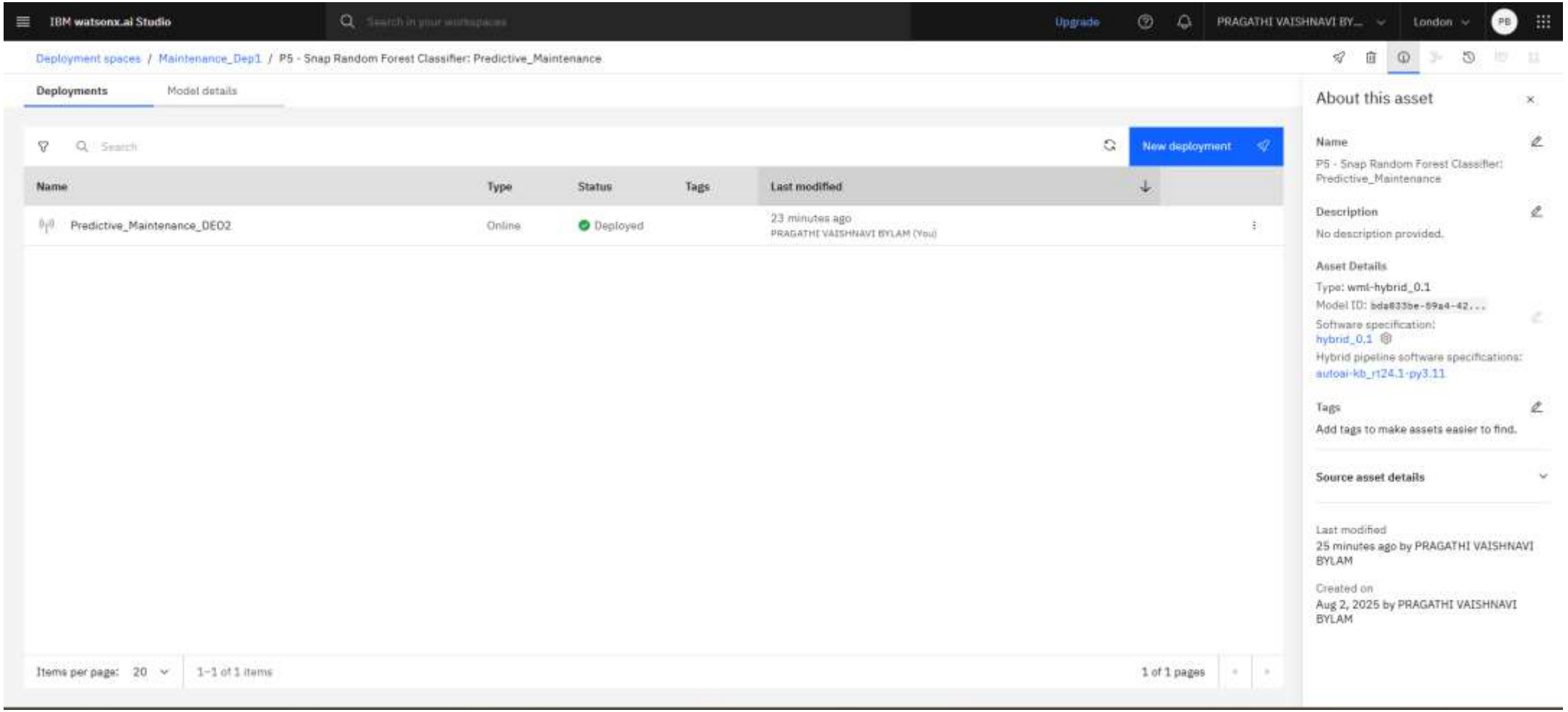
RESULT



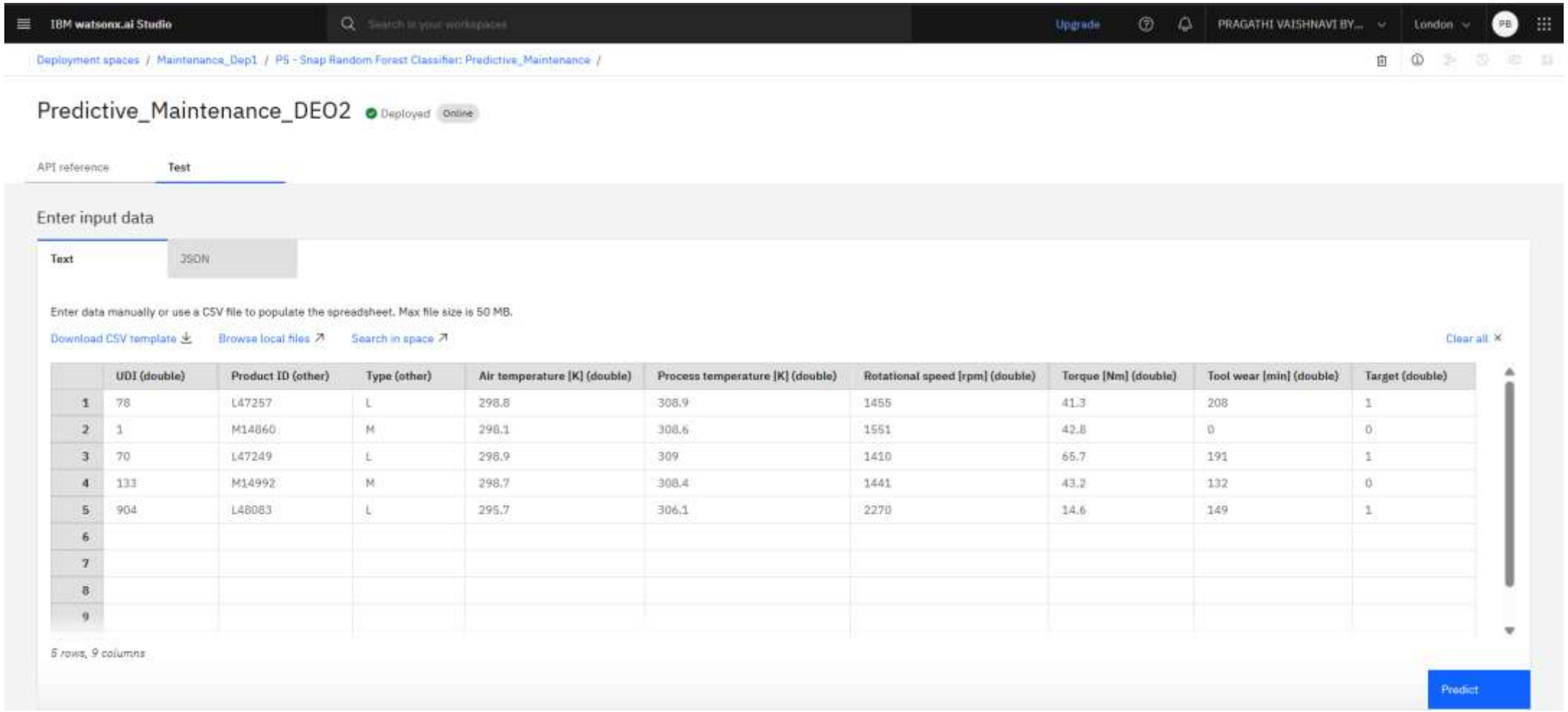
RESULT



RESULT

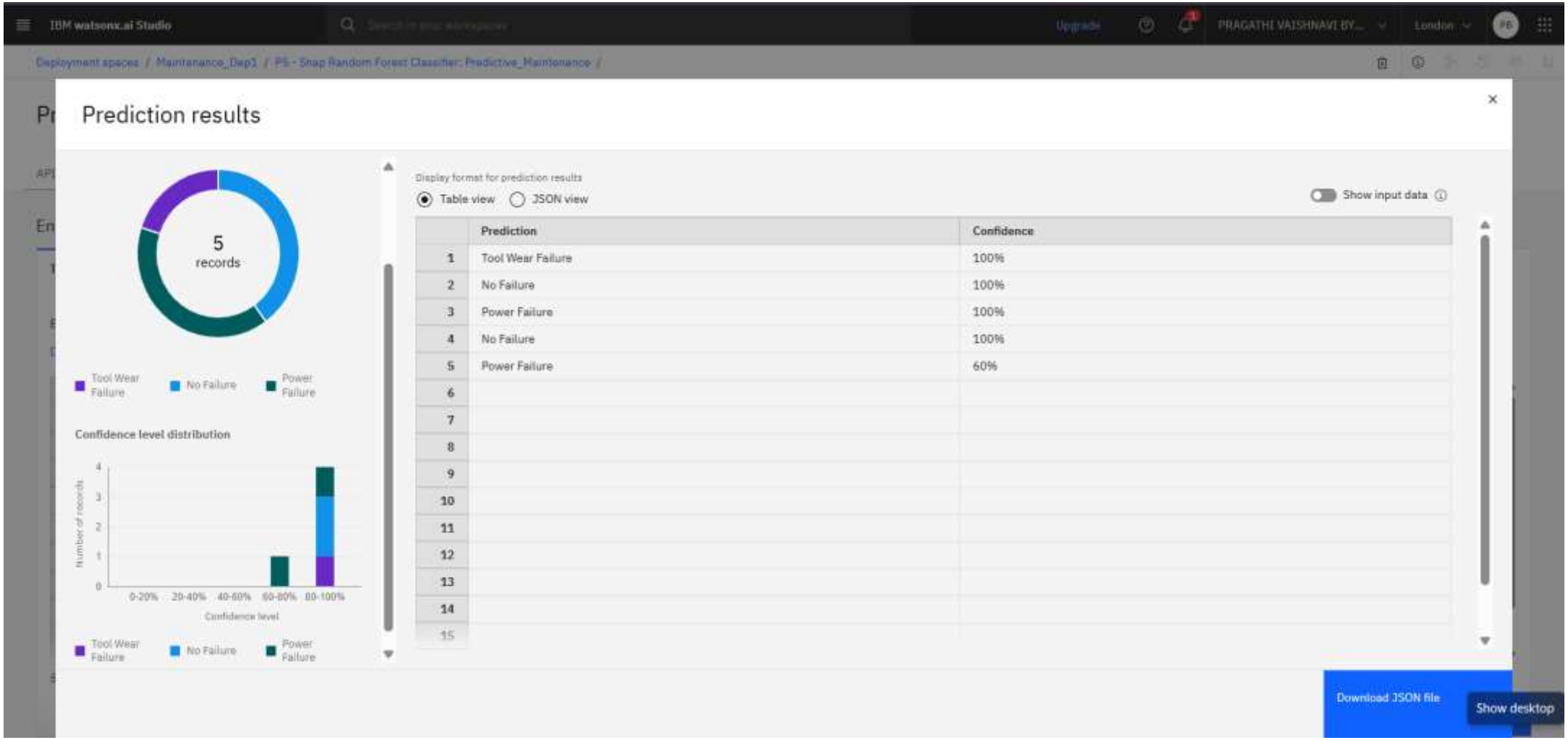


RESULT



	UDI (double)	Product ID (other)	Type (other)	Air temperature [K] (double)	Process temperature [K] (double)	Rotational speed [rpm] (double)	Torque [Nm] (double)	Tool wear [min] (double)	Target (double)
1	78	L47257	L	298.8	308.9	1455	41.3	208	1
2	1	M14860	M	298.1	308.6	1551	42.8	0	0
3	70	L47249	L	298.9	309	1410	65.7	191	1
4	133	M14992	M	298.7	308.4	1441	43.2	132	0
5	904	L48083	L	295.7	306.1	2270	14.6	149	1
6									
7									
8									
9									

RESULT



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CONCLUSION

- The predictive maintenance model was able to effectively anticipate different types of machinery failures using real-time sensor data. By deploying the model through IBM Watson Machine Learning, industries can now proactively detect issues such as:
- Tool Wear
- Power Failure
- Overstrain or Mechanical Failures
- This minimizes unexpected downtimes, enhances safety, and reduces maintenance costs significantly.

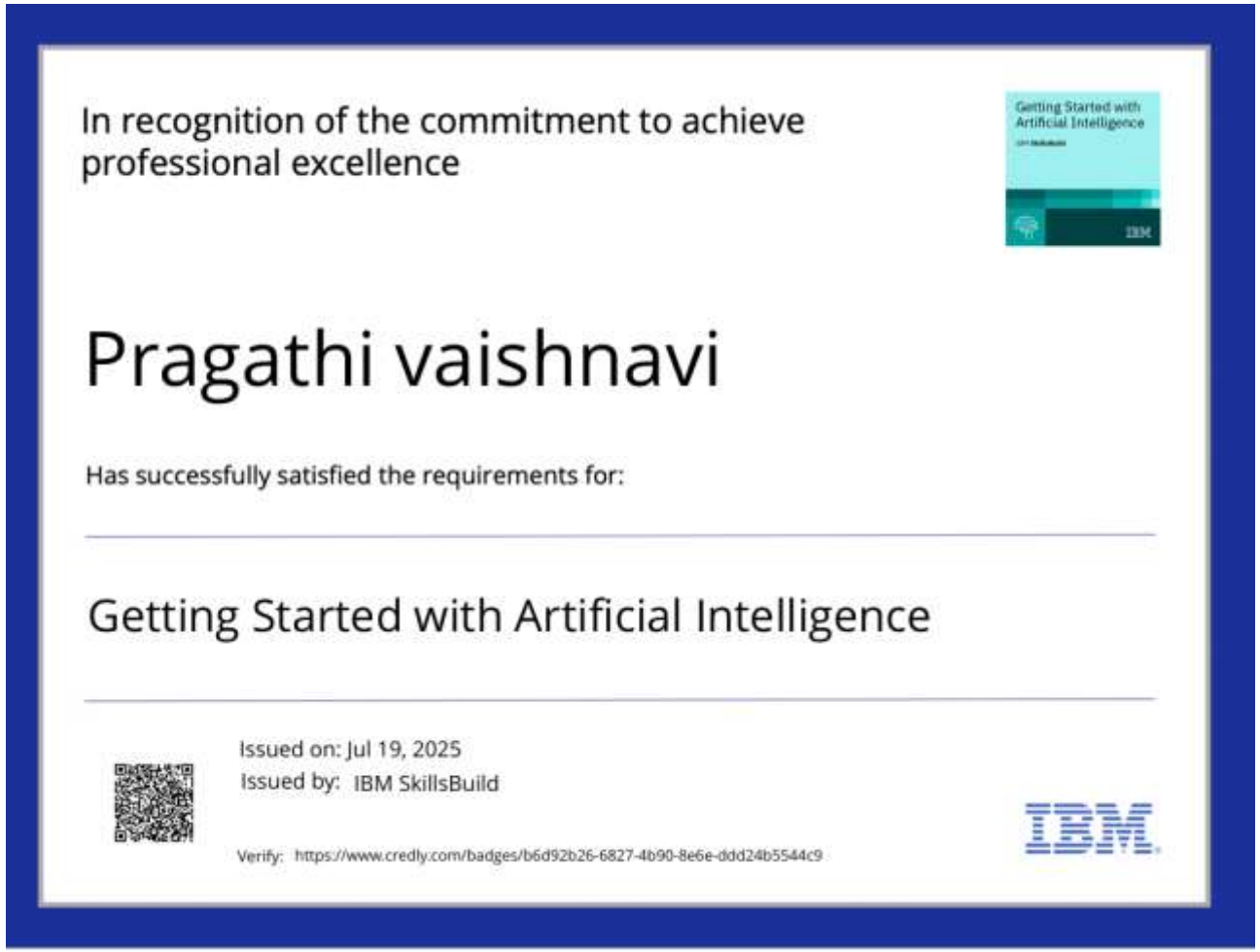
FUTURE SCOPE

- Integrate the model with IoT sensors to enable real-time failure prediction and alerts
- Extend the model to support multi-class anomaly detection for early warning systems
- Apply edge computing for real-time analysis in remote/low-connectivity industrial zones
- Train the model continuously with live incoming sensor streams using IBM Cloud pipelines

REFERENCES

- Kaggle Dataset: Predictive Maintenance Classification
- IBM Cloud Lite: https://www.ibm.com/cloud/watson-studio
- IBM Watson Machine Learning: https://www.ibm.com/cloud/machine-learning

IBM CERTIFICATIONS



IBM CERTIFICATIONS

In recognition of the commitment to achieve professional excellence

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Has successfully satisfied the requirements for:

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IBM **SkillsBuild** Completion Certificate

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According to the Adobe Learning Manager system of record

Completion date: 24 Jul 2025 (GMT) **Learning hours:** 20 mins

THANK YOU

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