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

- Our solution uses machine learning to predict machinery failures in advance, helping reduce downtime and maintenance costs.
- **Data Collection**: Use historical sensor data (temperature, torque, speed, tool wear, etc.) from machines.
- **Preprocessing**: Clean and prepare the data by handling missing values and encoding machine types.
- **Modeling**: Train a classification model (e.g., Random Forest or XGBoost) to detect failure types like tool wear or power failure.
- **Deployment**: Deploy the model on **IBM Cloud** using Watson Studio and Watson Machine Learning.
- **Result**: Real-time failure predictions that enable proactive maintenance and improve operational efficiency.

SYSTEM APPROACH

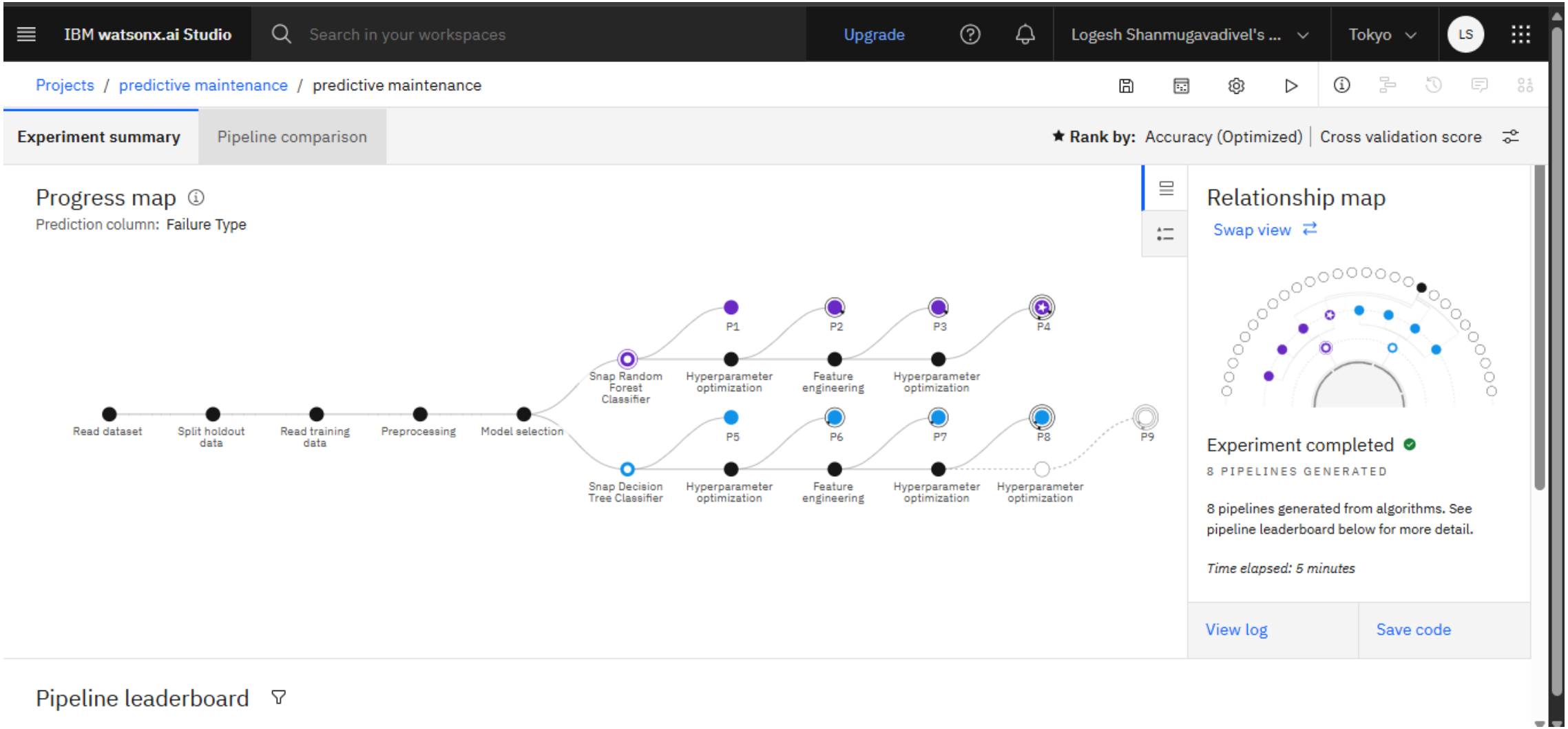
This approach uses IBM Watson Studio's **AutoAI** tool to automate model selection, training, and pipeline generation for predicting machinery failures.

- **System requirements**
  - **Platform**: IBM Cloud (Lite Plan)
  - **Tools Used**:
    - **IBM Watson Studio** – For AutoAI experimentation
    - **IBM Watson Machine Learning** – For deployment of the pipeline
- **Library required to build the model**
  - AutoAI Pipeline
  - Predictive maintenance Dataset

ALGORITHM & DEPLOYMENT

- **Algorithm Selection:**
  - We used **IBM Watson AutoAI**, which automatically compares multiple machine learning algorithms (e.g., Random Forest, Gradient Boosting, Logistic Regression) to find the best model for predicting machine failures based on sensor data. AutoAI also performs data cleaning, feature engineering, and hyperparameter optimization.
- **Data Input:**
  - Features like air temperature, process temperature, rotational speed, torque, tool wear, and machine type.
- **Training Process:**
  - AutoAI handles data preprocessing, splits data, and tunes model parameters to generate the best pipeline..
- **Prediction Process:**
  - The best model pipeline is deployed as an API using IBM Watson Machine Learning, allowing real-time failure predictions from sensor inputs.

RESULT (PIPELINE)

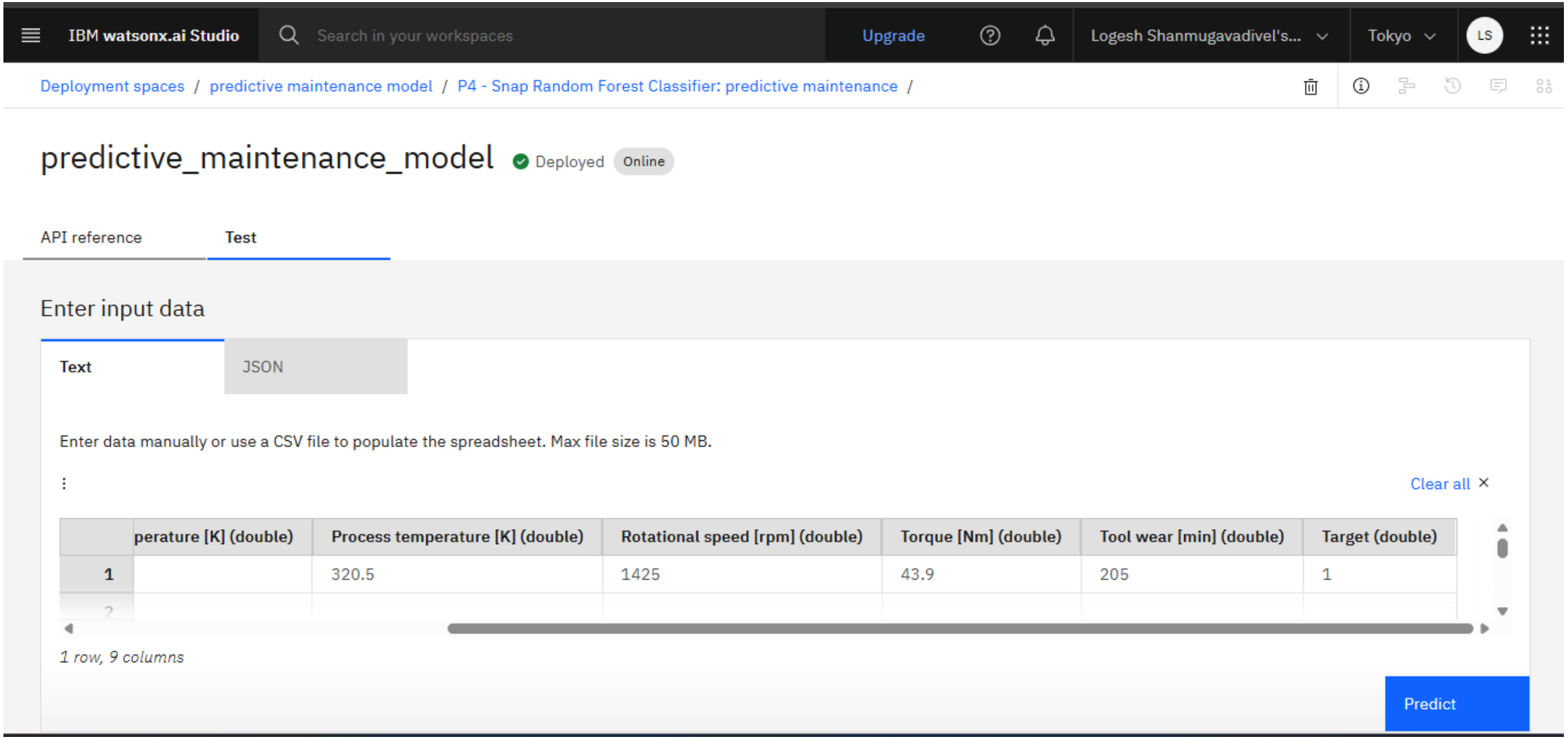


RESULT (PIPELINE LEADERBOARD)

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	00:00:52
	2	Pipeline 3	Snap Random Forest Classifier		0.995	HPO-1 FE	00:00:39
	3	Pipeline 8	Snap Decision Tree Classifier		0.994	HPO-1 FE HPO-2	00:00:42
	4	Pipeline 2	Snap Random Forest Classifier		0.994	HPO-1	00:00:12

RESULT (MODEL PREDICTION)



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RESULT (PREDICTION)

Prediction results

Prediction type

Multiclass classification

Prediction percentage

Display format for prediction results

(•) Table view ( ) JSON view

Show input data

	Prediction	Confidence
1	Tool Wear Failure	100%
2		
3		
4		
5		
6		
7		

CONCLUSION

- The proposed solution using IBM AutoAI successfully predicts different types of machinery failures based on sensor data, enabling proactive maintenance.
- The system helps reduce unexpected downtime, improve machine efficiency, and lower operational costs.
- AutoAI simplified the model development process by automating preprocessing, algorithm selection, and tuning.

FUTURE SCOPE

- Add real-time sensor and maintenance data
- Improve model accuracy with advanced algorithms
- Expand system to more machines and locations
- Use edge devices for on-site predictions
- Make predictions easier to understand with explainable AI

REFERENCES

- IBM DOCS
- IBM ZOOM VIDEOS

IBM CERTIFICATIONS

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IBM **SkillsBuild** Completion Certificate

This certificate is presented to

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for the completion of

Lab: Retrieval Augmented Generation with LangChain

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According to the Adobe Learning Manager system of record

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THANK YOU

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