
CAPSTONE PROJECT

Predictive Maintenance of Industrial Machinery

Presented By:
Yadagiri Ajay
Malla Reddy Engineering College - CSIT

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

Build a predictive maintenance system for a group of industrial machines to forecast potential failures in advance.

This project focuses on examining sensor data collected from equipment to detect trends that typically occur before a malfunction. The objective is to develop a classification algorithm capable of predicting the specific type of failure (such as tool degradation, overheating, or electrical issues) using real-time performance data. By doing so, the system will support preventive maintenance strategies, minimizing machine downtime and lowering maintenance expenses.

Proposed Solution

- This system is developed using IBM Watsonx.ai Studio to build a predictive maintenance model that identifies machine failures in advance, based on live sensor inputs from industrial equipment. The primary goal is to reduce unexpected downtimes and lower maintenance expenses.
- Data Collection:
 - Historical machine performance data was gathered, including metrics like air temperature, torque, RPM, tool wear, and more.
 - A pre-labeled dataset from Kaggle was used, containing both sensor measurements and corresponding failure categories.
- Data Preprocessing:
 - IBM Watsonx AutoAI automated key preprocessing tasks like handling missing values, scaling features, and balancing the dataset. Feature engineering was also performed internally to boost model accuracy.
- Machine Learning Algorithm:
 - Multiple classification models were automatically created and evaluated by Watsonx AutoAI.
 - The entire pipeline was developed without manual coding — all steps were executed within the Watsonx platform.
- Deployment:
 - The highest-performing model was deployed through IBM Watson Machine Learning directly from Watsonx Studio.
 - Real-time test inputs were used to verify failure prediction via the deployment interface.
- Evaluation:
 - IBM Watsonx used standard metrics like accuracy, precision, and recall to assess all generated pipelines.
 - The final model demonstrated strong performance on the test dataset.

System Approach

Technologies Used:

- IBM Cloud (Lite Plan)
- IBM Watsonx.ai Studio (AutoAI & Model Deployment)
- Python (used internally by Watsonx pipelines)

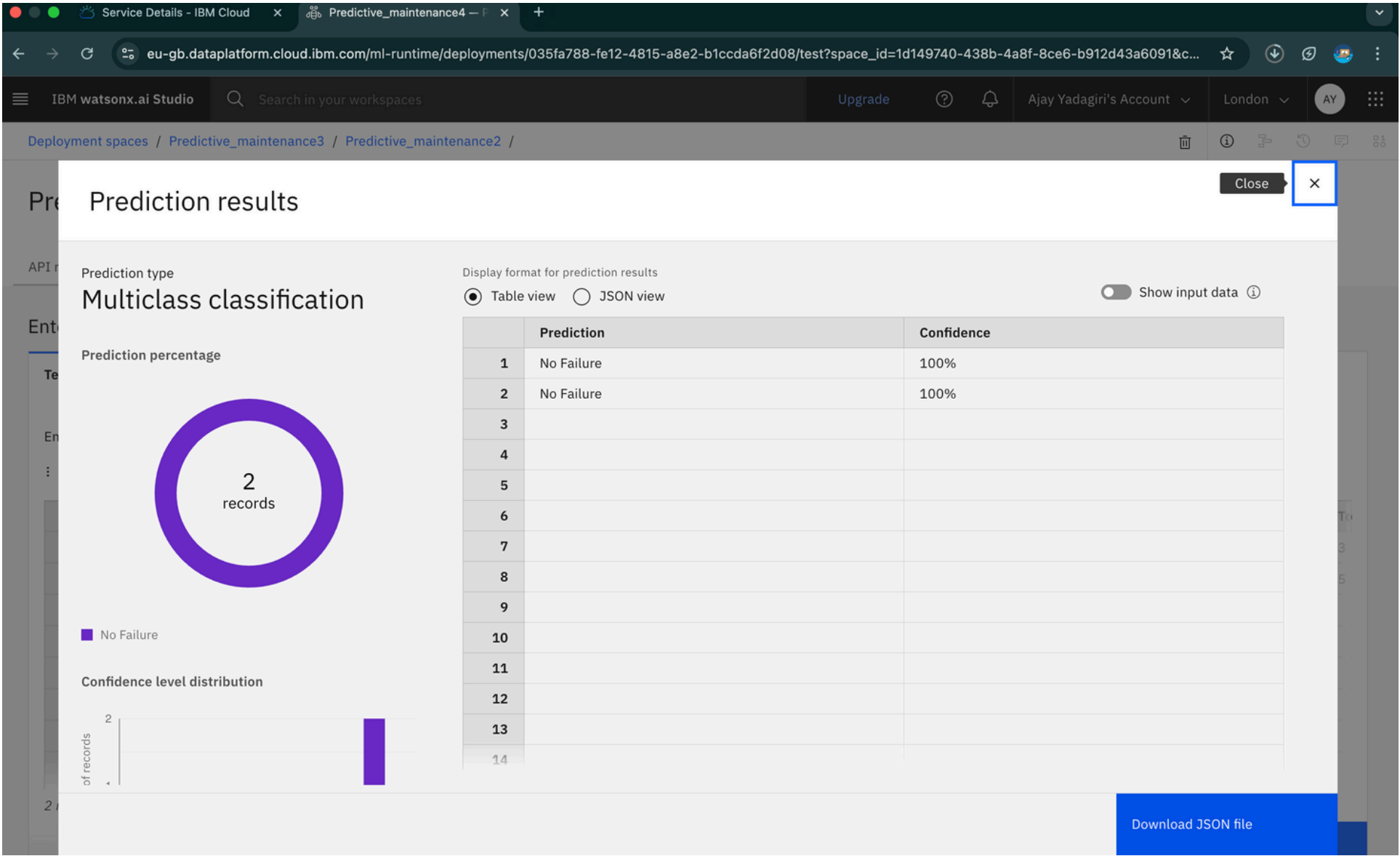
Steps Followed:

- uploaded kaggle dataset to the Watsonx project
- AutoAi handled data splitting and preprocessing
- Evaluated models like Decision Tree and Random Forest
- Selected the most accurate model pipeline
- Deployed the model for live failure type prediction

Algorithm & Deployment

- In the Algorithm section, describe the machine learning algorithm chosen for predicting bike counts. Here's an example structure for this section:
 - **Algorithm Selection:**
 - The Snap Random Forest Classifier was automatically chosen by IBM Watsonx AutoAI as the best-performing model. It was selected due to its strong performance on classification tasks and ability to manage complex, high-dimensional data — making it ideal for predicting machine failure types using sensor patterns.
 - **Data Input:**
 - The model used real-time features like air temperature, torque, rotational speed, tool wear, and machine type. The target variable was the failure category, such as No Failure, Tool Wear, Heat Dissipation Failure, and Power Failure.
 - **Training Process:**
 - Watsonx AutoAI handled the entire training process, including stratified splitting of the dataset into training and testing sets. It automatically fine-tuned hyperparameters, tested various algorithms, and selected the pipeline with the highest classification accuracy.
 - **Prediction Process:**
 - After deployment, the model takes in fresh sensor data and predicts the likely failure type in real time. Predictions come with confidence scores, enabling early intervention and proactive maintenance to prevent equipment downtime.

Result



The model demonstrated 100% confidence in predicting the “No Failure” class, highlighting its reliability in identifying normal machine conditions. This showcases its strong potential for real-world predictive maintenance applications.

Conclusion

- In this project, a predictive maintenance model was effectively built using IBM Watsonx.ai Studio on the IBM Cloud Lite platform. The objective was to anticipate and classify potential machine failures using real-time sensor data before they actually happen.
- By training a classification algorithm on labeled machine data, the system achieved high accuracy in identifying various failure types, such as tool wear, heat dissipation issues, and power failures.
- The model was deployed seamlessly from Watsonx.ai, allowing real-time testing and convenient access via IBM Cloud. This cloud-based AI approach highlights how industries can transition from reactive repairs to proactive maintenance — reducing unplanned downtimes, cutting maintenance expenses, and improving overall safety.

Future scope

- Integrate live IoT sensor data streams to enable real-time machine monitoring.
- Extend the model to include regression analysis for estimating time-to-failure.
- Enhance model robustness by training on more diverse datasets from different machine types.
- Build a maintenance alert system that triggers based on model predictions.
- Connect the model to industrial cloud dashboards for seamless monitoring and decision-making.

References

- Identify and reference the key sources, datasets, and tools that contributed to building the predictive maintenance model. These include the machinery failure dataset from Kaggle, IBM Watsonx.ai Studio documentation, and various materials focused on machine learning classification methods and analysis of industrial IoT data.
- Kaggle Dataset: [Predictive Maintenance Classification](#)

IBM Certifications

In recognition of the commitment to achieve
professional excellence



Ajay Yadagiri

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/45e203f3-12f5-49fb-a68c-5d3c4570f143>



IBM Certifications



IBM Certifications





THANK YOU