FAILURE AHEAD: MACHINE LEARNING-BASED PREDICTIVE MAINTENANCE SYSTEM

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OUTLINE

- Problem Statement
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- System Development Approach
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PROBLEM STATEMENT

- Currently, unplanned equipment failures in industrial machinery lead to costly downtimes and maintenance. Identifying failures only after they occur disrupts operations. The challenge is to build a system that can predict the type of failure before it happens using real-time sensor data.

PROPOSED SOLUTION

- The proposed solution uses sensor data from machines and machine learning to predict specific failure types:
- - Tool Wear
- - Heat Dissipation Failure
- - Power Failure
- - Random Failures
- - Overstrain Failure

- Key components:
- - Data preprocessing of real-time operational metrics
- - Training classification models (Random Forest, Decision Tree)
- - Deploying top models using IBM Watsonx.ai
- - Real-time prediction through deployed interface

SYSTEM DEVELOPMENT APPROACH

- Technology Used:
- - IBM Watsonx.ai Studio (Cloud Lite)
- - AutoAI Pipeline Generation
- - Python-based Jupyter notebooks
- - ROC Curve Analysis

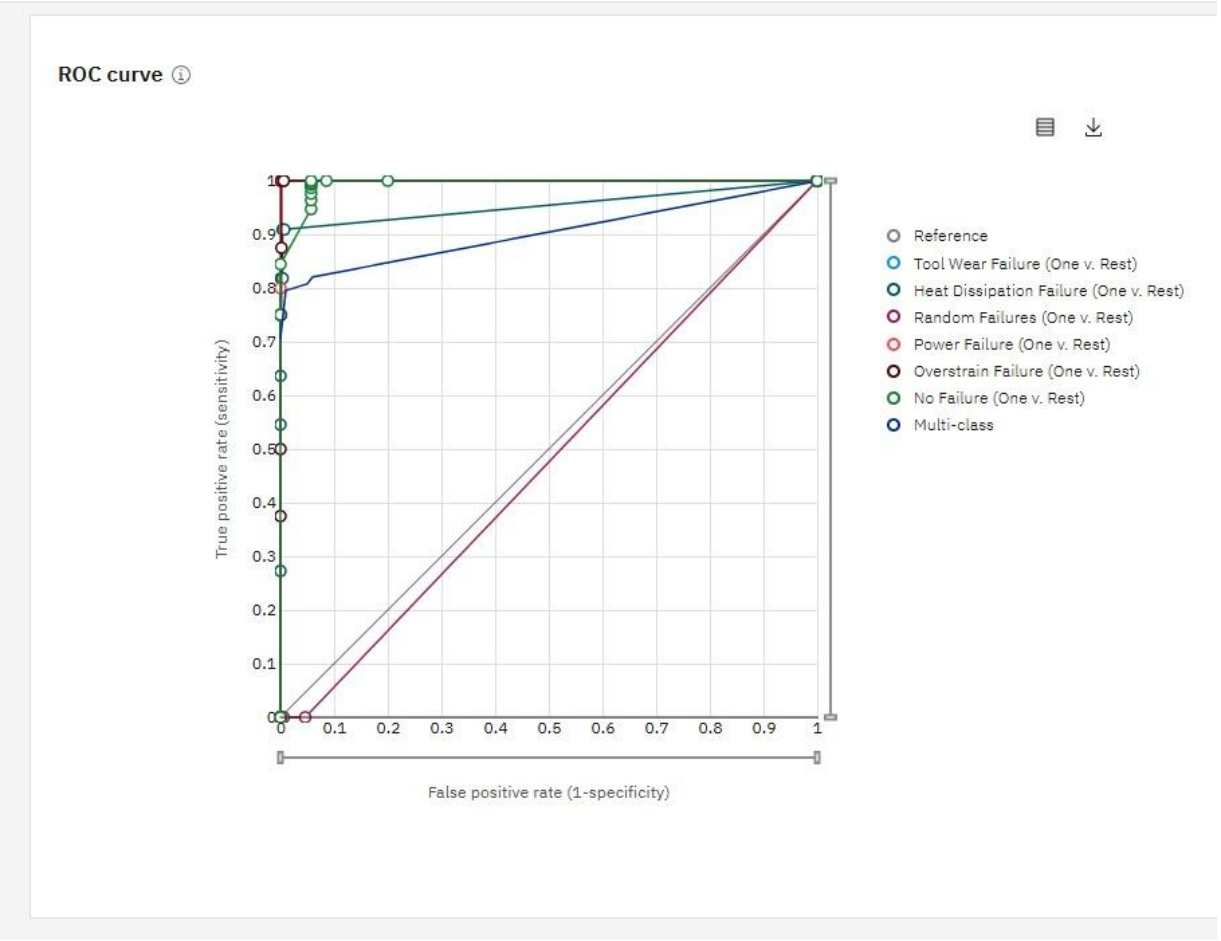
- System Requirements:
- - Kaggle Sensor Dataset
- - Features: Temperature, Torque, Tool Wear, Speed, Product ID

ALGORITHM & DEPLOYMENT

- - Best Algorithm: Snap Random Forest Classifier (Accuracy: 99.5%)
- - AutoAI Pipeline: Data Split → Preprocessing → Model Selection
- - Steps: Hyperparameter Optimization + Feature Engineering
- - Deployment: Model (P4) deployed using IBM Cloud
- - Input Format: Manual or CSV/JSON
- - Output: Multiclass Prediction (e.g., Power Failure)

RESULT

- - Prediction Type: Multiclass Classification
- - Predicted Failure: Power Failure
- - Confidence Level: 40%
- - ROC Curve: Excellent separation (close to top-left corner)



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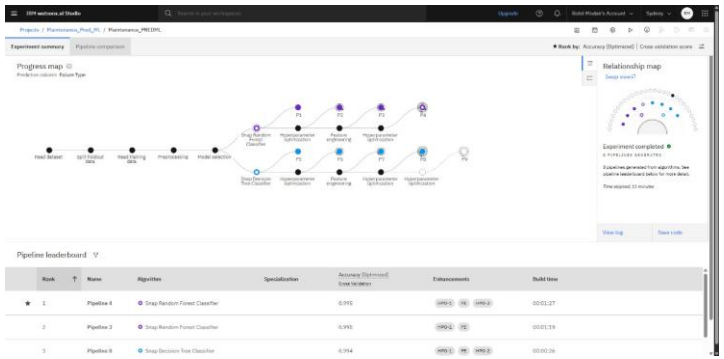
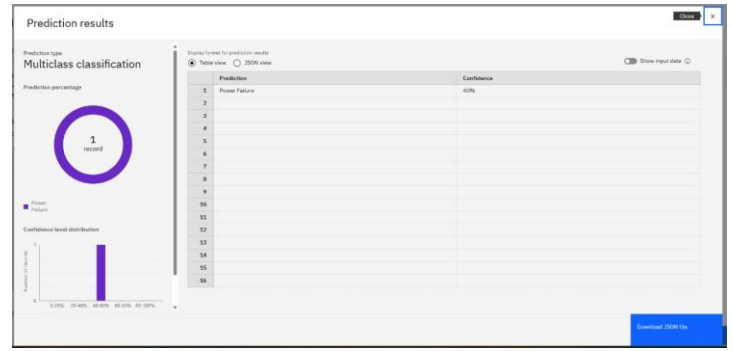
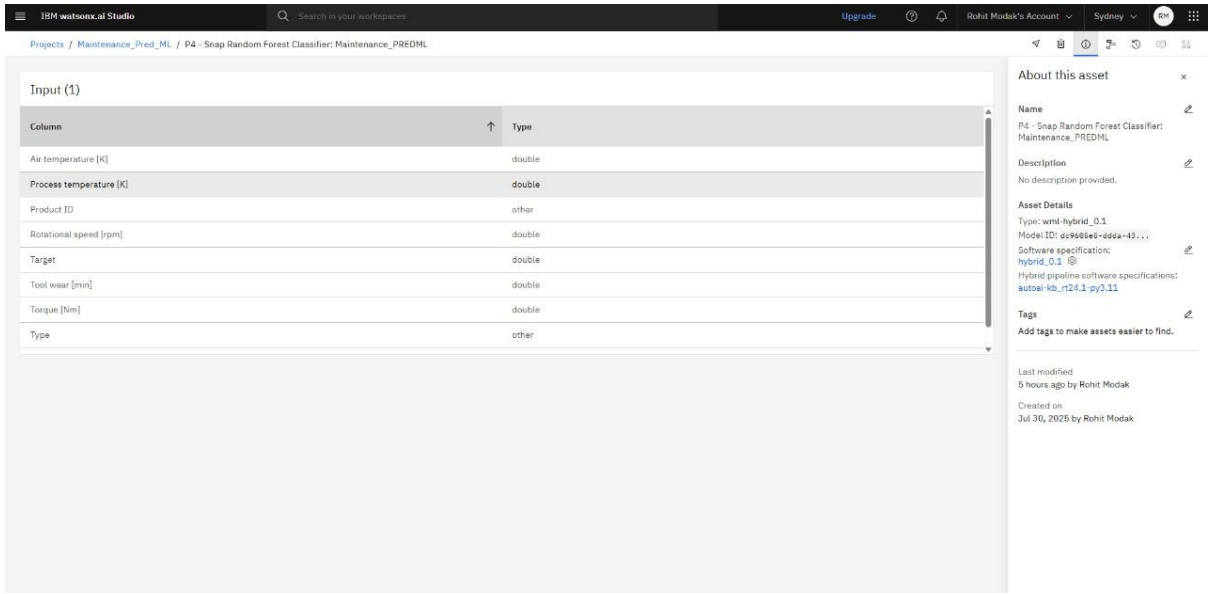
OUTCOMES


Progress map
Relationship map
Pipeline leaderboard


Prediction results
Multiclass classification


IBM watsonx.ai Studio
Projects / Maintenance_Pred_ML / P4 - Snap Random Forest Classifier: Maintenance_PREDML
Input (1)
Column
Type
Air temperature [K] double
Process temperature [K] double
Product ID other
Rotational speed [rpm] double
Target double
Tool wear [min] double
Torque [Nm] double
Type other
About this asset
Name
P4 - Snap Random Forest Classifier: Maintenance_PREDML
Description
No description provided.
Asset Details
Type: wml-hybrid_0.1
Tags
Add tags to make assets easier to find.

CONCLUSION

- - Built and deployed a predictive model for machinery failure detection
- - Achieved high accuracy (99.5%)
- - Enabled real-time predictions with low latency
- - Helps reduce unplanned downtimes and maintenance costs

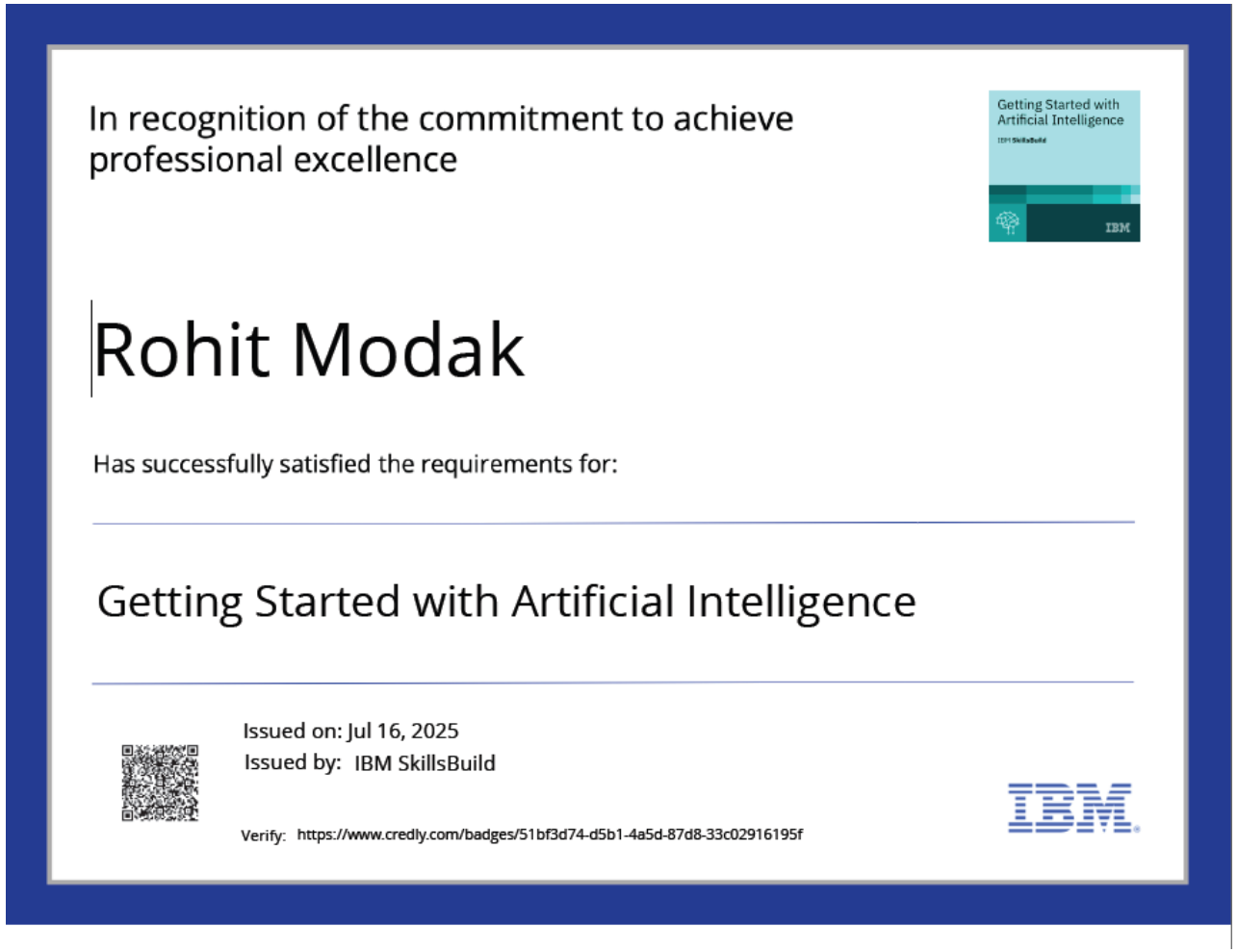
FUTURE SCOPE

- - Add real-time sensor types (e.g., vibration, voltage)
- - Integrate alert systems for preventive actions
- - Expand to edge computing for local predictions
- - Explore LSTM or deep learning for time-series failure prediction

REFERENCES

- - Kaggle Dataset: https://www.kaggle.com/datasets/shivamb/machine-predictive-maintenance-classification
- - IBM Cloud Docs & AutoAI Guide
- - Research on predictive maintenance & ML in industry

IBM CERTIFICATIONS



IBM CERTIFICATIONS

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IBM **SkillsBuild** Completion Certificate

This certificate is presented to

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THANK YOU

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