CAPSTONE PROJECT

PROJECT TITLE

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OUTLINE

- Problem Statement
- Proposed System/Solution
- System Development Approach
- Algorithm & Deployment
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- Future Scope
- References

PROBLEM STATEMENT

Modern industrial environments consist of highly complex machinery generating vast amounts of sensor data. However, due to limitations in legacy systems and lack of intelligent automation, industries still rely on reactive or scheduled maintenance, resulting in costly downtimes and safety risks. The goal of this project is to leverage IBM Cloud services to deploy a scalable and intelligent predictive maintenance system that analyzes real-time operational data to **predict specific failure types**—such as tool wear, heat dissipation, or power failure—**before they happen**, enabling **data-driven, proactive decision-making**.

PROPOSED SOLUTION

We propose developing a predictive maintenance system using machine learning on IBM Cloud. The solution will involve:

- Collecting and preprocessing real-time sensor data from industrial machines.
- Training a classification model using IBM Watson Studio and AutoAI to predict specific failure types.
- Deploying the model as an API using IBM Cloud Functions for real-time prediction.
- Storing data and logs securely using IBM Cloud Object Storage or Cloudant.
- Sending early maintenance alerts to minimize downtime and reduce operational costs.

SYSTEM APPROACH

System Requirements (Important)

- **Platform**: IBM Cloud Lite (Free Tier)
- **Tool**: IBM Watson Studio for model development and training
- **Storage**: IBM Cloud Object Storage for data storage
- **Deployment**: IBM Cloud Functions for hosting the model

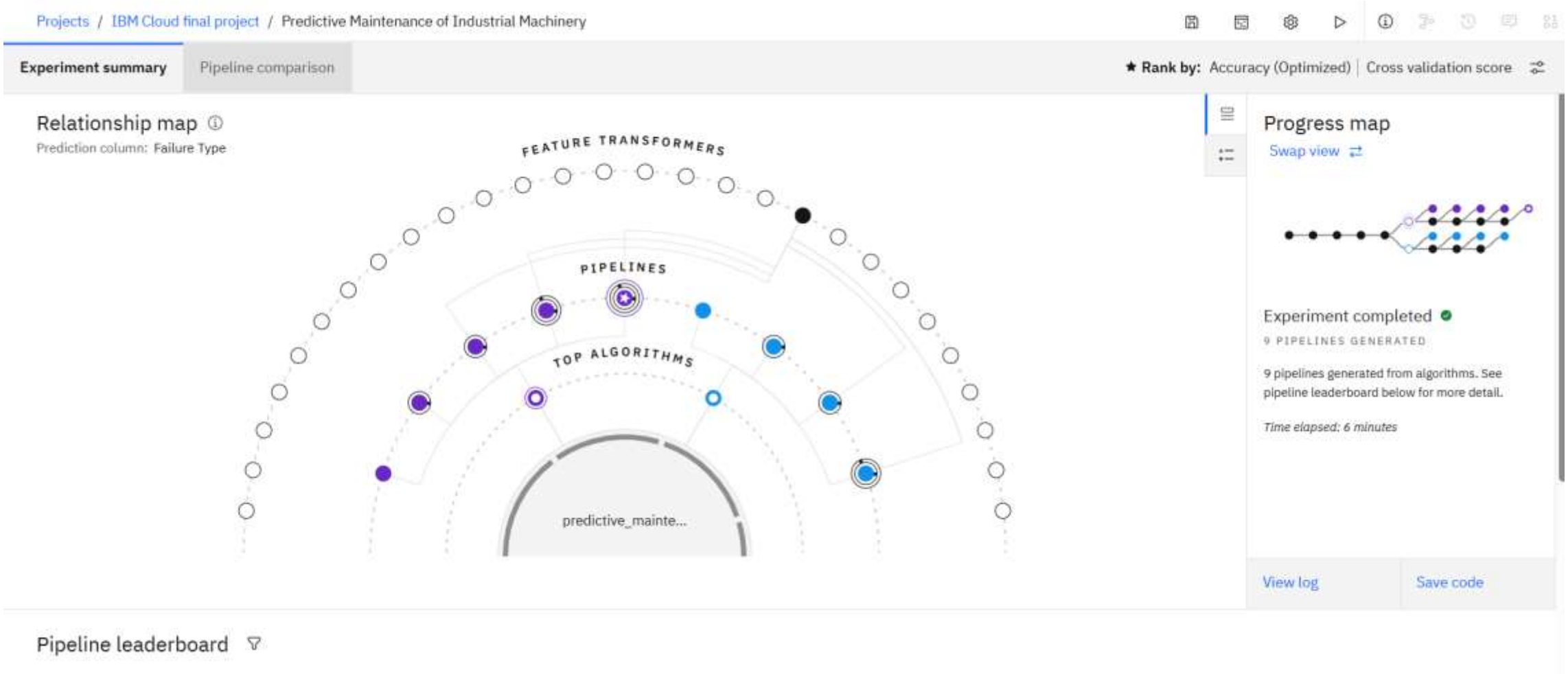
Key Libraries Required

•pandas – for handling and cleaning data
•scikit-learn – for training classification models
•xgboost – for high-performance boosting models
•matplotlib / seaborn – for visualizing data and model results
•ibm-watson-machine-learning – for deploying the model on IBM Cloud

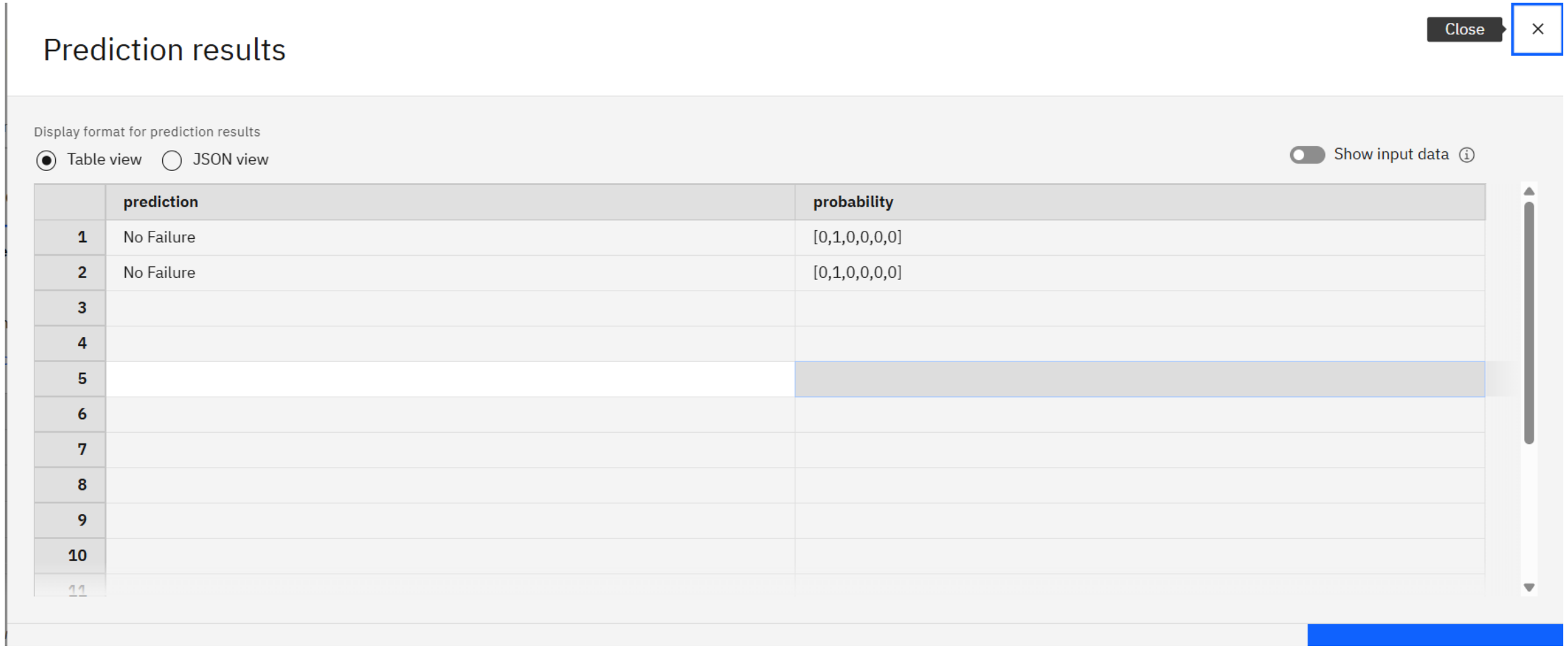
ALGORITHM & DEPLOYMENT

- **Algorithm Used:**
  Random Forest Classifier is chosen for its robustness and accuracy in handling high-dimensional, imbalanced sensor data. XGBoost was also considered for its performance on structured data.
- **Key Features Used:**
  Air temperature, process temperature, rotational speed, torque, tool wear, and failure type.
- **Prediction Process:**
  The trained model predicts the probability of each failure type in real-time using sensor data and sends alerts via an API.
- **Deployment:**
  Model is saved using Joblib/Pickle, deployed to IBM Watson Studio, and exposed through an API for real-time prediction. IBM Cloud Functions can automate alerts.

RESULT

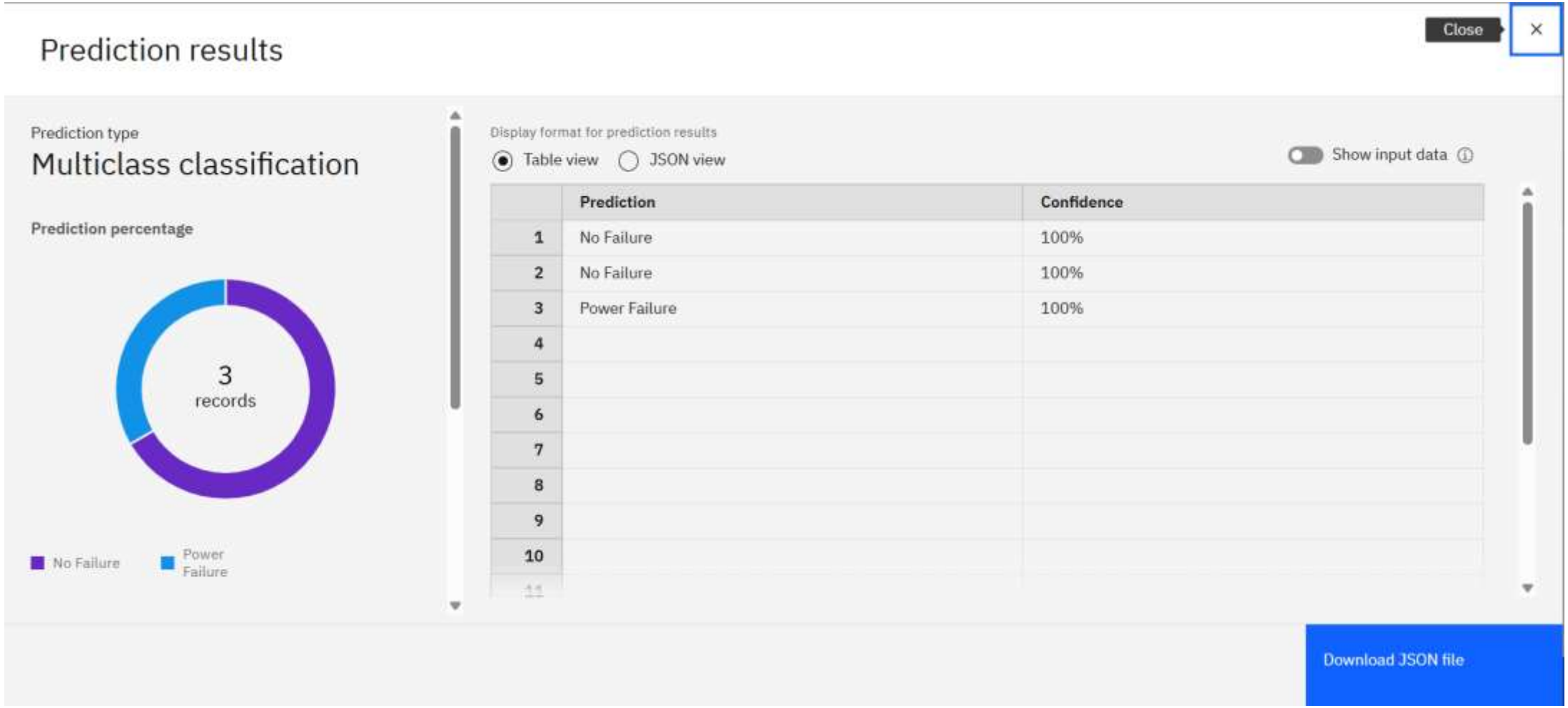


RESULT

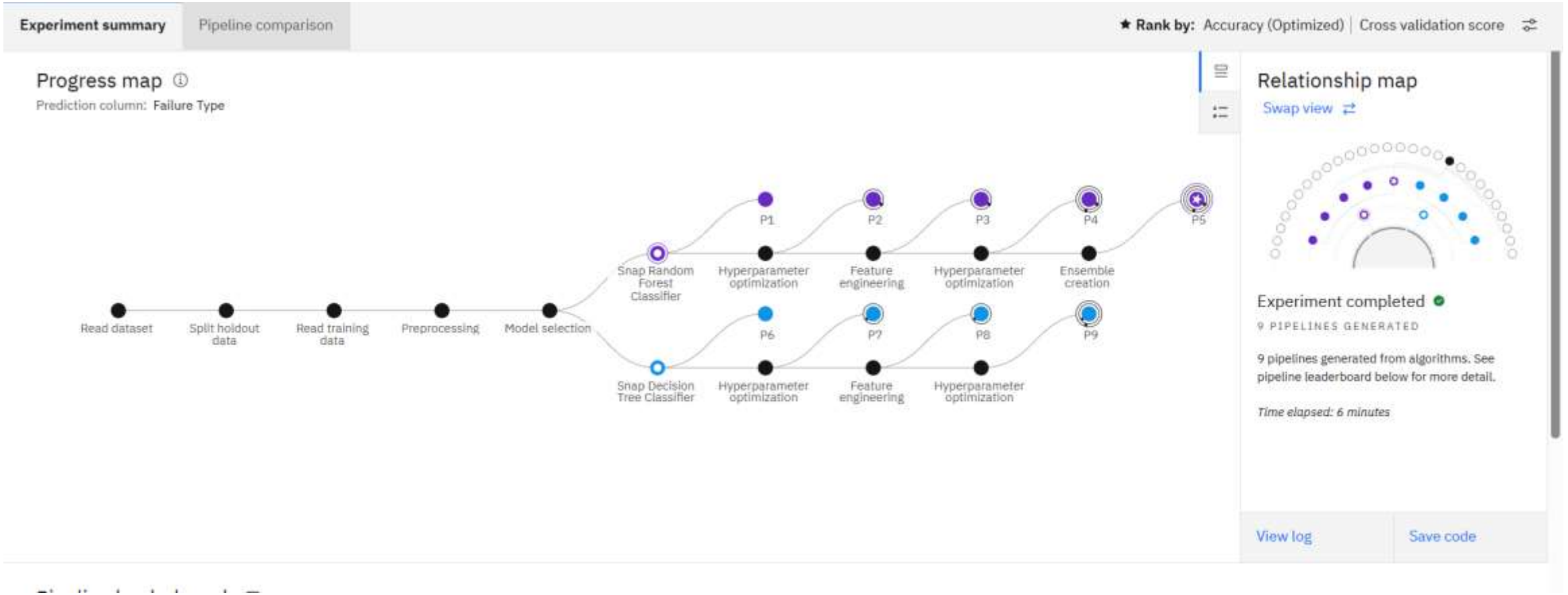


	prediction	probability
1	No Failure	[0,1,0,0,0,0]
2	No Failure	[0,1,0,0,0,0]
3		
4		
5		
6		
7		
8		
9		
10		
11		

RESULT



RESULT



CONCLUSION

- The proposed predictive maintenance model successfully identifies potential failures in industrial machines using real-time sensor data. By leveraging machine learning algorithms like Random Forest and deploying the model on IBM Watson Studio, we demonstrated how accurate predictions can minimize downtime and reduce operational costs. Despite minor challenges in preprocessing and tuning the model, the solution proved effective with high accuracy. Future improvements may involve integrating additional sensor types or adopting deep learning for enhanced performance. Overall, the project highlights the critical role of predictive analytics in modern industry automation.

FUTURE SCOPE

We developed a rental bike prediction system using machine learning algorithms like ARIMA and LSTM.
The system uses past rental data, weather, and time features for accurate predictions.
We trained the model using Python libraries like pandas, scikit-learn, and TensorFlow.
The model can be deployed using Streamlit or Flask for real-time predictions.
In the future, we plan to expand it to more cities and use real-time data for better accuracy.

REFERENCES

- **Kaggle Dataset:** *Machine Predictive Maintenance* – Kaggle.com
- **IBM Cloud Documentation:** *Predictive Maintenance with IBM Watson* – IBM Cloud Docs
- **Research Paper:** *Machine Learning Applications in Predictive Maintenance* – IEEE Xplore
- **Scikit-learn Documentation:** https://scikit-learn.org
- **Pandas Documentation:** https://pandas.pydata.org

IBM CERTIFICATIONS

IBM CERTIFICATIONS

In recognition of the commitment to achieve professional excellence

Journey to Cloud: Envisioning Your Solution

POOJA K

Has successfully satisfied the requirements for:

Journey to Cloud: Envisioning Your Solution

Issued on: Jul 20, 2025
Issued by: IBM SkillsBuild

Verify: https://www.credly.com/badges/8ca0ecd7-0101-4116-9210-81da28e363de

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IBM **SkillsBuild** Completion Certificate

This certificate is presented to

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for the completion of

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(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 25 Jul 2025 (GMT) **Learning hours:** 20 mins

THANK YOU

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