# 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

- Develop a Machine Learning model that can predict the type of failure using the dataset provided. The model will analyse sensor data from machinery to identify patterns that precede a failure. This will enable proactive maintenance, reducing downtime and operational costs.
- Key components:
- Data Collection: Use the Kaggle dataset on predictive maintenance of industrial machinery.
- Preprocessing: Clean and normalise the dataset.
- Model Training: Train a classification model.
- Evaluation: Validate the model using accuracy, precision,recall and F1 score.

# SYSTEM APPROACH

**The "System Approach" section outlines the overall strategy and methodology for developing and implementing the rental bike prediction system. Here's a suggested structure for this section:**

- **System requirements:**
- **IBM Cloud**
- **IBM Watson studio for model development and deployment**
- **IBM Cloud object storage for dataset handling**

# ALGORITHM & DEPLOYMENT

- **Algorithm Selection:**

  **Snap Random Forest Classifier**

- **Data Input:**

  **Air temperature , Process temperature, Rotational speed,  Torque, Tool wear ,Target**

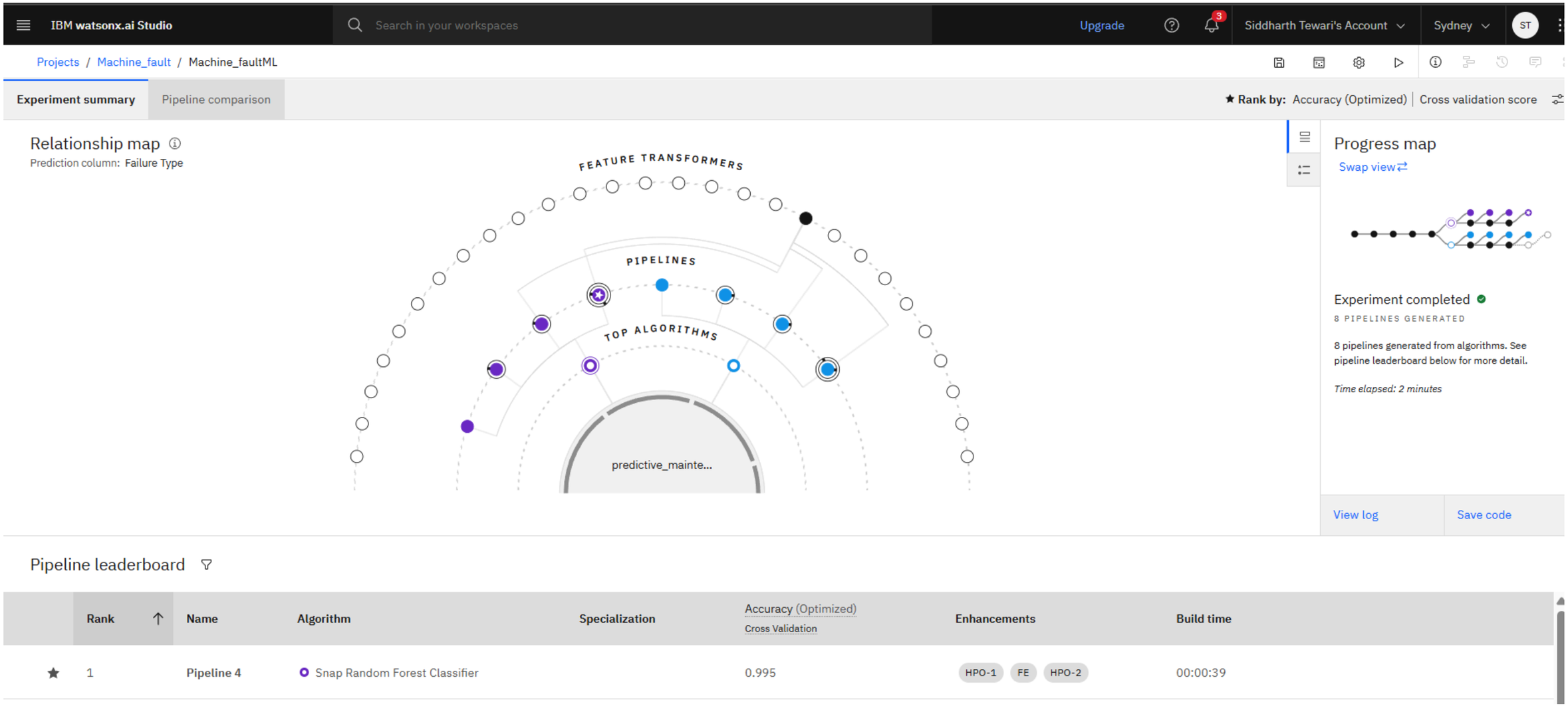
- **Training Process:**

  **Supervised learning using labelled failure type**

- **Prediction Process:**

  **Model deployed on IBM Watson studio**

# RESULT

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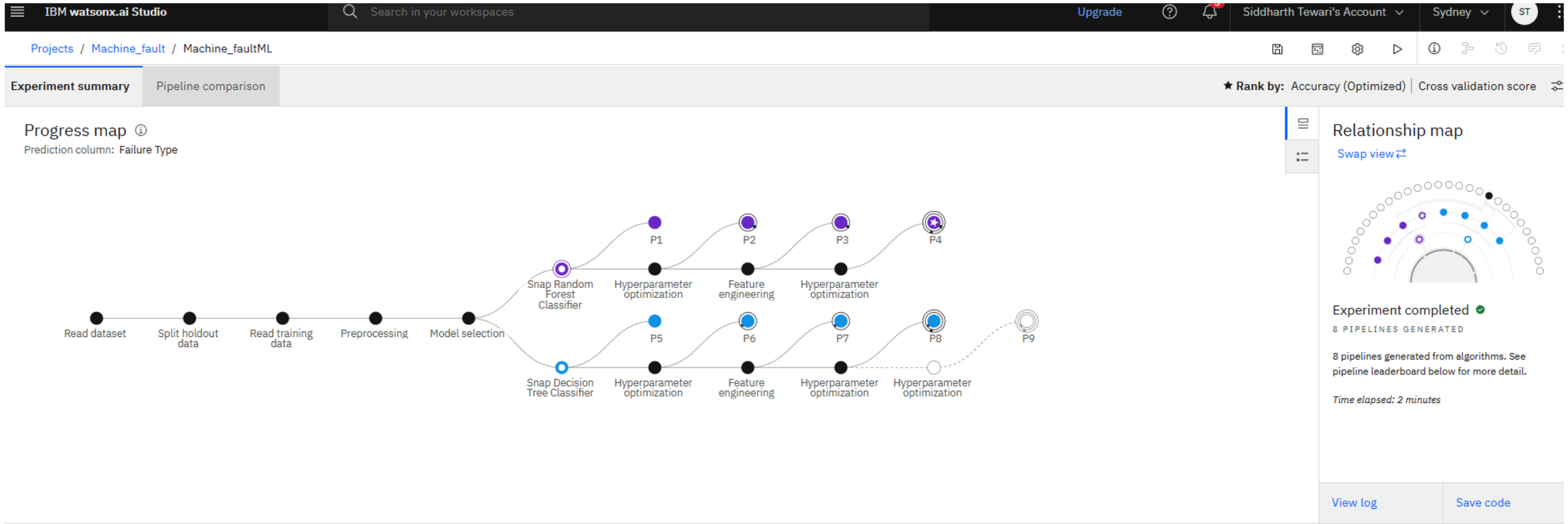
# RESULT

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 | 00:00:39 |
| | 2 | Pipeline 3 | Snap Random Forest Classifier | | 0.995 | HPO-1 FE | 00:00:29 |
| | 3 | Pipeline 8 | Snap Decision Tree Classifier | | 0.994 | HPO-1 FE HPO-2 | 00:00:24 |
| | 4 | Pipeline 2 | Snap Random Forest Classifier | | 0.994 | HPO-1 | 00:00:06 |

# RESULT



# RESULT

machinefault Deployed Online

API reference | Test

## Enter input data

Text | JSON

Enter data manually or use a CSV file to populate the spreadsheet. Max file size is 50 MB.

Download CSV template | Browse local files | Search in space | Clear all

| | 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 | 1 | M14860 | M | 298.1 | 308.6 | 1551 | 42.8 | 0 | 0 |
| 2 | 15 | L47194 | L | 298.6 | 309.2 | 2035 | 19.6 | 40 | 0 |
| 3 | 464 | L47643 | L | 297.4 | 308.7 | 2874 | 4.2 | 118 | 1 |
| 4 | 78 | L47257 | L | 298.8 | 308.9 | 1455 | 41.3 | 208 | 1 |
| 5 | 161 | L47340 | L | 298.4 | 308.2 | 1282 | 60.7 | 216 | 1 |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |

*5 rows, 9 columns*

Predict

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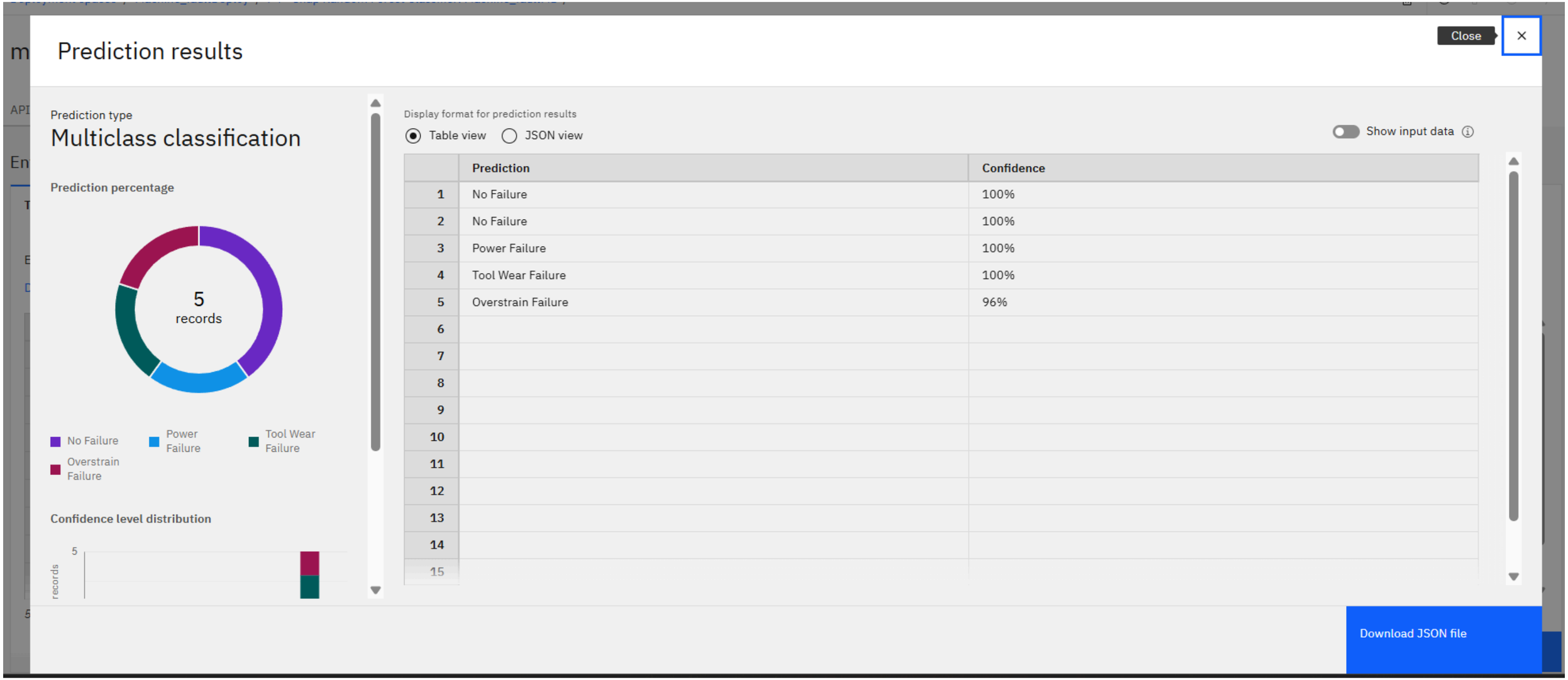
# RESULT



# CONCLUSION

- Created a machine learning model that helps us to predict the type of failure (e.g., tool wear , heat dissipation, power failure) based on real-time operational data.
- This machine learning model  helps industrial machines to anticipate failures before they occur.

# FUTURE SCOPE

- **Integration with IoT :**

**The convergence of ML with Internet of Things (IoT) devices enables real-time data collection from sensors embedded in machinery. Edge computing allows ML models to process data locally, reducing latency and bandwidth costs.**

- **Cross-Industry Applications Scope :**

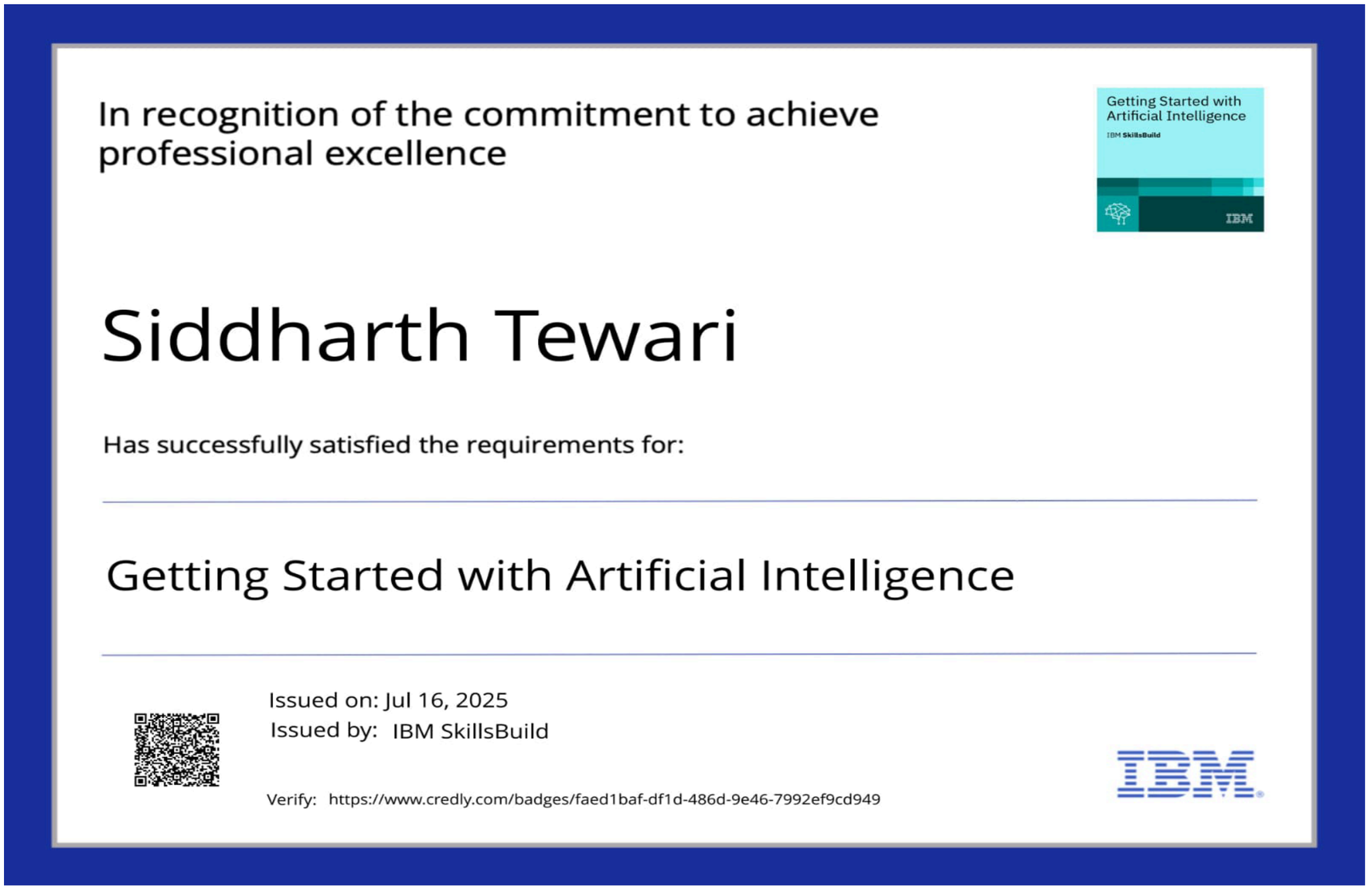
**Beyond traditional industries (manufacturing, energy), predictive maintenance will expand into healthcare (e.g., medical equipment), agriculture (e.g., farming machinery), and smart cities (e.g., infrastructure maintenance).**

# REFERENCES

- **Kaggle dataset link(for predicting maintenance of industrial machinery) :**

**https://www.kaggle.com/datasets/shivamb/machine-predictive-maintenance-classification**

# IBM CERTIFICATIONS

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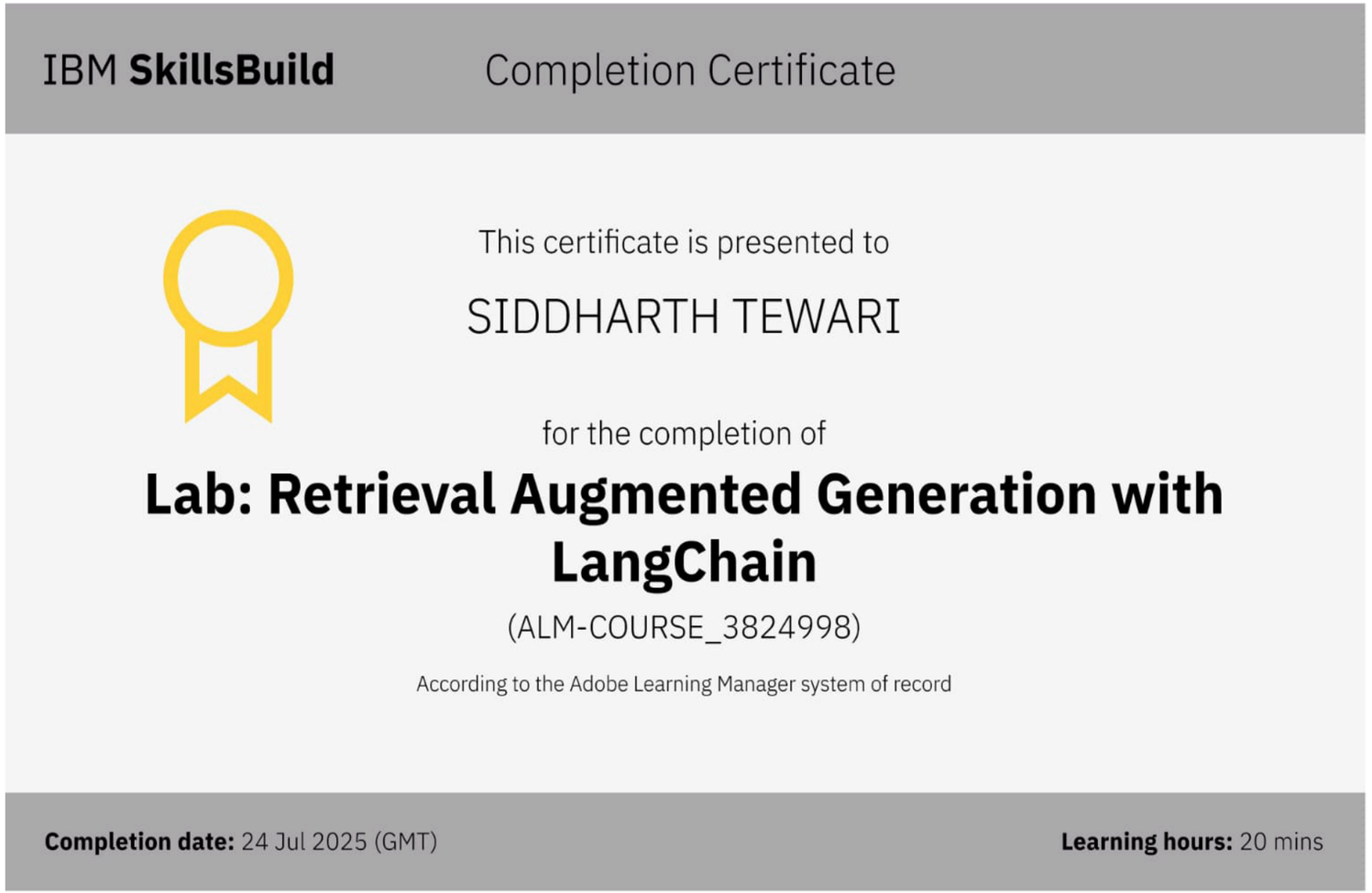

IBM **SkillsBuild** Completion Certificate

This certificate is presented to

SIDDHARTH TEWARI

for the completion of

**Lab: Retrieval Augmented Generation with LangChain**

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

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

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# THANK YOU

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