CAPSTONE PROJECT

PREDICTIVE MAINTENANCE OF INDUSTRIAL MACHINERY

Presented By:

1. Aman Jambhulkar
2. Wainganga college of engineering & Mangement, Nagpur (Computer science & Engineering)

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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 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.

- **Key components:**
  - **Data collection** : use the Kaggle dataset on redictive Maintenance of IndusPtrial Machinery
  - **Data preprocessing**: clean and normalize data set
  - **Model trainig:**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
  - **Evalution:**This will enable proactive maintenance, reducing downtime and operational costs. Validate the model using accuracy, precision, and F-1 Score,

SYSTEM APPROACH

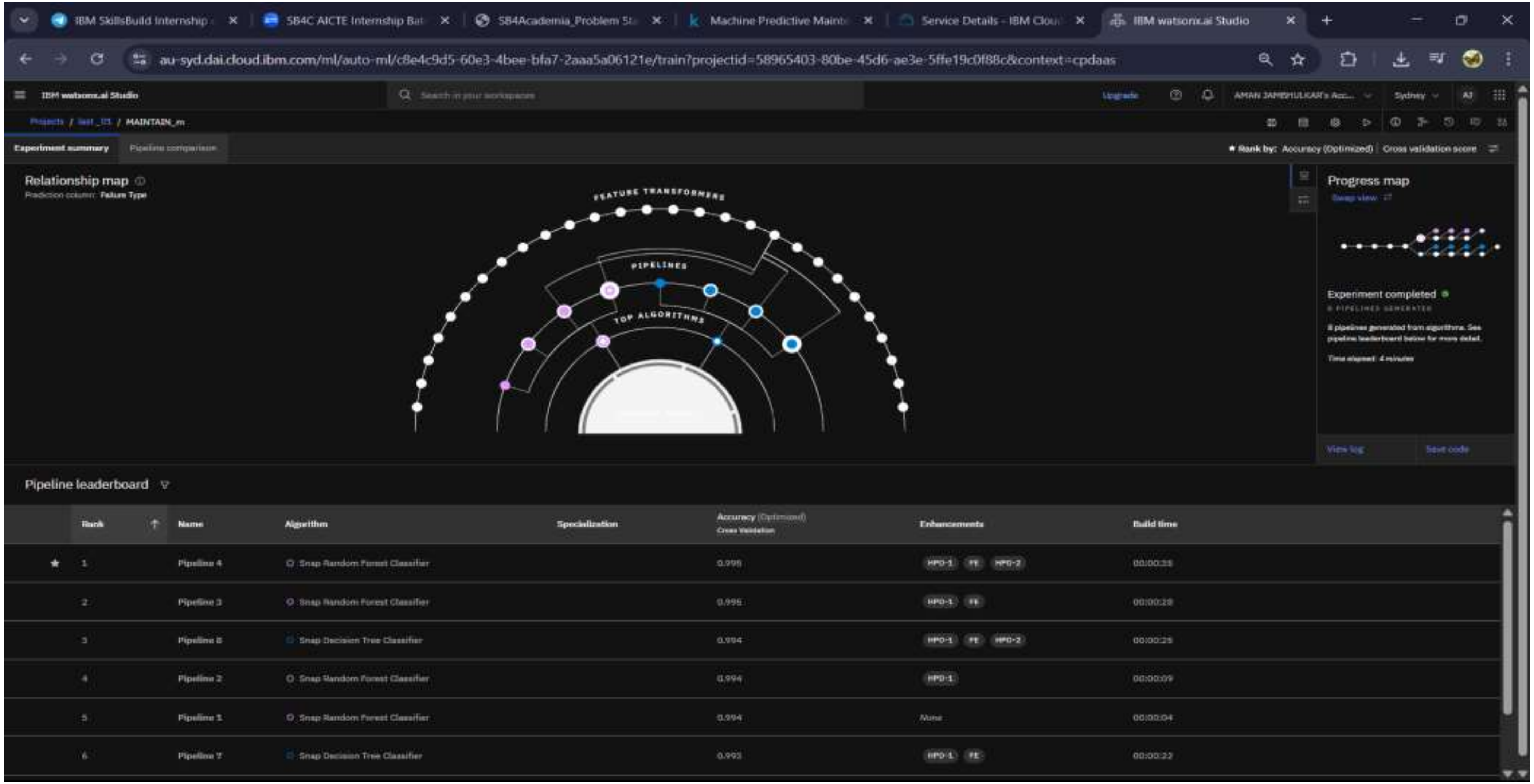
The Approach" section outlines the overall strategy and methodology for developing and implementing the rental bike prediction system. Here's a suggested structure for this section:

- System requirements "System : IBM CLOUD (MANDATORY)
- IBM WATSON AI- Studio for model development and deployment
- Ibm cloud object storage for dataset handling

ALGORITHM & DEPLOYMENT

- **Algorithm Selection:** Rendom forest classifier (or SVM based on performance)
- **Data Input** : Tool wear, heat dissipation, power failure from dataset.
- **Training Process**: Supervised learning using type of failure.
- **Prediction Process:** Model deployed on Watson ai studio with API endpoint for real time prediction.

RESULT



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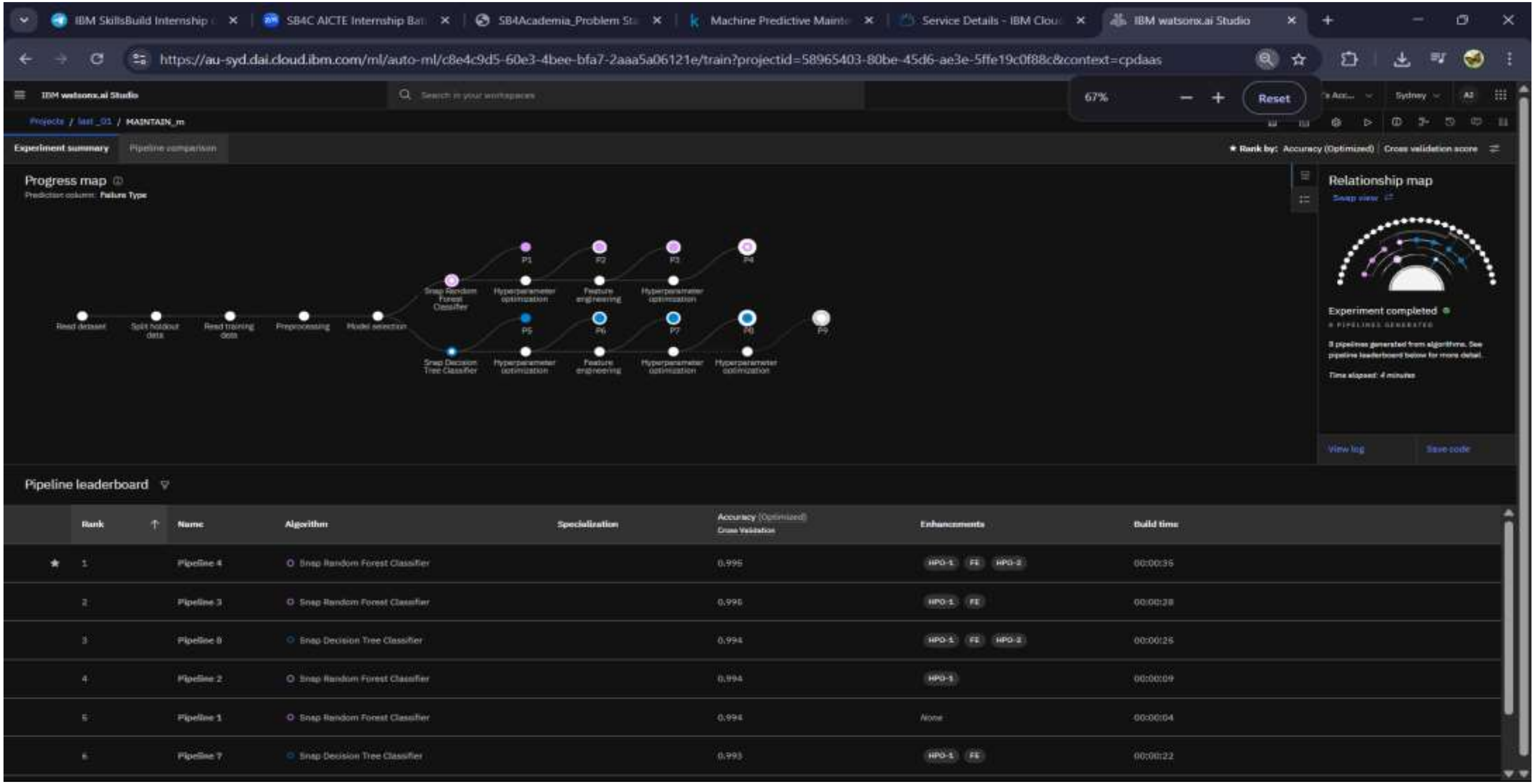
Relationship map
Prediction column: Failure Type
FEATURE TRANSFORMERS
PIPELINES
TOP ALGORITHMS
Progress map
Experiment completed
Pipeline leaderboard
Rank
Name
Algorithm
Specialization
Accuracy (Optimized)
Cross Validation
Enhancements
Build time
1 Pipeline 4 Snap Random Forest Classifier 0.995 HPO-1 FE HPO-2 00:00:35
2 Pipeline 3 Snap Random Forest Classifier 0.995 HPO-1 FE 00:00:28
3 Pipeline 8 Snap Decision Tree Classifier 0.994 HPO-1 FE HPO-2 00:00:25
4 Pipeline 2 Snap Random Forest Classifier 0.994 HPO-1 00:00:09
5 Pipeline 1 Snap Random Forest Classifier 0.994 None 00:00:04
6 Pipeline 7 Snap Decision Tree Classifier 0.993 HPO-1 FE 00:00:22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67%
Reset
Experiment summary
Pipeline comparison
Progress map
Prediction column: Failure Type
Read dataset
Split holdout data
Read training data
Preprocessing
Model selection
Snap Random Forest Classifier
Snap Decision Tree Classifier
Hyperparameter optimization
Feature engineering
Relationship map
Experiment completed
Pipeline leaderboard
Rank
Name
Algorithm
Specialization
Accuracy (Optimized) Cross Validation
Enhancements
Build time
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4 Pipeline 2 Snap Random Forest Classifier 0.994 HPO-1 00:00:09
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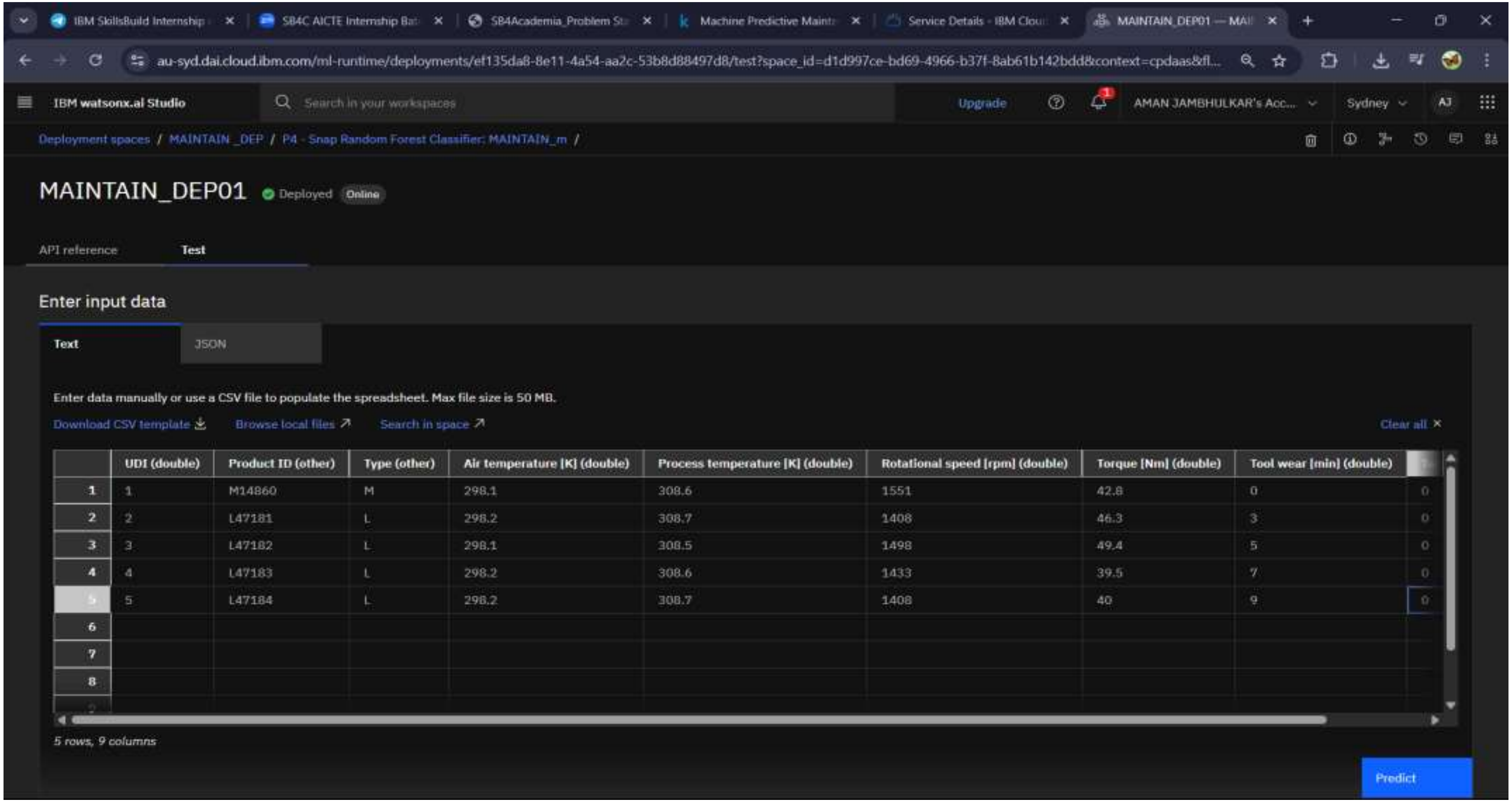
6 Pipeline 7 Snap Decision Tree Classifier 0.993 HPO-1 FE 00:00:22



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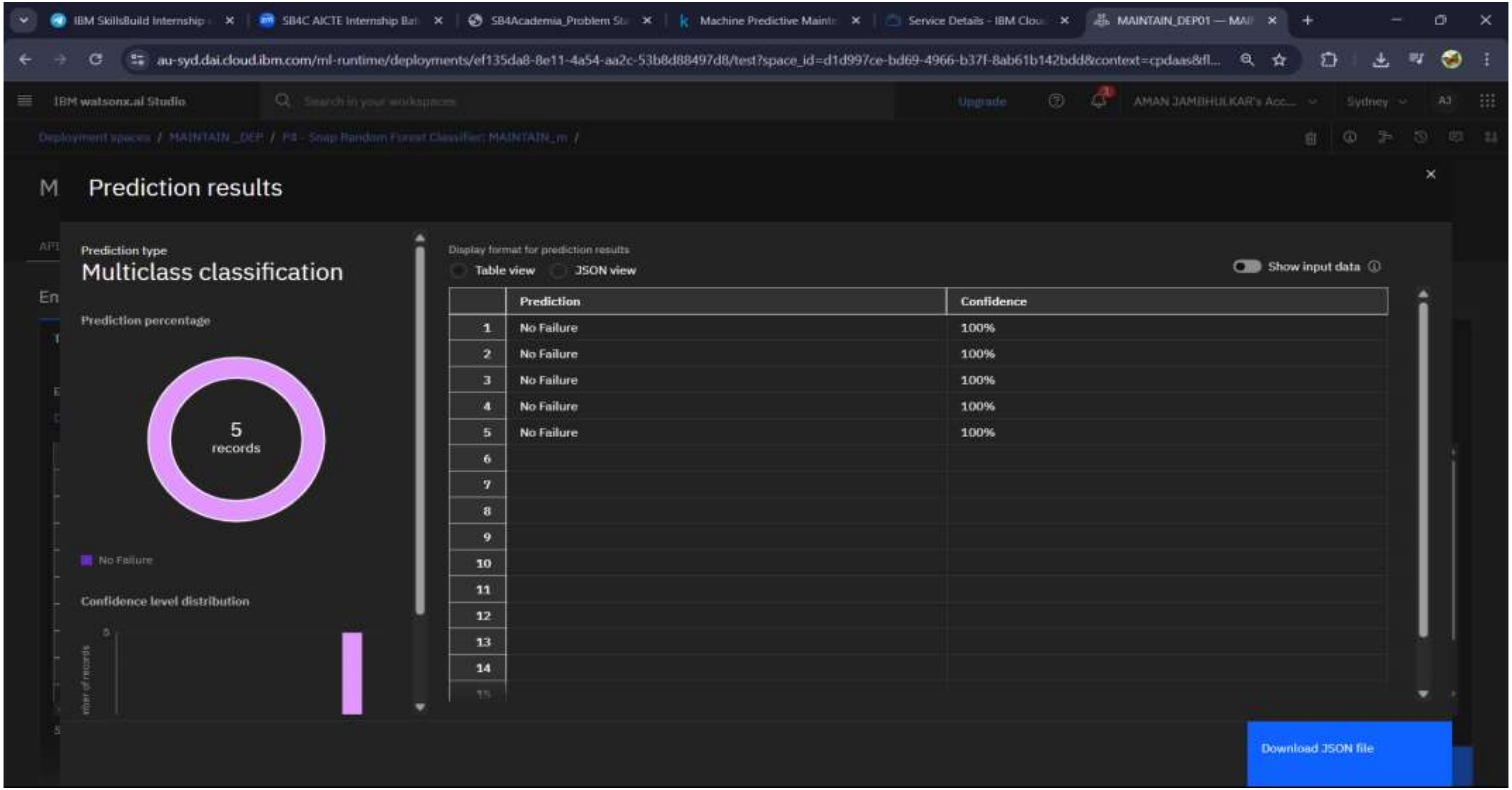

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CONCLUSION

- The development of a predictive maintenance model significantly enhances the reliability and efficiency of industrial machinery by proactively identifying potential failures before they occur. By analyzing real-time sensor data, the model effectively classifies different types of machine failures—such as tool wear, heat dissipation issues, and power failures—allowing for timely maintenance actions. This data-driven approach not only minimizes unplanned downtime and maintenance costs but also extends the lifespan of machinery and optimizes operational workflows. Ultimately, predictive maintenance empowers industries to shift from reactive to preventive strategies, driving higher productivity and smarter decision-making.

FUTURE SCOPE

- Real-Time Deployment at Scale
- Remaining Useful Life (RUL) Prediction
- Unsupervised and Anomaly Detection Models
- Self-Learning Systems
- Integration with ERP & Maintenance Systems
- Cross-Industry Applications
- Enhanced Sensor Fusion
- Cost-Based Maintenance Optimization

REFERENCES

•**Jardine, A. K. S., Lin, D., & Banjevic, D. (2006).**
A review on machinery diagnostics and prognostics implementing condition-based maintenance.
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Machine learning for predictive maintenance: A review.
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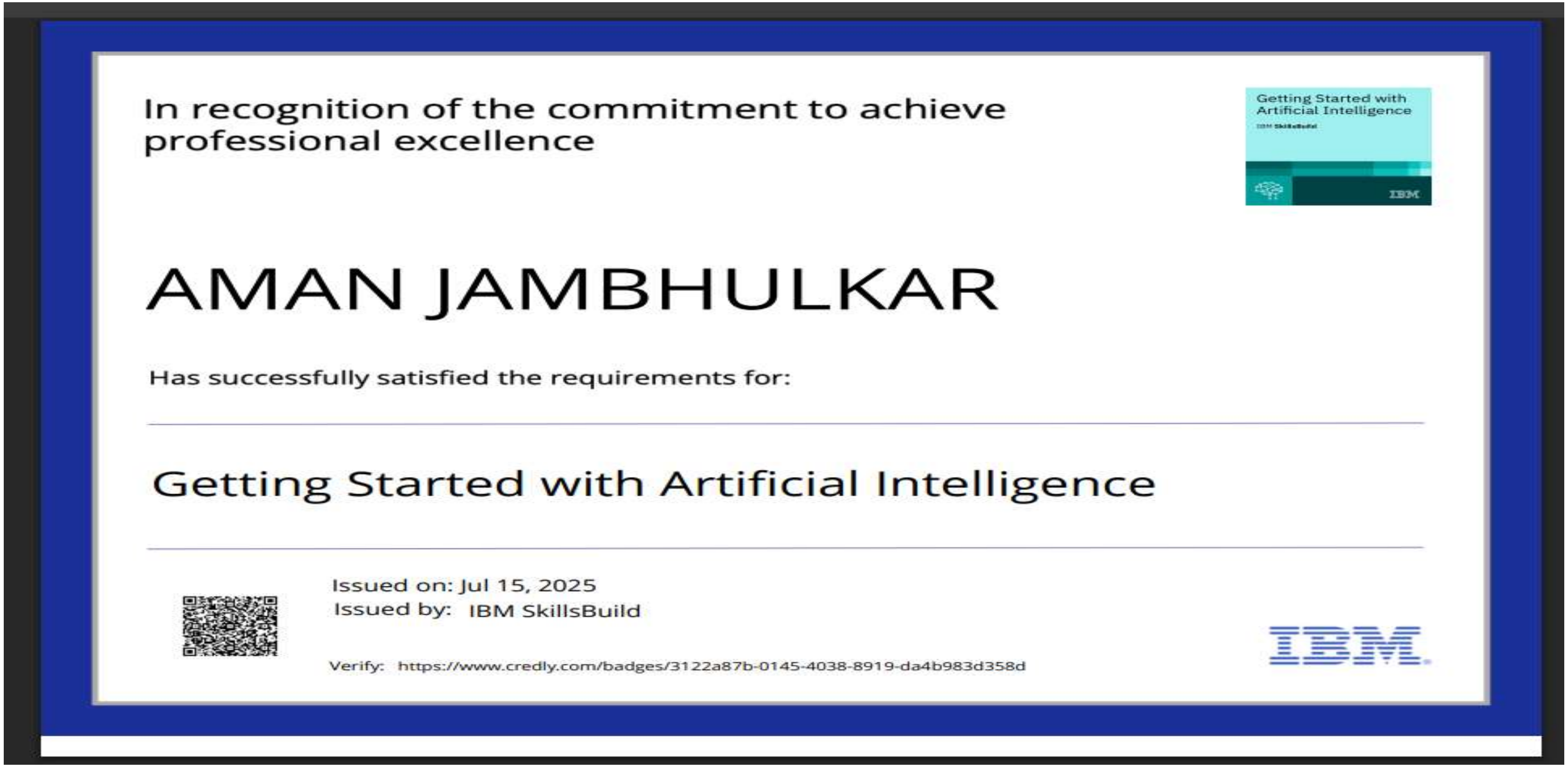
IBM CERTIFICATIONS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