CAPSTONE PROJECT

PREDICTIVE MAINTENANCE OF INDUSTRIAL MACHINERY USING MACHINE LEARNING

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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

Industrial machines are prone to unplanned failures, leading to unexpected downtime, productivity loss, and increased maintenance costs. Traditional maintenance approaches are either time-based or reactive, resulting in inefficiencies. Predicting these failures before they occur using machine learning allows organizations to take proactive measures. The challenge is to analyze real-time sensor data and classify the type of machine failure (e.g., tool wear, heat dissipation, power failure) before it happens..

PROPOSED SOLUTION

- Develop a machine learning model that classifies industrial machinery failures using the dataset provided. The model will process sensor measurements to identify the type of failure (e.g., tool wear, heat dissipation, power failure) rapidly and accurately. This classification will help automate fault detection and assist in predictive maintenance actions, reducing downtime and increasing operational efficiency.

- Key components:

- Data Collection: Use the Kaggle dataset on predictive maintenance of machinery
- .Preprocessing: Clean and normalize the dataset.
- Model Training: Train a classification model (e.g., Decision Tree, Random Forest, or SVM).
- 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 maintenance model for industrial machinery. Here's a suggested structure for this section:

- System requirements:

  IBM Cloud (mandatory)

  IBM Watson studio for model development and deployment

  IBM cloud object storage for dataset handling

ALGORITHM & DEPLOYMENT

- **Algorithm Selection:**

  Random Forest Classifier (or Logistic Regression based on performance)

- Data Input:

  Air temperature, process temperature, rotational speed, torque, and tool wear measurements from the dataset

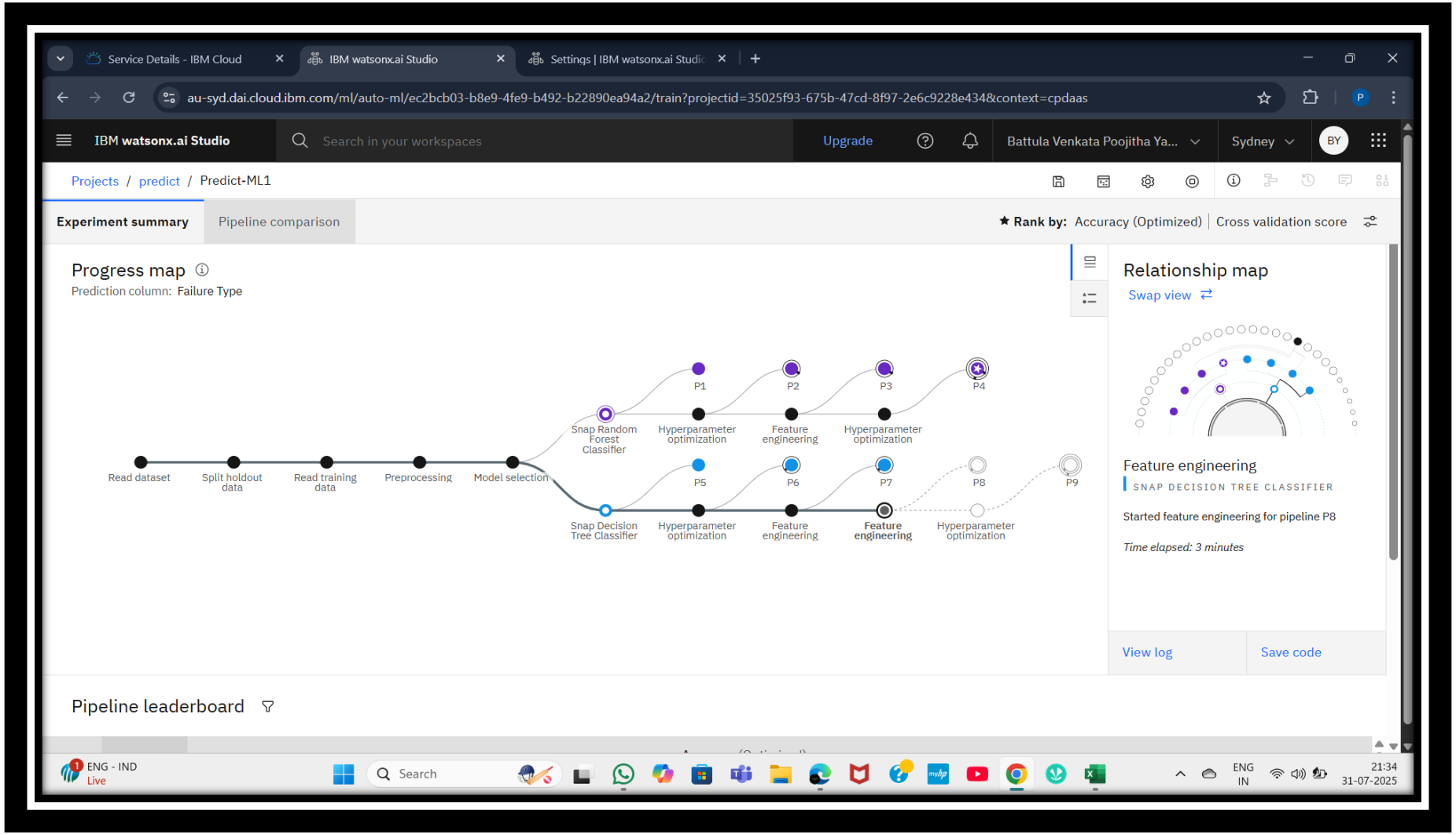
- Training Process:

  Supervised learning using labeled machine failure types (e.g., heat dissipation, power failure, tool wear)

- Prediction Process:

  Model deployed on IBM Watson Studio with API endpoint for real-time machine failure predictions

RESULT



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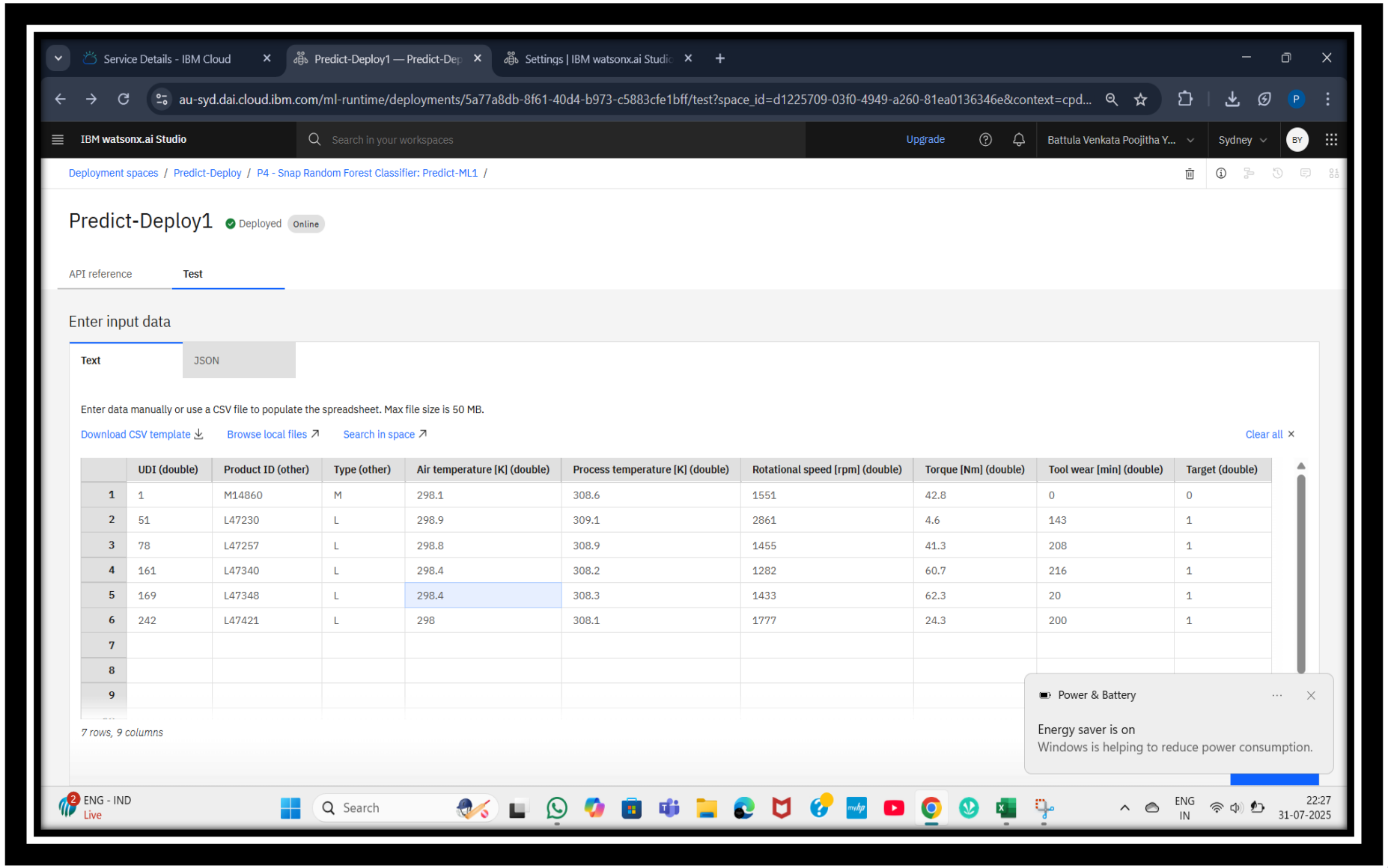

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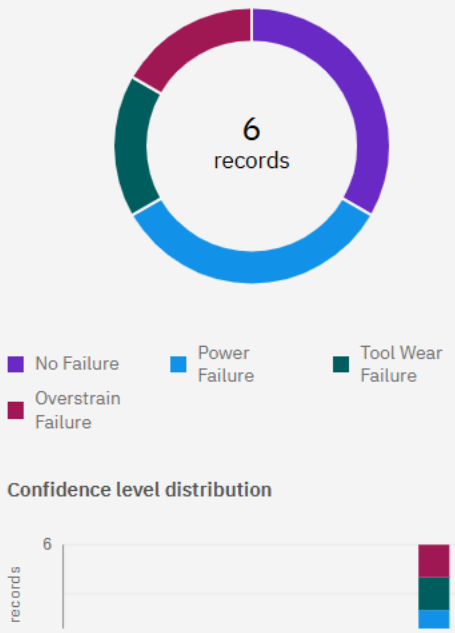
Prediction results

Close

Prediction type

Multiclass classification

Prediction percentage



Confidence level distribution

Display format for prediction results

(•) Table view ( ) JSON view

Show input data

	Prediction	Confidence
1	No Failure	100%
2	Power Failure	100%
3	Tool Wear Failure	100%
4	Overstrain Failure	96%
5	Power Failure	100%
6	No Failure	100%
7		
8		
9		
10		
11		
12		
13		
14		
15		

Download JSON file

CONCLUSION

- This project developed a machine learning model to predict industrial machinery failures in advance using real-time sensor data. The Random Forest algorithm provided accurate classification of different failure types, such as tool wear and power failure. The system enables industries to reduce downtime, improve maintenance planning, and lower operational costs. Although challenges like data preprocessing and feature selection were encountered, the overall solution proved to be effective, practical, and valuable for real-world industrial applications.

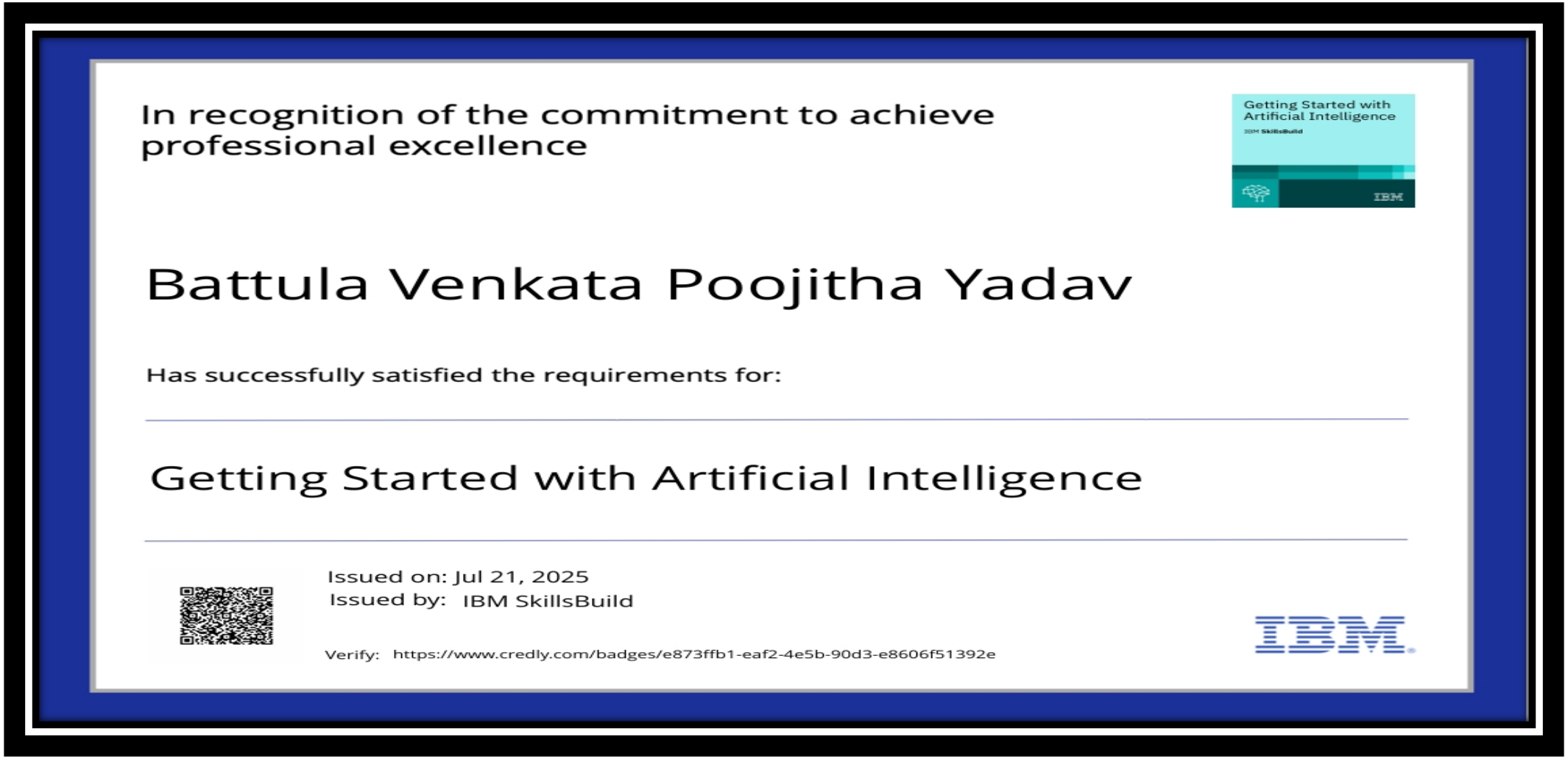
FUTURE SCOPE

- In the future, this project can be connected with real-time IoT sensors to make live predictions on machines.
- More advanced models like XGBoost or deep learning can be tested to improve the accuracy even more
- .We can also try to predict not just the failure type, but how soon the failure might happen.
- The system can be used in different factories and for various machines, not just the ones in this dataset.
- A simple dashboard or app can be created so that operators can easily see alerts and plan maintenance.

REFERENCES

- Kaggle dataset on predictive maintenance of industrial machinery
- IBM Cloud documentation for Watson Studio and Machine Learning
- scikit-learn library for model building and evaluation
- Online tutorials and articles on predictive maintenance techniques
- Research materials on failure classification using sensor data

IBM CERTIFICATIONS



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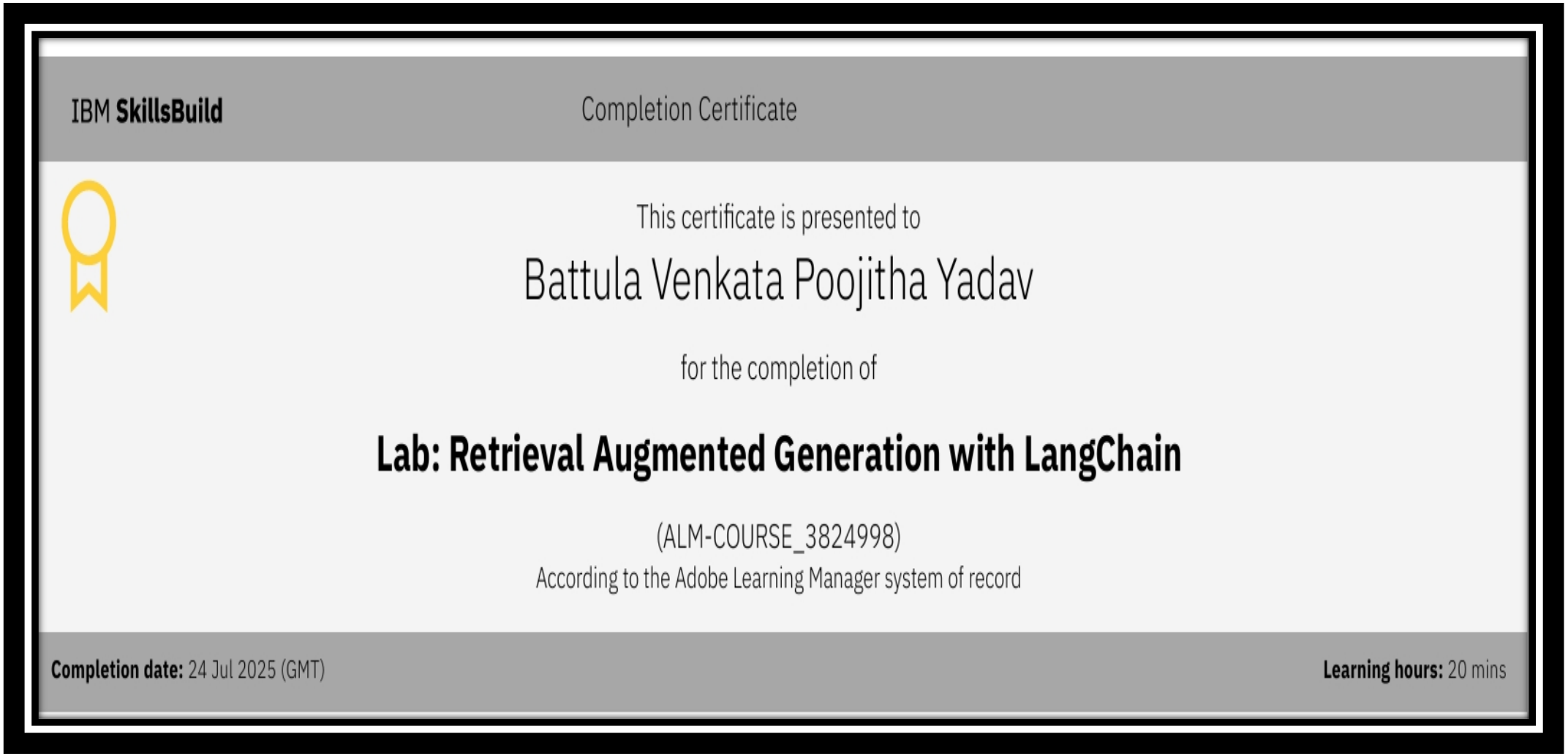

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