CAPSTONE PROJECT

POWER SYSTEM FAULT DETECTION AND CLASSIFICATION

Presented By:

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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

Power distribution system are prone to various types of faults such as line-to-ground, line-to-line, three-phase fault. These fault can disrupts power supply and reduce system reliability . The challenge lies in accurately detecting and classifying these faults using electrical measurement data (voltage , current , phasors) to differentiate them from normal operating conditions, thereby ensuring the stability of the power grid .

PROPOSED SOLUTION

Develop a machine learning model that classifies power system faults using the dataset provided. The model will process electrical measurements to identify the type of fault rapidly and accurately. This classification will help automate fault detection and assist in quicker recovery actions, ensuring system reliability.Key components:Data Collection: Use the Kaggle dataset on power system faults.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 power system fault detection and classification. Here's a suggested structure for this section:

System requirements:

IBM Cloud(mandatory)IBM Watson studio for model development and deploymentIBM cloud object storage for dataset handling

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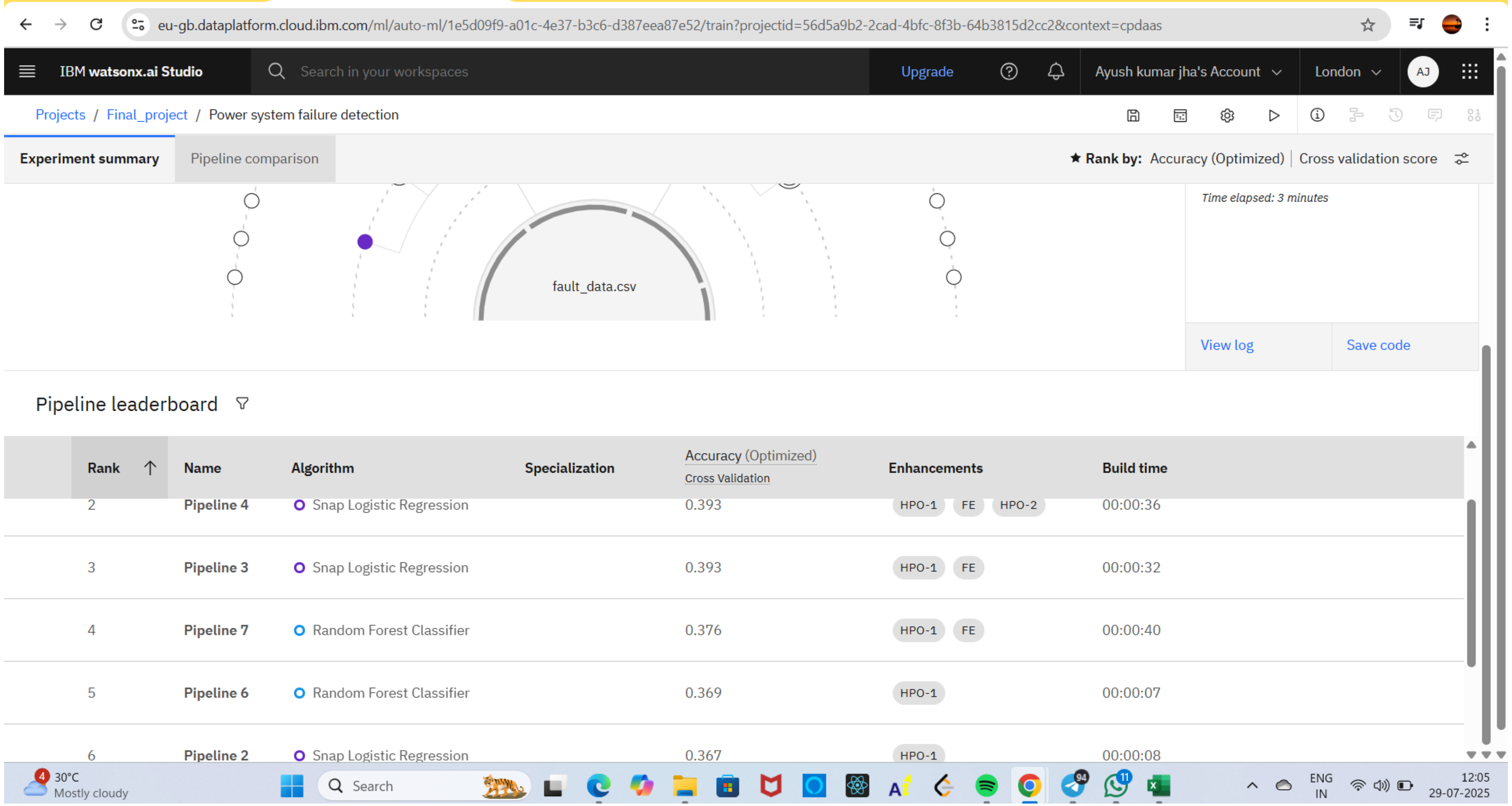
ALGORITHM & DEPLOYMENT

- Algorithm Selection
- Random Forest Classifier (or SVM based on performance)
- Data Input– Voltage, current, and phasor measurements from the dataset
- Training Process:– Supervised learning using labeled fault types
- Prediction Process: – Model deployed on IBM Watson Studio with API endpoint for real-time predictions

RESULT



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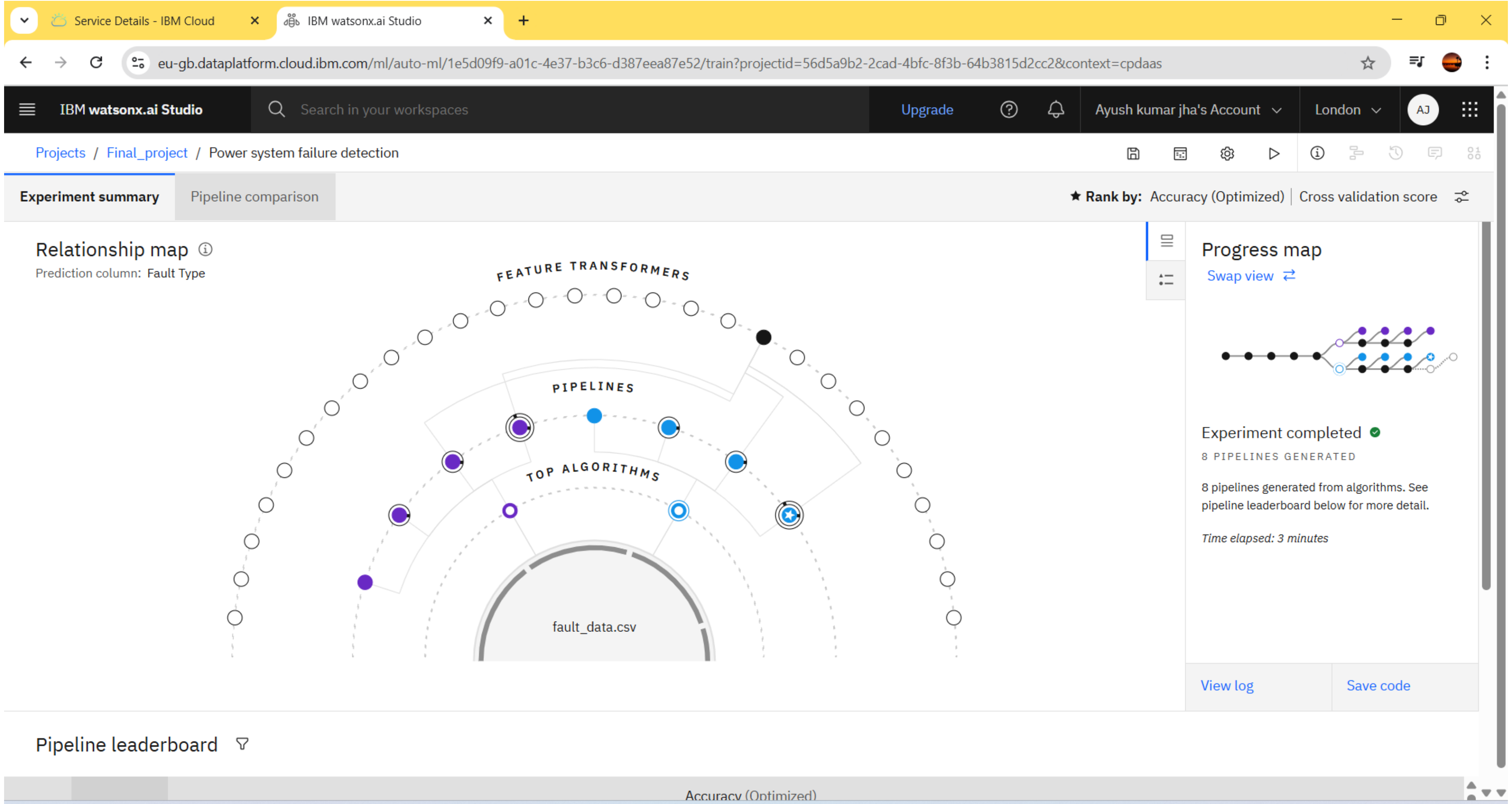
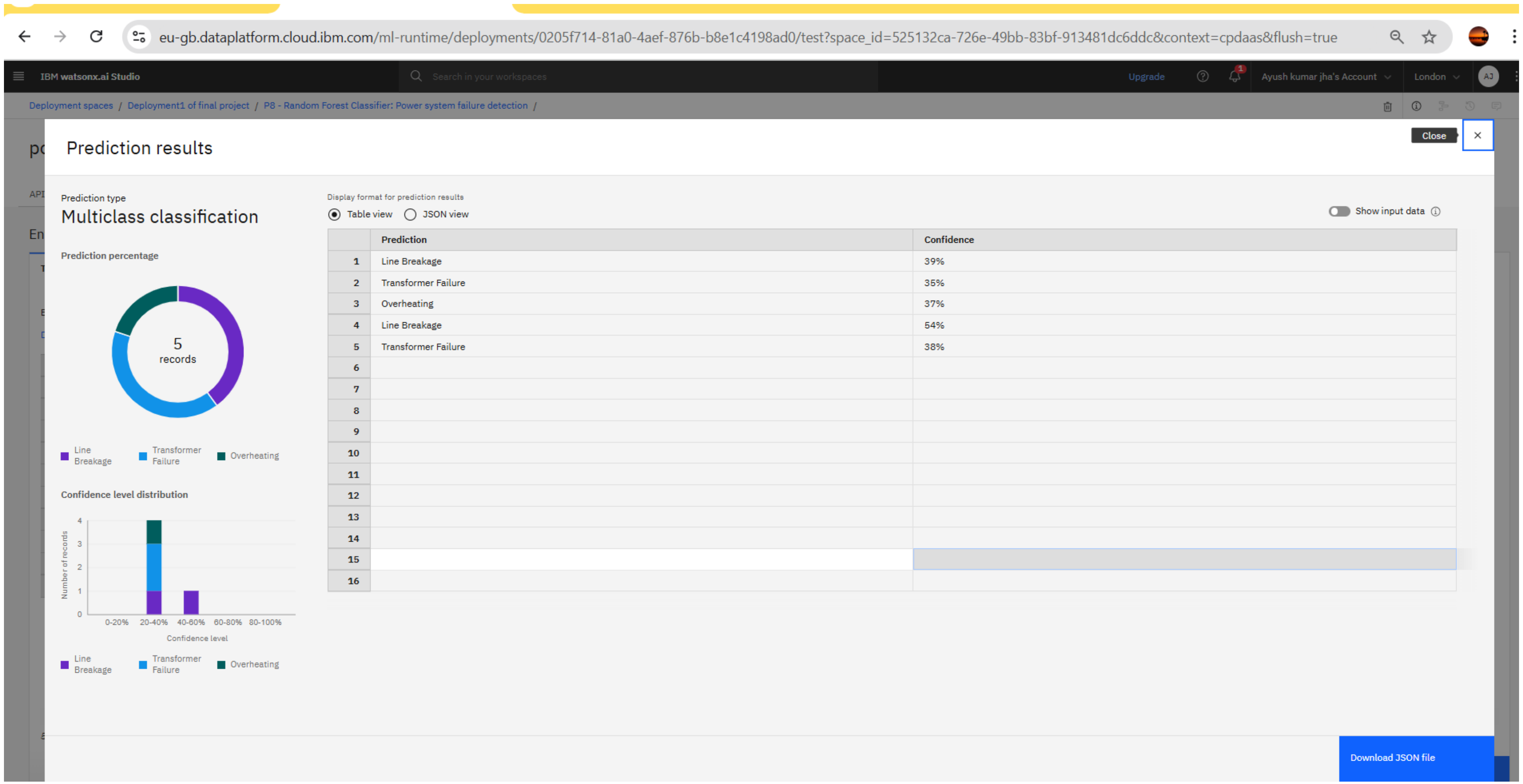
RESULT



Service Details - IBM Cloud
IBM watsonx.ai Studio
eu-gb.dataplatform.cloud.ibm.com/ml/auto-ml/1e5d09f9-a01c-4e37-b3c6-d387eea87e52/train?projectid=56d5a9b2-2cad-4bfc-8f3b-64b3815d2cc2&context=cpdaas
IBM watsonx.ai Studio
Search in your workspaces
Upgrade
Ayush kumar jha's Account
London
AJ
Projects / Final_project / Power system failure detection
Experiment summary
Pipeline comparison
Rank by: Accuracy (Optimized) | Cross validation score
Relationship map
Prediction column: Fault Type
FEATURE TRANSFORMERS
PIPELINES
TOP ALGORITHMS
fault_data.csv
Progress map
Swap view
Experiment completed
8 PIPELINES GENERATED
8 pipelines generated from algorithms. See pipeline leaderboard below for more detail.
Time elapsed: 3 minutes
View log
Save code
Pipeline leaderboard
Accuracy (Optimized)

RESULT



	Prediction	Confidence
1	Line Breakage	39%
2	Transformer Failure	35%
3	Overheating	37%
4	Line Breakage	54%
5	Transformer Failure	38%
6		
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16		

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CONCLUSION

- In this project, a machine learning-based approach was successfully designed and implemented to detect and classify various types of faults in a power distribution system using electrical measurement data such as voltage and current phasors. The developed model effectively distinguished between normal operating conditions and critical fault types, including line-to-ground, line-to-line, and three-phase faults. By leveraging the pattern recognition capabilities of machine learning, the system demonstrated high accuracy, fast response time, and adaptability to complex fault scenarios.
- This intelligent fault detection framework contributes significantly to enhancing the stability, reliability, and safety of the power grid. It enables real-time fault diagnosis, supports faster isolation and restoration actions, and ultimately reduces system downtime and damage. The results indicate that data-driven solutions can complement traditional protection mechanisms and pave the way for smarter and more resilient electrical networks.

FUTURE SCOPE

- The proposed machine learning model for fault detection and classification in power distribution systems opens several promising avenues for future development and research:
- Integration with Real-Time Monitoring Systems:
  - The model can be integrated with SCADA and smart grid infrastructure for real-time fault monitoring, enabling faster and automated response to disturbances.
- Expansion to Complex Grid Architectures:
  - Future enhancements could involve adapting the model to handle more complex distribution networks, including multi-feeder systems, microgrids, and distributed energy resources (DERs).
- Incorporation of Deep Learning Techniques:
  - Advanced deep learning models like CNNs and RNNs could be employed to improve fault classification accuracy, especially under noisy or incomplete measurement conditions.
- Development of a Hybrid Fault Diagnosis System:
  - Combining machine learning with signal processing techniques (like wavelet transforms) or expert systems can yield a more robust and intelligent hybrid fault detection mechanism.

REFERENCES

- IBM Cloud technology platform.
- Edunet foundation
- Live sessions

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Has successfully satisfied the requirements for:

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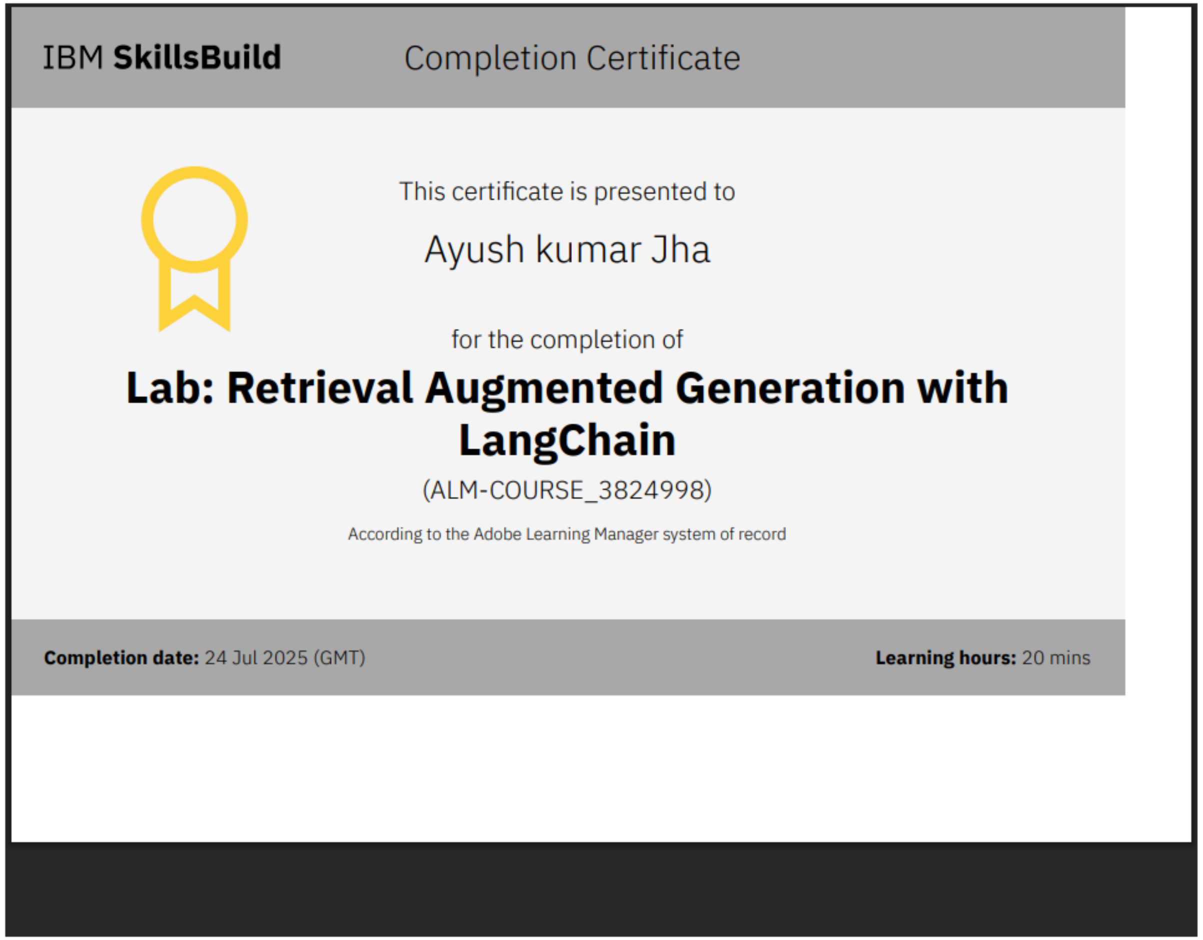
IBM SkillsBuild Completion Certificate

This certificate is presented to

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According to the Adobe Learning Manager system of record

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THANK YOU