# CAPSTONE PROJECT

## POWER SYSTEM FAULT DETECTION AND CLASSIFICATION

**Presented By:**
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# OUTLINE

- **Problem Statement**
- **Proposed System/Solution**
- **System Development Approach** (Technology Used)
- **Algorithm & Deployment**
- **Result (Output Image)**
- **Conclusion**
- **Future Scope**
- **References**

# PROBLEM STATEMENT

Frequent faults in power systems—such as line breakages, short circuits, and overloads—disrupt grid stability, damage equipment, and cause unplanned outages. Rapidly identifying the type of fault from sensor readings is essential to minimize downtime and ensure reliable electricity delivery.

# PROPOSED SOLUTION

**Data Collection:**

Capture historical fault events with features: Voltage (V), Current (A), Power Load (MW), Temperature (°C), Wind Speed (km/h), Fault Duration (hrs), Down Time (hrs), Component Health, Maintenance Status, and GPS Location.

**Automated Model Building:**

Use IBM watsonx.ai Studio’s AutoAI to preprocess data, engineer features, and generate multiple classification pipelines.

**Model Deployment:**

**1.** Promote the best-performing model to a dedicated “fault type” deployment space in Watsonx.ai Runtime.

**2.** Expose a REST API for real-time fault type predictions.

# SYSTEM APPROACH

**IBM Cloud Services:**

1. watsonx.ai Studio (no-code AutoAI experiments)
2. watsonx.ai Runtime (model serving)
3. Cloud Object Storage (data asset management)

**End-to-end no-code pipeline:**

data upload → AutoAI experiment → model asset creation → deployment space configuration → online endpoint

# ALGORITHM & DEPLOYMENT

1. Launch an AutoAI experiment for multiclass classification on **fault_data.csv .**

2. AutoAI generates 9 pipelines (Random Forest, Logistic Regression, Batched Tree Ensemble, etc.) with hyperparameter optimization and feature engineering.

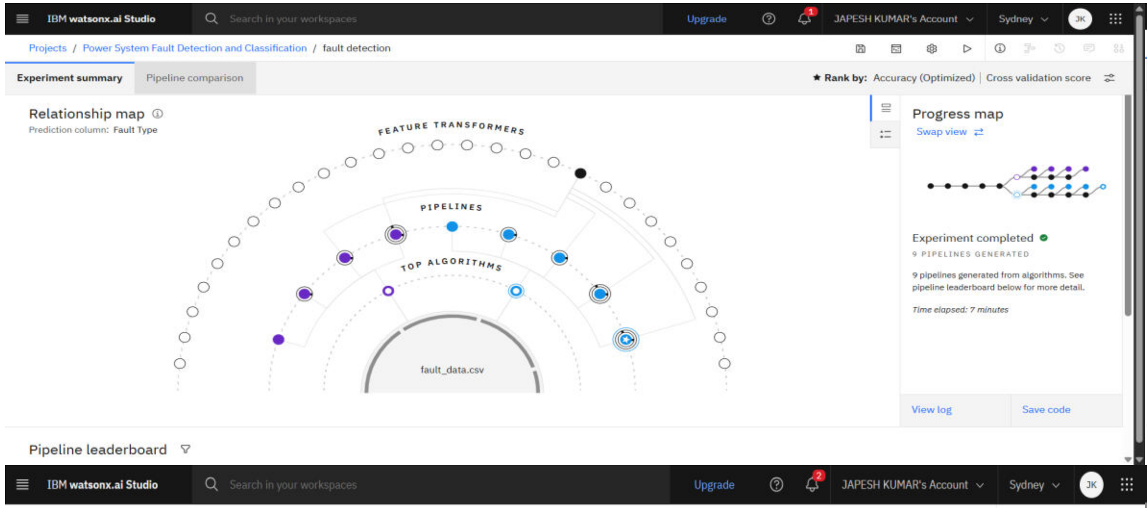
3. Select **Pipeline 9: Batched Tree Ensemble Classifier (Random Forest)** as top performer.

4. Save the pipeline as a Watson Machine Learning model asset.

5. Promote the model asset to the **fault type** deployment space.

6. Create an **online deployment** (fault detect) and obtain REST endpoints for real-time inference.

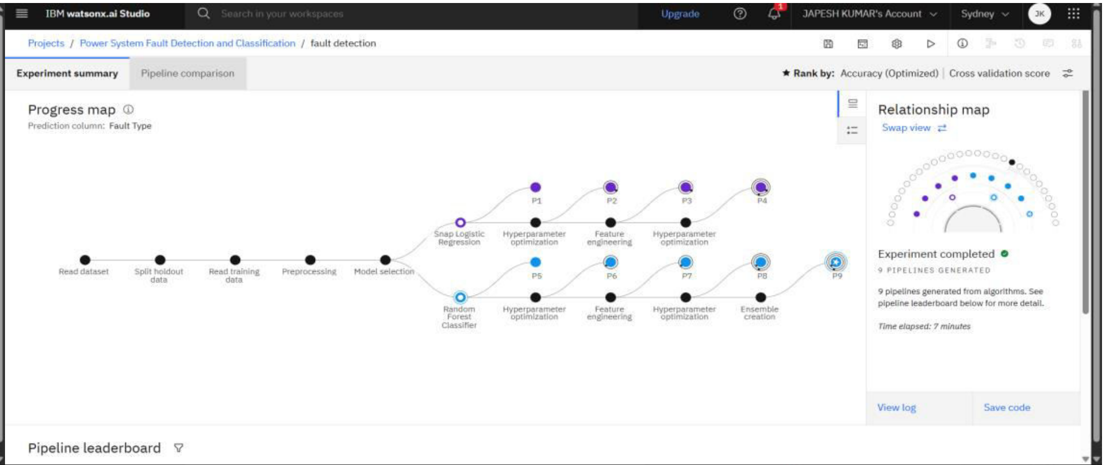
# RESULT



Relationship map
Prediction column: Fault Type

Experiment completed
9 PIPELINES GENERATED
9 pipelines generated from algorithms. See pipeline leaderboard below for more detail.
*Time elapsed: 7 minutes*

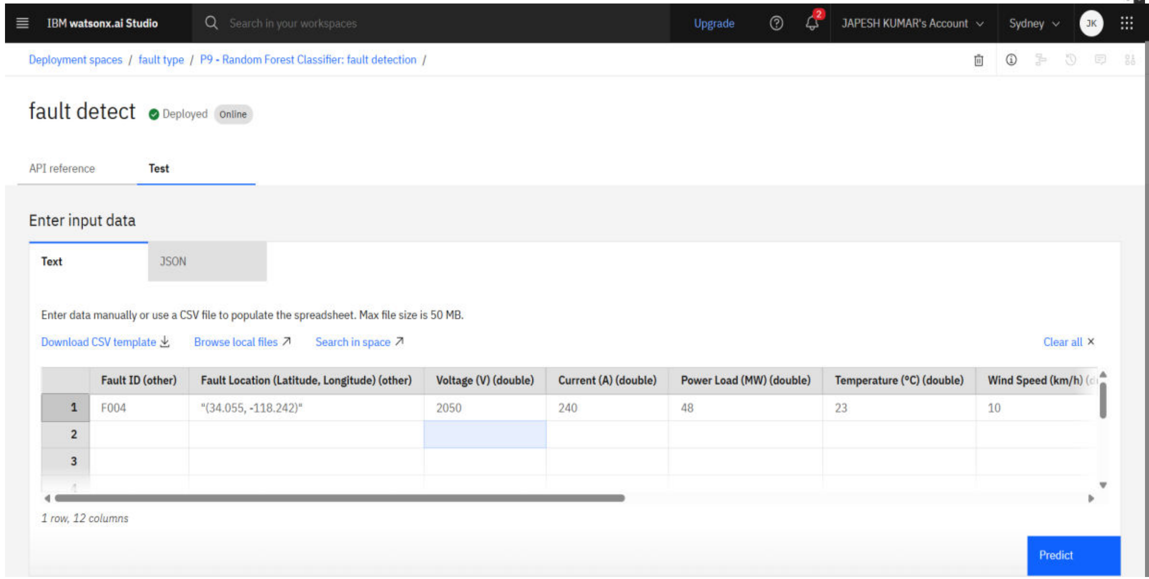
Pipeline leaderboard



Progress map
Prediction column: Fault Type

Experiment completed
9 PIPELINES GENERATED
9 pipelines generated from algorithms. See pipeline leaderboard below for more detail.
*Time elapsed: 7 minutes*

Pipeline leaderboard



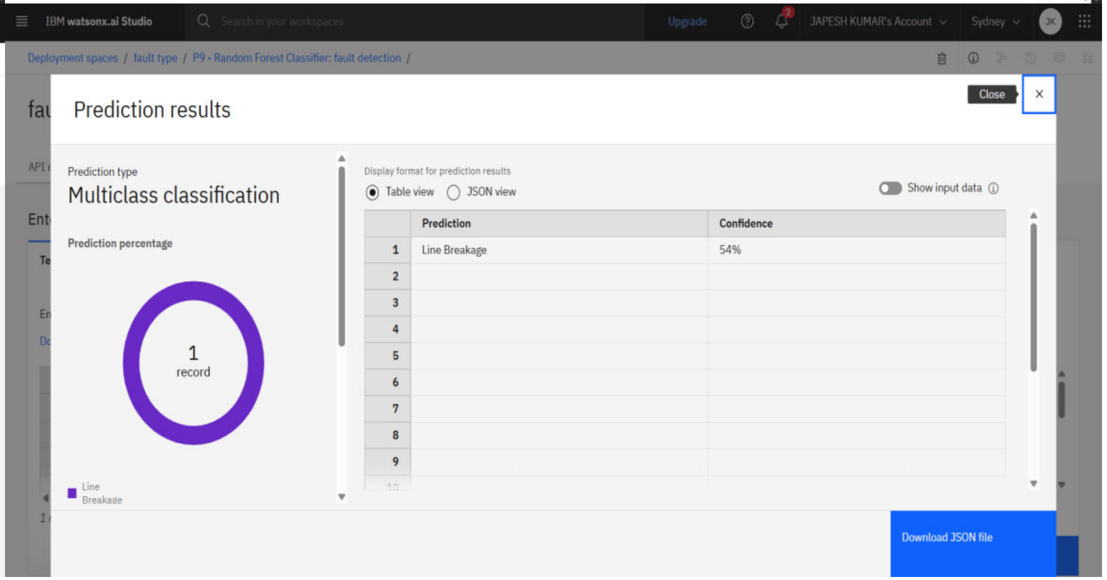
fault detect ● Deployed Online

Enter input data

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

| | Fault ID (other) | Fault Location (Latitude, Longitude) (other) | Voltage (V) (double) | Current (A) (double) | Power Load (MW) (double) | Temperature (°C) (double) | Wind Speed (km/h) (d |
|---|---|---|---|---|---|---|---|
| 1 | F004 | "(34.055, -118.242)" | 2050 | 240 | 48 | 23 | 10 |
| 2 | | | | | | | |
| 3 | | | | | | | |

*1 row, 12 columns*



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Search in your workspaces
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Deployment spaces / fault type / P9 - Random Forest Classifier: fault detection /
Close
×
1
record
Line Breakage
Download JSON file

Prediction results

Prediction type
Multiclass classification

Prediction percentage

Display format for prediction results
● Table view ○ JSON view
Show input data

| | Prediction | Confidence |
|---|---|---|
| 1 | Line Breakage | 54% |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |

**Github link:- https://github.com/JapeshKumarB/Power-System-Fault-Detection-and-Classification.git**

# CONCLUSION

The AutoAI-driven Random Forest classifier automates the end-to-end ML workflow without code and successfully categorizes power system faults. Deployment as an online API demonstrates seamless integration into monitoring systems. While the initial accuracy (~41%) indicates scope for enhancement, the solution lays a robust foundation for rapid, scalable fault classification.

# FUTURE SCOPE

1. Expand the dataset with more fault types and environmental variables.
2. Integrate streaming sensor data for live anomaly detection.
3. Evaluate advanced ensemble and deep-learning models to boost accuracy.
4. Build a React-based dashboard to visualize fault events in real time.
5. Deploy lightweight models on edge devices for substation-level inference.

# REFERENCES

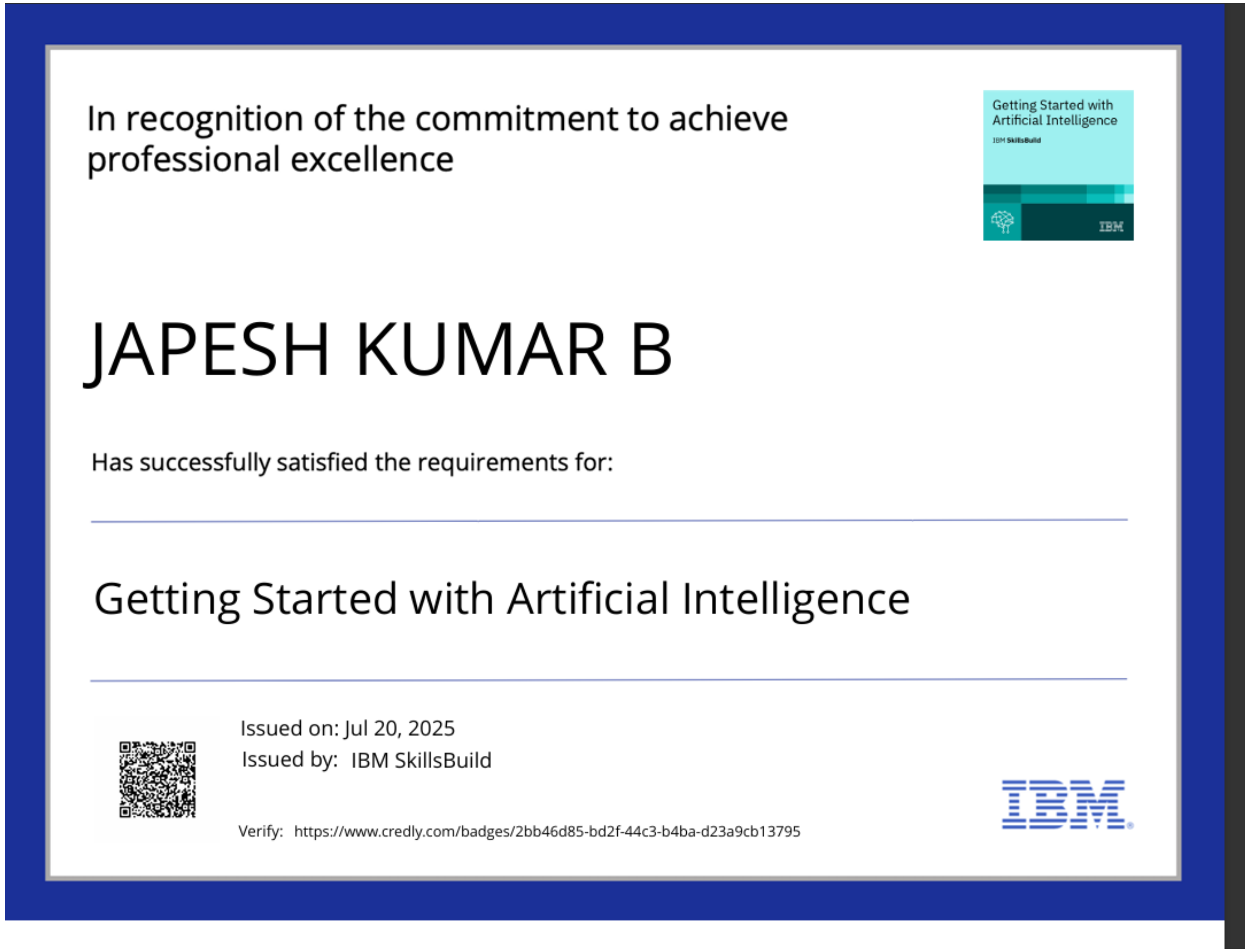
1. Kaggle dataset link – https://www.kaggle.com/datasets/ziya07/power-system-faults-dataset

2. IBM Cloud: https://cloud.ibm.com

3. AutoAI Docs: https://dataplatform.cloud.ibm.com/docs/

4. IBM Watson Machine Learning

# IBM CERTIFICATIONS



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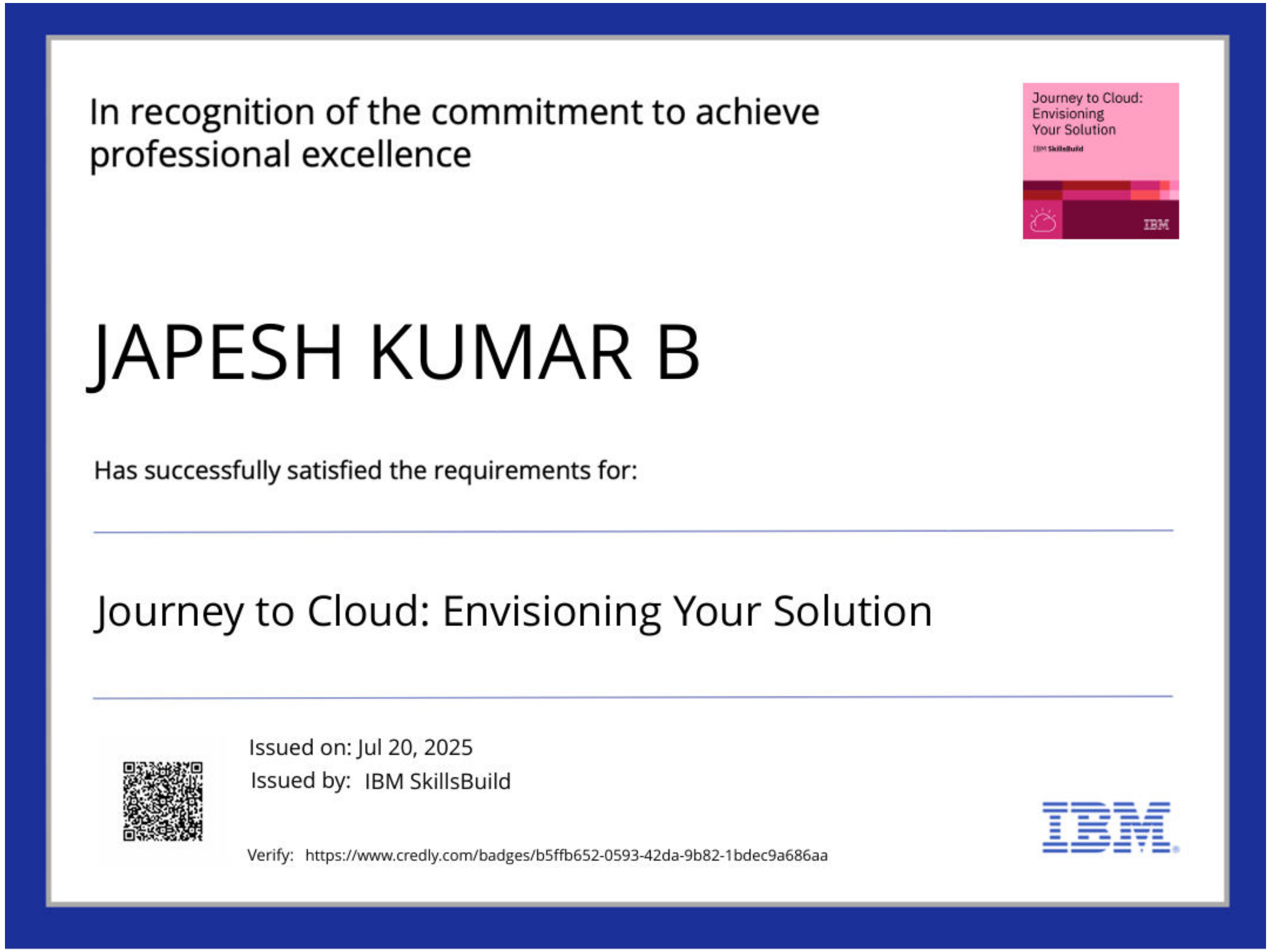

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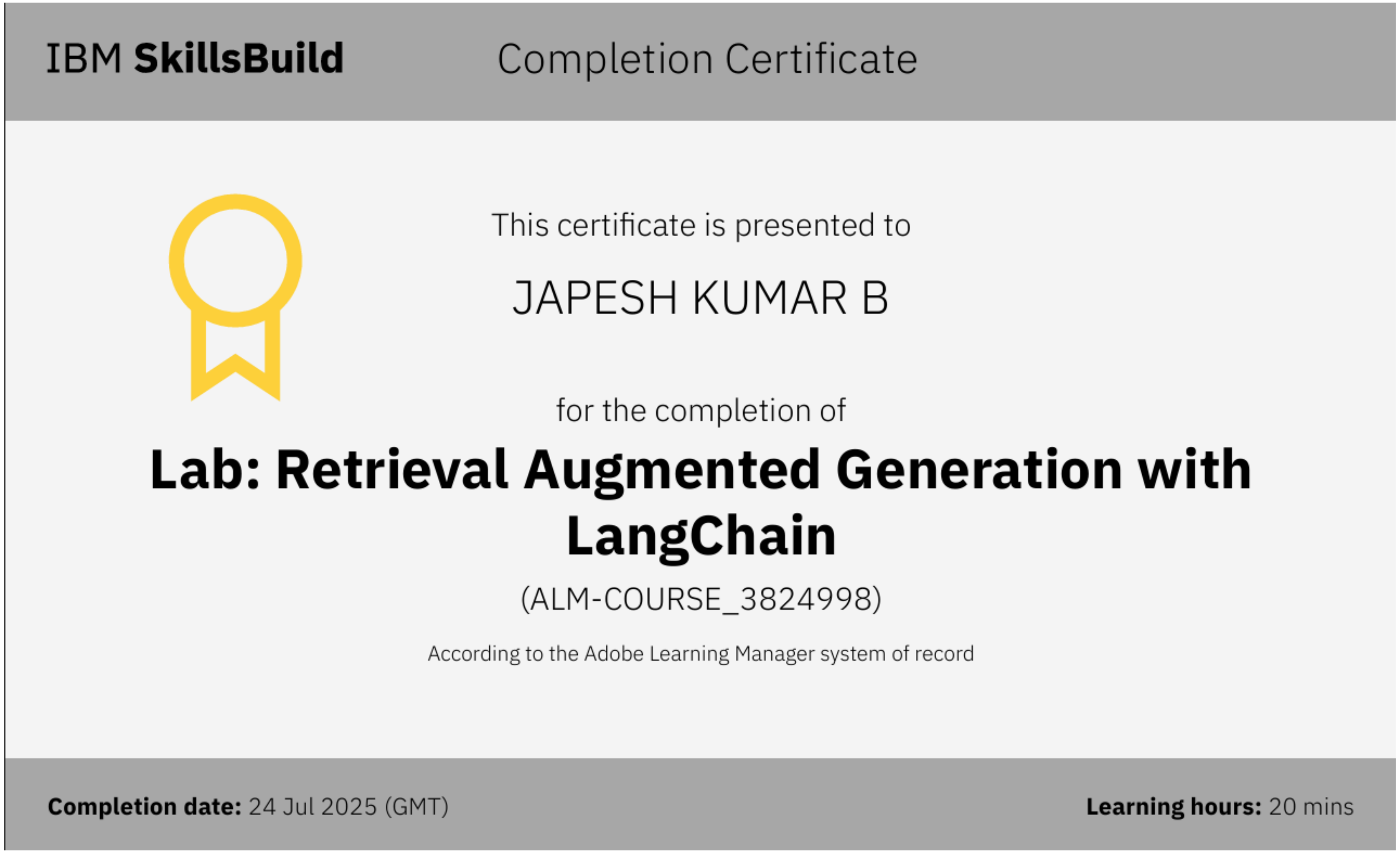

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