# CAPSTONE PROJECT

## POWER SYSTEM FAULT DETECTION AND CLASSIFICATION

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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**

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# PROBLEM STATEMENT

=>Power distribution systems are prone to various types of faults such as line-to-ground, line-to-line, and three-phase faults. These faults can disrupt 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

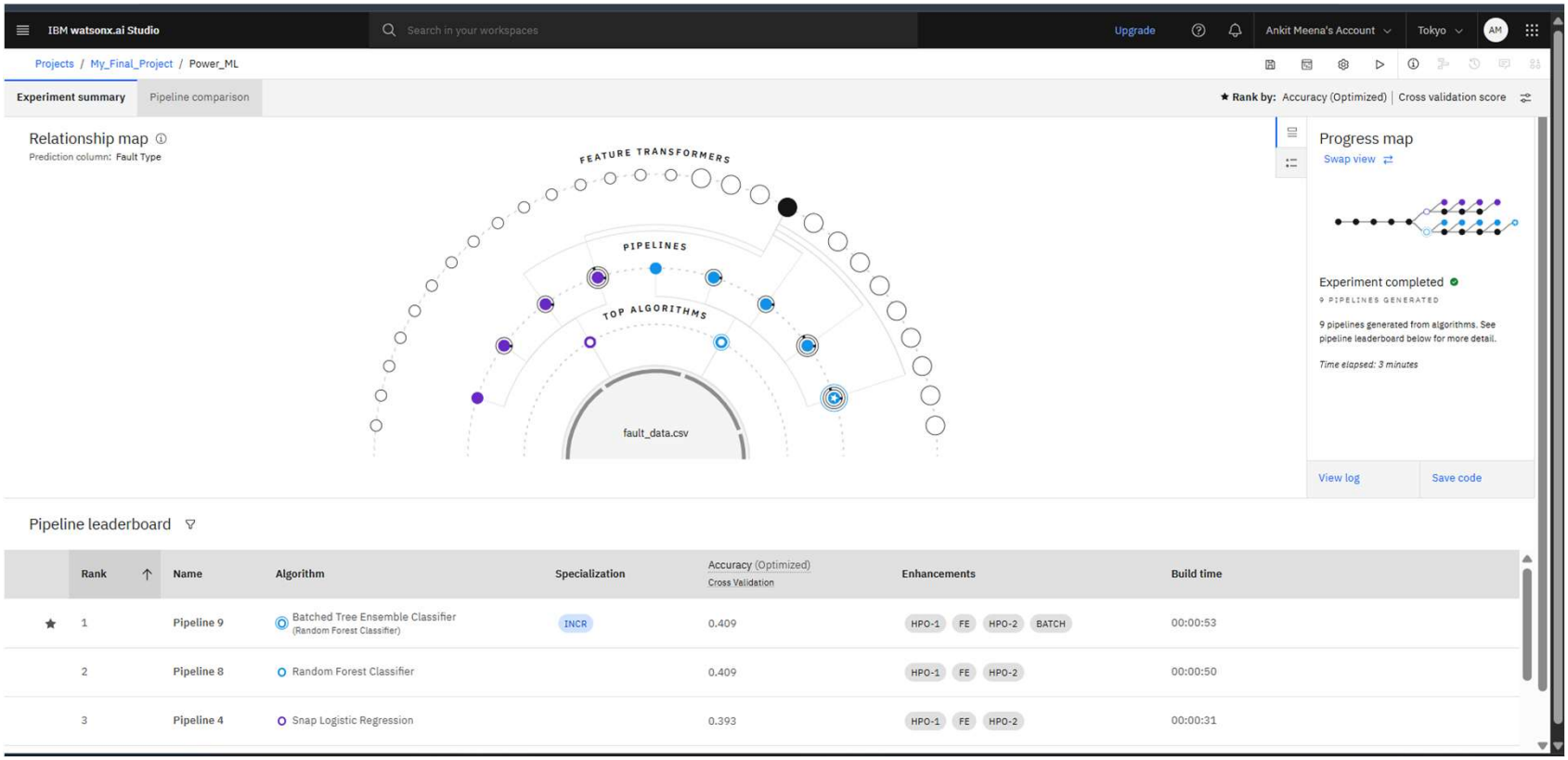
The "System Approach" section outlines the overall strategy and methodology for developing and implementing the rental bike prediction system. Here's a suggested structure for this section:

- System requirements
- => IBM Cloud(mandatory).
- => IBM Watson AI studio for model development and deployment.
- => IBM cloud object storage for dataset handling.

# 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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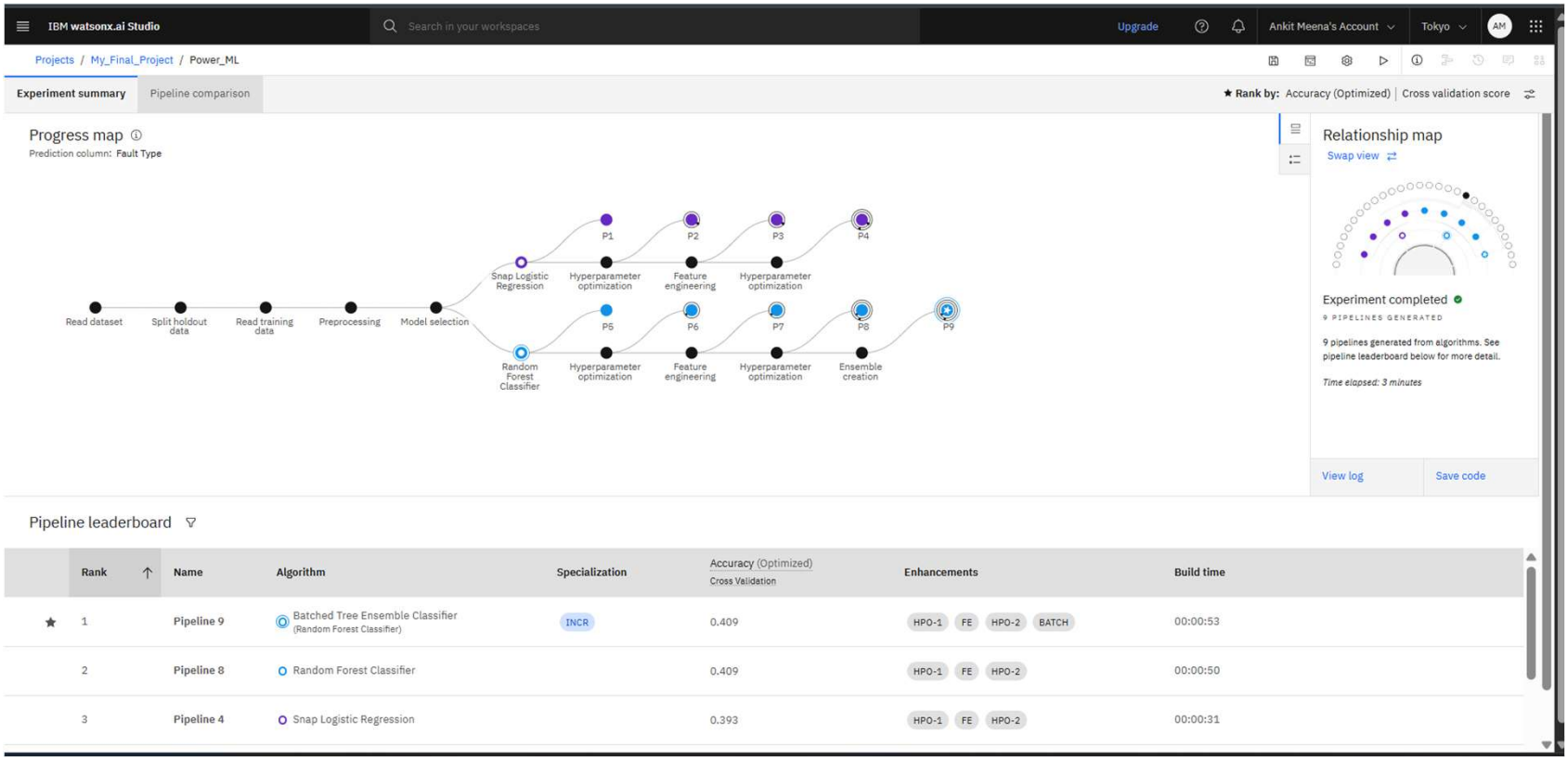
# RESULT

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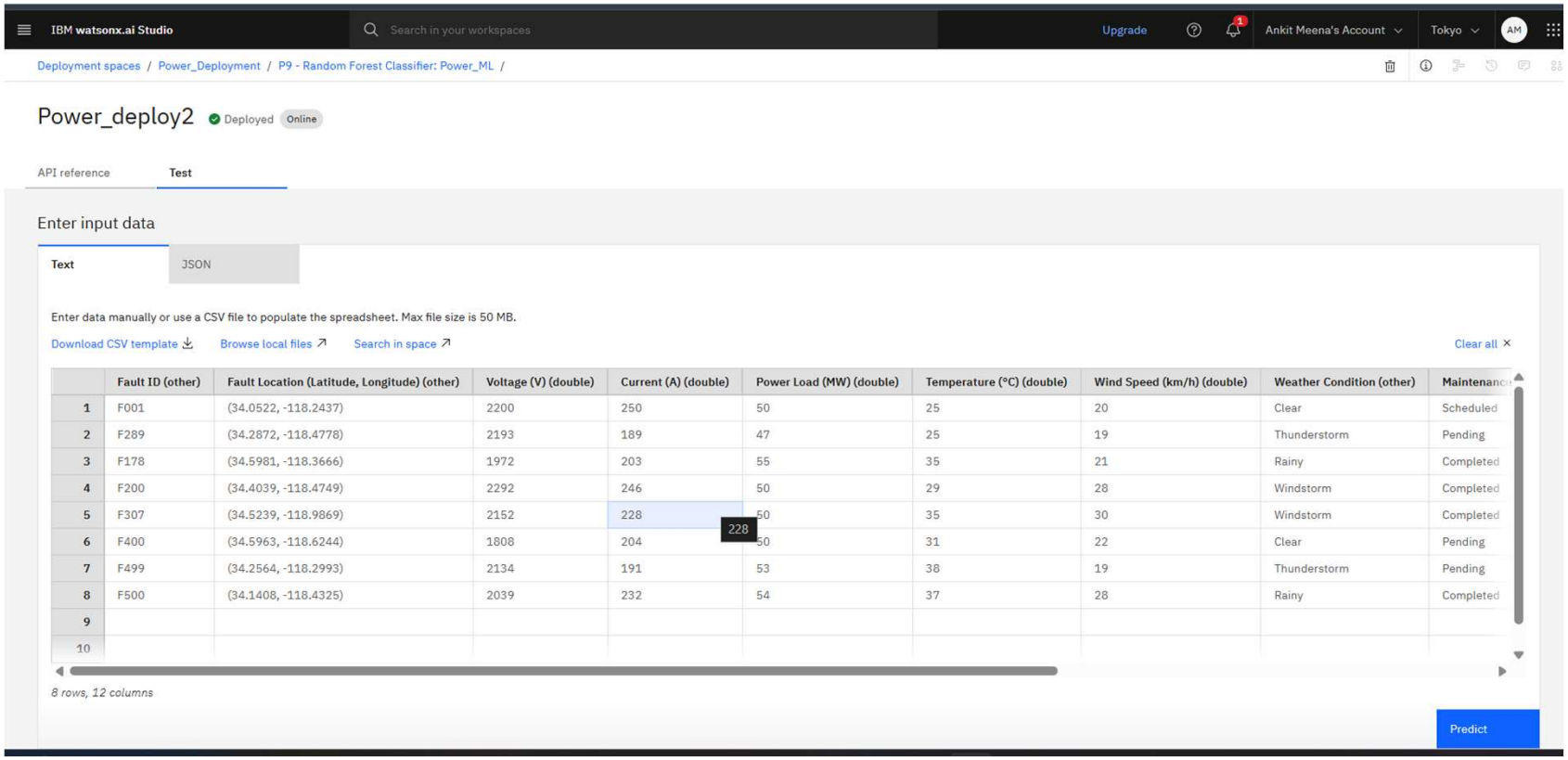
# RESULT




| | 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) (double) | Weather Condition (other) | Maintenanc |
|---|---|---|---|---|---|---|---|---|---|
| 1 | F001 | (34.0522, -118.2437) | 2200 | 250 | 50 | 25 | 20 | Clear | Scheduled |
| 2 | F289 | (34.2872, -118.4778) | 2193 | 189 | 47 | 25 | 19 | Thunderstorm | Pending |
| 3 | F178 | (34.5981, -118.3666) | 1972 | 203 | 55 | 35 | 21 | Rainy | Completed |
| 4 | F200 | (34.4039, -118.4749) | 2292 | 246 | 50 | 29 | 28 | Windstorm | Completed |
| 5 | F307 | (34.5239, -118.9869) | 2152 | 228 | 50 | 35 | 30 | Windstorm | Completed |
| 6 | F400 | (34.5963, -118.6244) | 1808 | 204 | 50 | 31 | 22 | Clear | Pending |
| 7 | F499 | (34.2564, -118.2993) | 2134 | 191 | 53 | 38 | 19 | Thunderstorm | Pending |
| 8 | F500 | (34.1408, -118.4325) | 2039 | 232 | 54 | 37 | 28 | Rainy | Completed |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |

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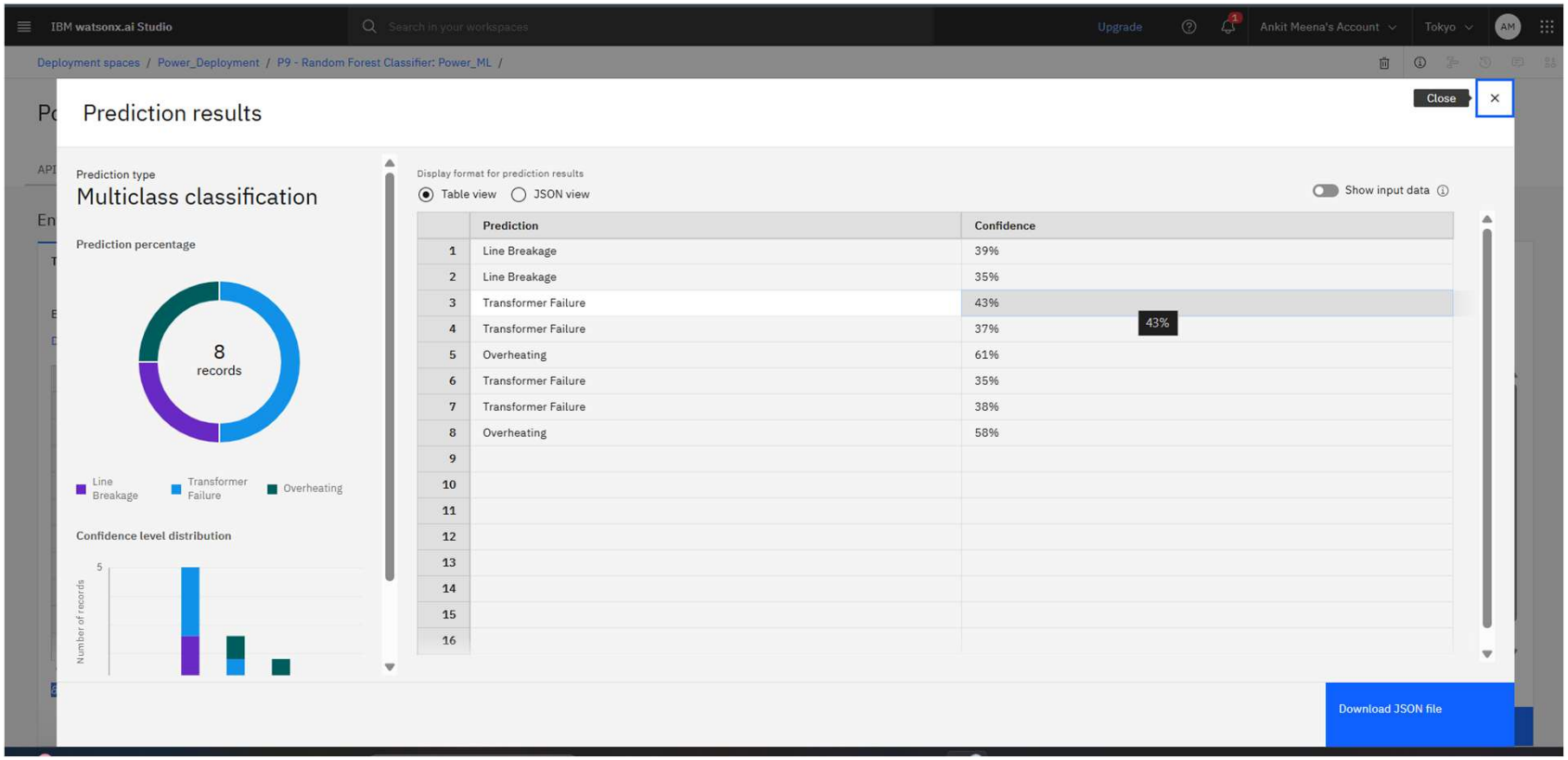
# RESULT

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# CONCLUSION

- The project demonstrates the use of **machine learning** — particularly classifiers like **Random Forest or SVM** — to **detect and classify power system faults** using electrical parameters such as voltage, current, and phasors.
- The ML model was able to distinguish between different types of faults (like line-to-ground, line-to-line, three-phase) with **good accuracy**, aiding in **faster fault identification and system recovery**.
- **IBM Watson Studio** was effectively used for model development and deployment, allowing real-time prediction through an API.
- The solution shows strong potential to **improve grid reliability** by automating fault detection processes.

# FUTURE SCOPE

The future scopes of this project is below -

- Mobile & Cloud-Based Monitoring:
  - Create **cloud APIs** or mobile dashboards for engineers to remotely view fault predictions and take actions.
  - Use platforms like **IBM Cloud, AWS, or Azure** for large-scale deployment.
- 🔐 Fault Prediction + Cybersecurity:
  - Combine fault detection with **grid cybersecurity monitoring** to detect **anomalies caused by cyber attacks** or false data injection.
- 🧠 Hybrid Model Approaches
  - Combine **rule-based logic + ML models** to enhance accuracy and interpretability.
  - Apply **ensemble techniques** (e.g., combining SVM, RF, and XGBoost) to minimize error.

and many more etc.....

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# REFERENCES

- IBM Watson Studio Documentation
  - 📌 *(Used as the platform for model training, evaluation, and deployment.)*
  - 🔗 https://www.ibm.com/docs/en/watson-studio
- And many mores

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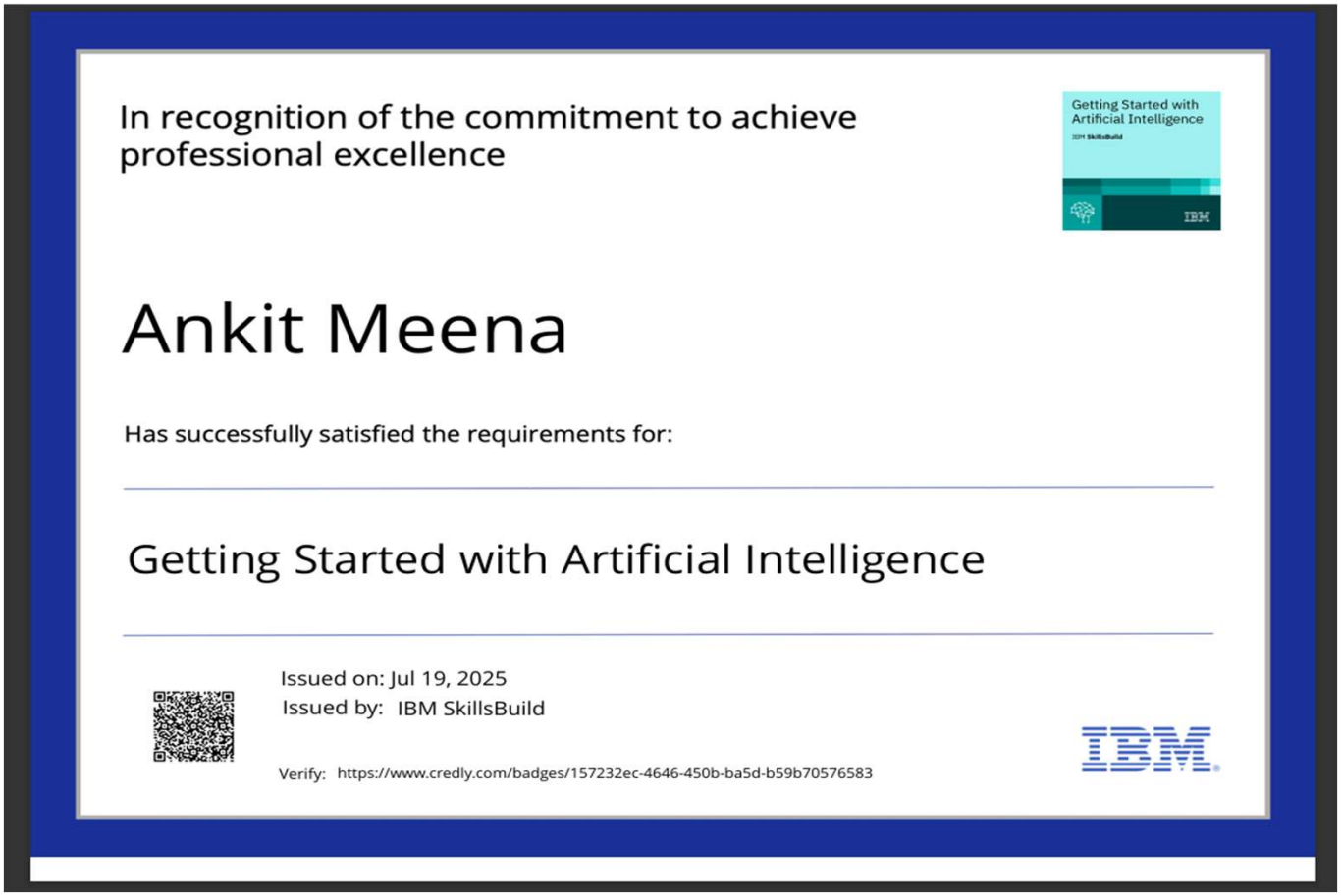
# IBM CERTIFICATIONS



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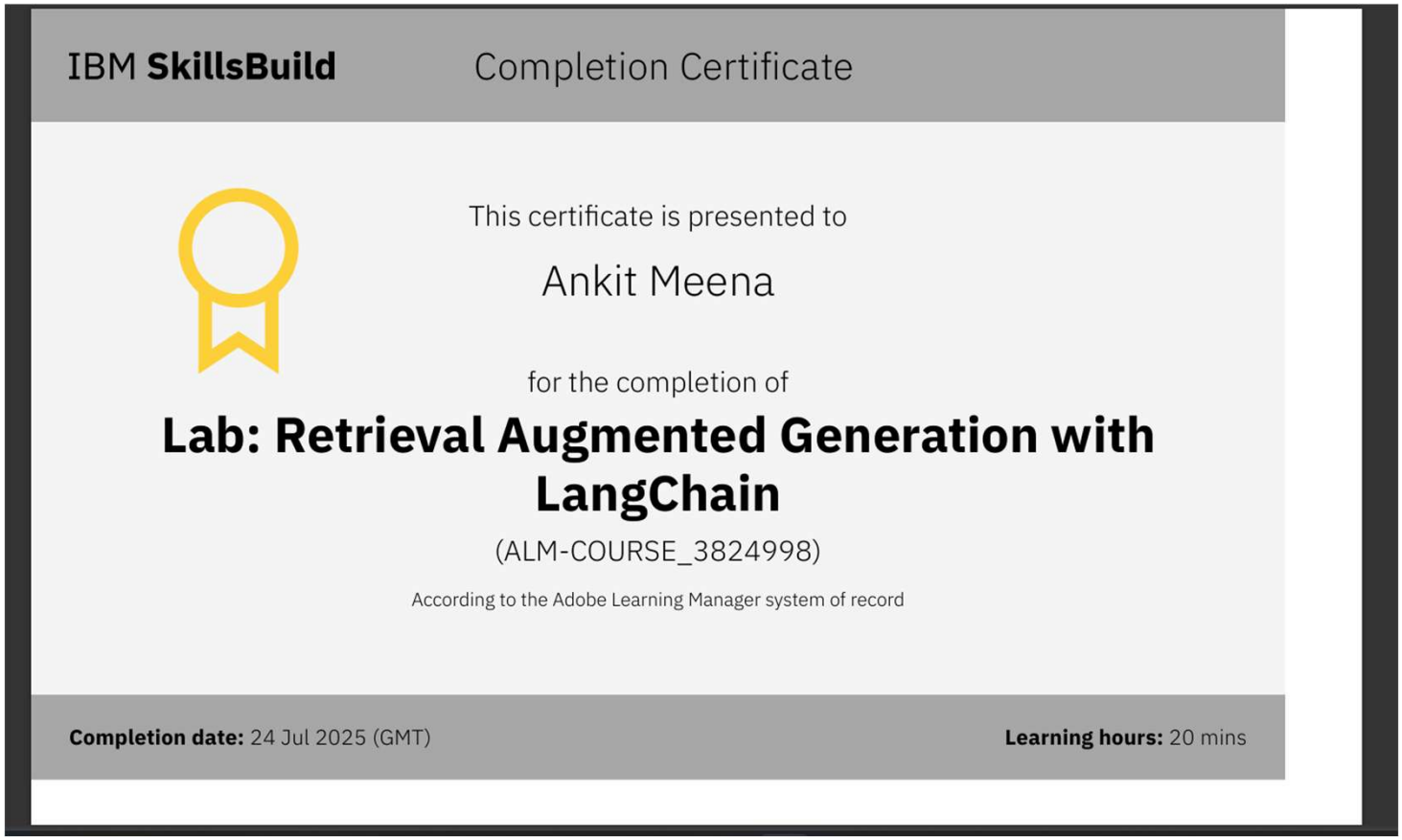

IBM **SkillsBuild** Completion Certificate

This certificate is presented to

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# THANK YOU

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