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**

PROBLEM STATEMENT

Design a machine learning model to detect and classify different types of faults in a power distribution system. Using electrical measurement data (e.g., voltage and current phasors), the model should be able to distinguish between normal operating conditions and various fault conditions (such as line-to-ground, line-to-line, or three-phase faults). The objective is to enable rapid and accurate fault identification, which is crucial for maintaining power grid stability and reliability.

PROPOSED SOLUTION

- The proposed system aims to address the challenge of predicting the required bike count at each hour to ensure a stable supply of rental bikes. This involves leveraging data analytics and machine learning techniques to forecast demand patterns accurately. The solution will consist of the following components:
- Data Collection:
  - Gather historical data Voltage , Current , Power Load and other relevant factors.
  - Utilize real-time data sources, such as Temperature , weather conditions, Component Health, Duration of Fault and Down Time, to enhance prediction accuracy.
- Data Preprocessing:
  - Clean and preprocess the collected data to handle missing values, outliers, and inconsistencies.
  - Feature engineering to extract relevant features from the data that might impact bike demand.
- Machine Learning Algorithm:
  - Implement a machine learning algorithm, such as a time-series forecasting model (e.g., ARIMA, SARIMA, or LSTM), to predict fault detection based on historical patterns.
  - Consider incorporating other factors like weather conditions , Component Health, and special events to improve prediction accuracy.
- Deployment:
  - Develop a user-friendly interface or application that provides real-time predictions for type of fault detection.
  - Deploy the solution on a scalable and reliable platform, considering factors like server infrastructure, response time, and user accessibility.
- Evaluation:
  - Assess the model's performance using appropriate metrics such as Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), or other relevant metrics.
  - Fine-tune the model based on feedback and continuous monitoring of prediction accuracy.
  - Result:

SYSTEM APPROACH

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

- System requirements:
- HP Probook Laptop (16 GB ram + 512 GB hard disk)
- IBM Cloud

Hardware configuration	2 vCPU and 8 GB RAM

- Library required to build the model
- Watsonx.ai studio
- Python
- Tensorflow
- Pytorch

ALGORITHM & DEPLOYMENT

Algorithm Selection:

- Algorithm like Snap Logisitic regression Decision Tree Classifier, Random Forest classifier and its selection based on the accuracy , In comparison of snap random forest classifier Gives 0.4% more accuracy so on this basis selection done and data characteristics.

- Data Input:
  - the input features used by the algorithm, such as historical data Voltage , Current , Power Load ,weather conditions, Temperature ,Wind Speed ,Weather , Maintenance Status , Component Health .Duration of Fault , Down Time .

- Training Process:
  - the algorithm is trained using historical data by using Machine learning . Splitting the historical data into training and test data and for more accuracy and specific consideration using cross validation techniques.

- Prediction Process:
  - the trained algorithm makes predictions for the fault type by using metrics like Root mean squared error and also by cost function and log loss by comparing actual value with predicted value it gives output. The real-time data inputs considered during the Predict are Weather condition and Component Health.

RESULT

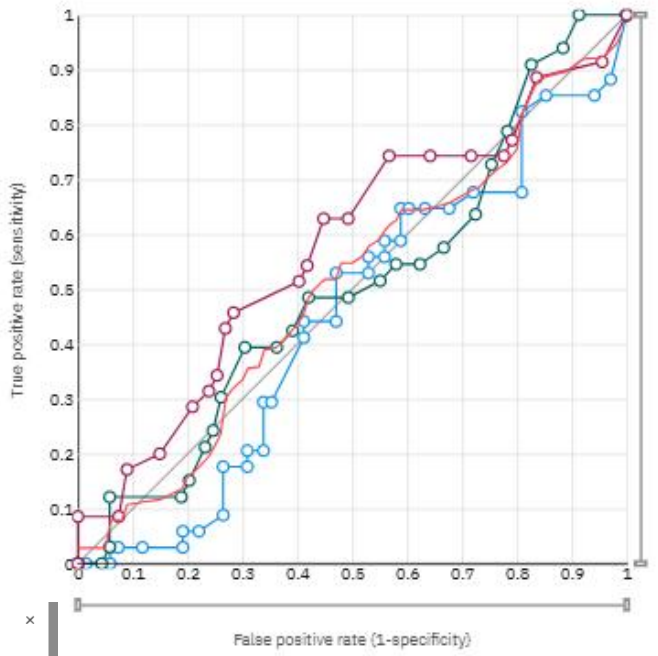
Enter input data

Text | JSON

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

Download CSV template | Browse local files | Search in space | Clear all

	er)	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)	Maintenance Status (other)	Component Health (other)	Duration of Fault (hrs) (double)	Down time (hrs) (doubl
1			2155	240	45	21	29	RAINY	PENDING	OVERHEATING	3.2	4.7
2			2065	199	55	25	21	CLEAR	SCHEDULED	NORMAL	4	2.8
3			2118	221	45	20	20	CLEAR	COMPLETE	NORMAL	4.9	1.9
4			2106	247	47	25	13	CLEAR	COMPLETE	NORMAL	2.4	6.9
5			2012	248	52	24	29	CLEAR	COMPLETE	FAULTY	3.9	6.4
6												
7												
8												
9												
10												



Prediction results

Display format for prediction results

Table view | JSON view

Show input data

	prediction	probability	Fault ID	Fault Location (Latitude, Lo	Voltage (V)	Current (A)	Power Load (MW)	Temperature (°C)	Wind Speed (km/h)	Weather Condition	Maintenance Status	Component Health
1	Line Breakage	[0.408823529630899...			2155	240	45	21	29	RAINY	PENDING	OVERHEATING
2	Line Breakage	[0.548260068893432...			2065	199	55	25	21	CLEAR	SCHEDULED	NORMAL
3	Overheating	[0.116230937093496...			2118	221	45	20	20	CLEAR	COMPLETE	NORMAL
4	Line Breakage	[0.45,0.30000000000...			2106	247	47	25	13	CLEAR	COMPLETE	NORMAL
5	Line Breakage	[0.487980771064758...			2012	248	52	24	29	CLEAR	COMPLETE	FAULTY
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CONCLUSION

In this solution ,We predict fault type by IBM CLOUD Tools , the solution is effective because from 10 output , 8-9 are absolutely correct . There was a challenge in this project that when I build this model at default training-test ratio 0f 90-10 , then this is little inaccurate but when I shift it to 80-20 ratio and increase no of algorithm for test than it predicted nice value. This Fault detection is important in electrical field because it saves the time , save cost and give overview of problem.

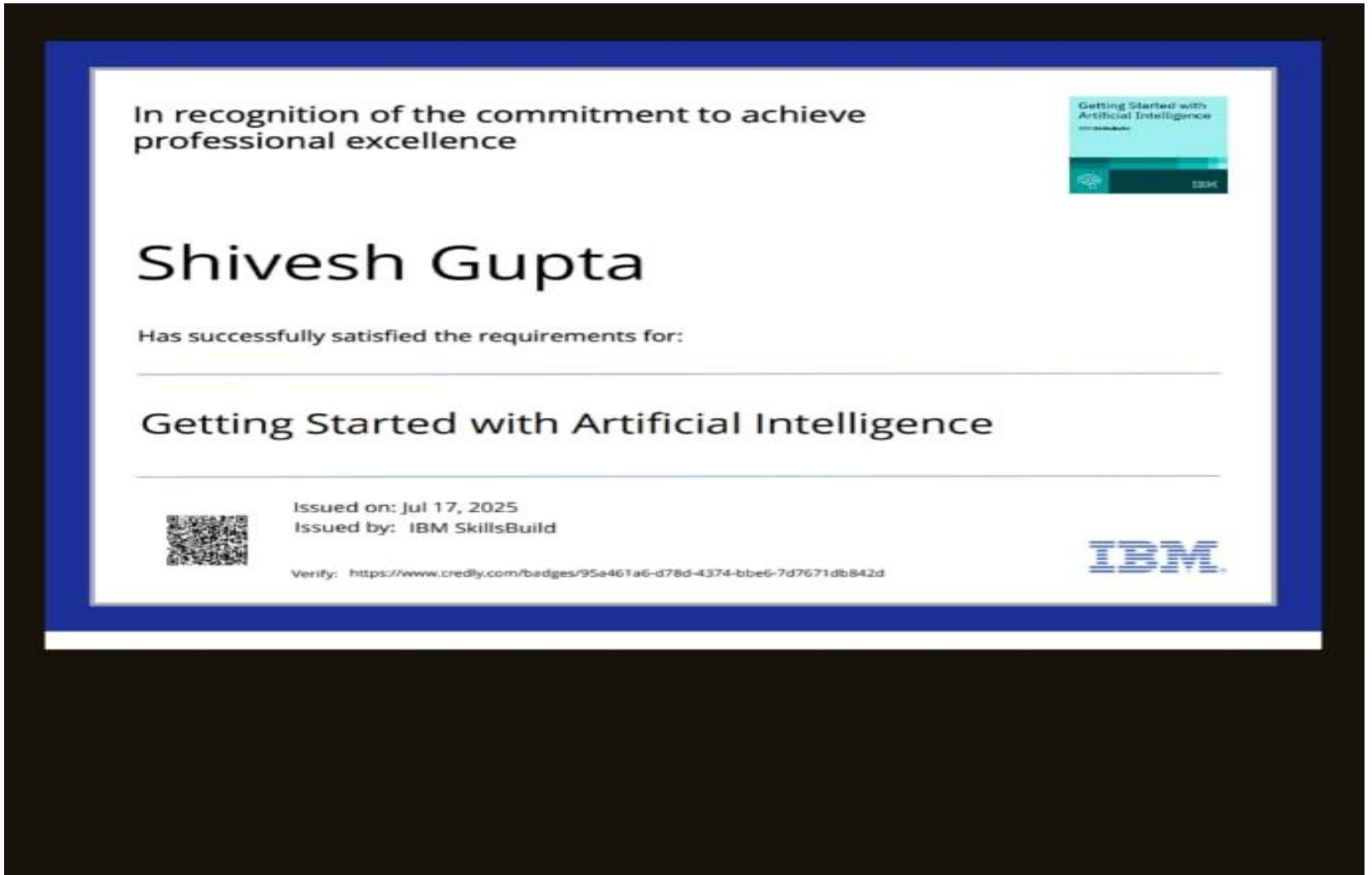
FUTURE SCOPE

- In future , I think that this type of model help in minutes to resolve the maintenance problem in many energy sectors.
- Also With increase of new algorithm or by also using image input in its prediction with history or recent data will be helpful in increasing accuracy of prediction.

REFERENCES

- IBM Skill Build Team Resources
- IBM Cloud
- Watsonx.ai Studio
- Kaggle Docs for Excel Data Sheet of Fault Detection.

IBM CERTIFICATIONS



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IBM CERTIFICATIONS

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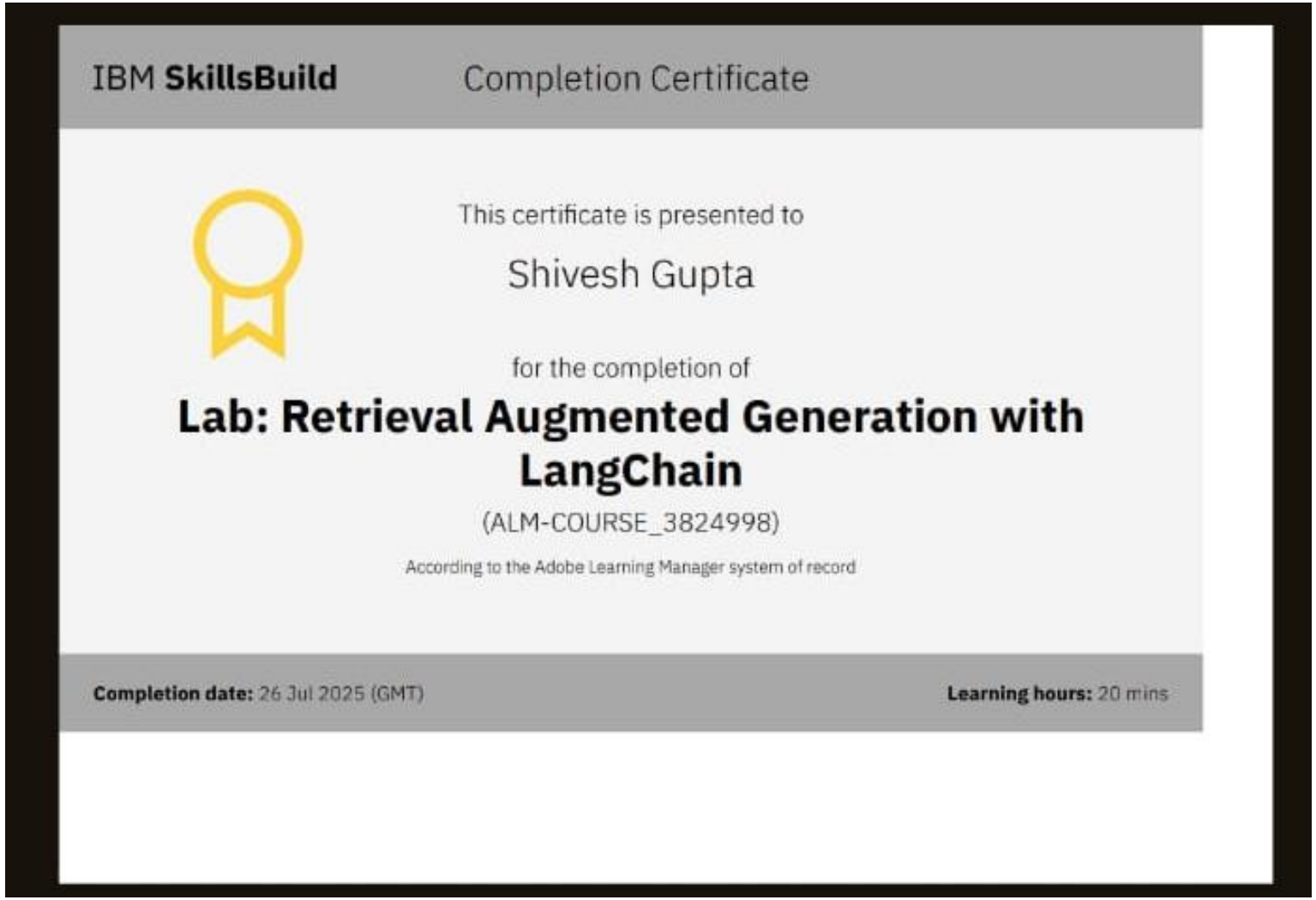

IBM **SkillsBuild** Completion Certificate

This certificate is presented to

Shivesh Gupta

for the completion of

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(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 26 Jul 2025 (GMT) **Learning hours:** 20 mins

THANK YOU

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