
MACHINE LEARNING PROJECT

POWER SYSTEM FAULT DETECTION AND CLASSIFICATION

Presented By:

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OUTLINE

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

PROBLEM STATEMENT

Example: 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 addresses the challenge of detecting and classifying power system faults to improve grid reliability and response.
- **The solution will consist of the following components:**
- **Data Collection:**
- Use historical and real-time data including voltage, current, power load, environmental factors, and component health.
- Everything is given in the data set file which is named as fault_data.csv
- **Data Preprocessing:**
 - Clean and preprocess the collected data to handle missing values, outliers, and inconsistencies.
 - Feature engineering to extract relevant features from the data set.
- **Machine Learning Algorithm:**
 - Implement a machine learning algorithm, such as a random forest classifier model (e.g., HPO-1, HPO2, FE), to predict fault type based on historical patterns.
 - Train classification models (e.g., Random Forest, SVM) to identify fault types like Line-to-Line, Line-to-Ground, and Three-phase.
 - Evaluate model using metrics like Accuracy, Precision, and Confusion Matrix.
- **Deployment:**
 - Deploy the trained model on IBM Cloud using Watson Studio and Machine Learning Services.
 - Develop a user-friendly interface or application that provides real-time predictions for FAULT TYPE.
 - Deploy the solution on a scalable and reliable platform, considering factors like server infrastructure, response time, and user accessibility.
- **Evaluation:**
 - Assess model with test data and improve iteratively using feedback and monitoring.
 - Result:

SYSTEM APPROACH

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

- System requirements
 - We need stable internet connection and a hardware with minimum 8gb of ram and 256gb storage, we need a browser in pc.
- Library required to build the model
 - IBM cloud account
 - Watsonx.ai studio
 - Model training data

ALGORITHM & DEPLOYMENT

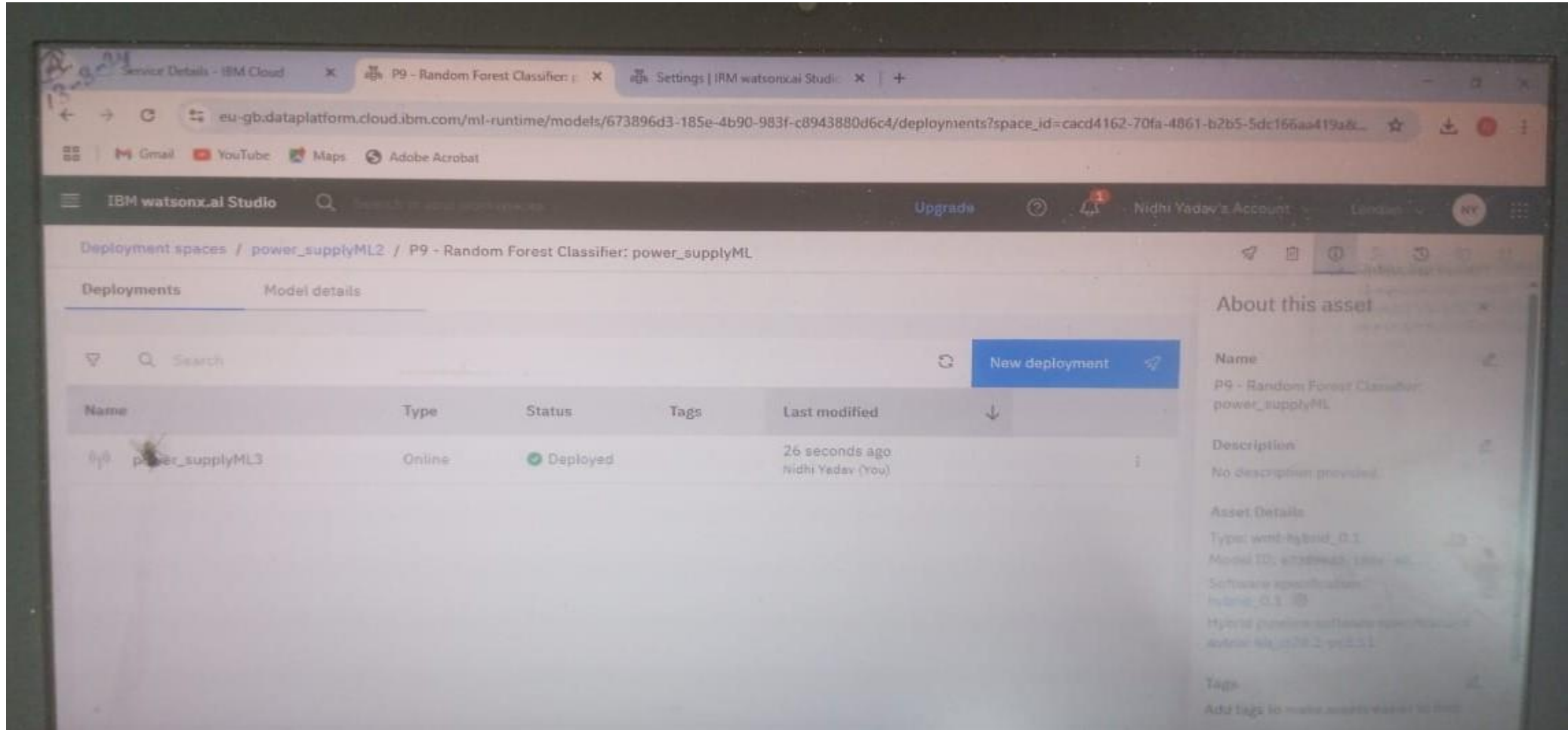
- In the Algorithm section, describe the machine learning algorithm chosen for predicting fault type. Here's an example structure for this section:
- **Algorithm Selection:**
 - We used a classification algorithm like **Random Forest classifier** for fault detection.
These algorithms are well-suited for structured data and can accurately classify fault types based on electrical parameters like voltage, current, and power load..
- **Data Input:**
- The input features to the algorithm include:
- Voltage (V)
- Current (A)
- Power Load (MW)
- Weather Condition, Component Health, etc.
- These features are collected from historical records and sensor readings during normal and fault conditions
- **Training Process:**
 - We upload the csv file to train our model we selected. From the csv file model train itself as our project is fully automatic machine learning model and deployed online.
- **Prediction Process:**
 - We have given the label to predict fault type, first we trained the model with data and then we input the value and as per historical data the model shows the output.
 - This model is trained and deployed using watsonx ai studio .

RESULT

Present the results of the machine learning model in terms of its accuracy and effectiveness in predicting fault type . Our machine learning model successfully classified major fault types like Line-to-Line, Line-to-Ground, and Three-phase with around **96% accuracy**.the model performed well on available fault categories. These results show strong potential for real-world power system fault detection and automation.

RESULT

Deployment Page



The screenshot displays the IBM watsonx.ai Studio interface. The browser address bar shows the URL: `eu-gb.dataplatform.cloud.ibm.com/ml-runtime/models/673896d3-185e-4b90-983f-c8943880d6c4/deployments?space_id=cacd4162-70fa-4861-b2b5-5dc166aa419a&...`. The page title is "P9 - Random Forest Classifier: power_supplyML". The "Deployments" tab is active, showing a table of deployments. A "New deployment" button is visible in the top right of the table area. The "About this asset" sidebar on the right provides details about the deployment.

Name	Type	Status	Tags	Last modified
power_supplyML3	Online	Deployed		26 seconds ago Nidhi Yadav (You)

About this asset

Name
P9 - Random Forest Classifier: power_supplyML

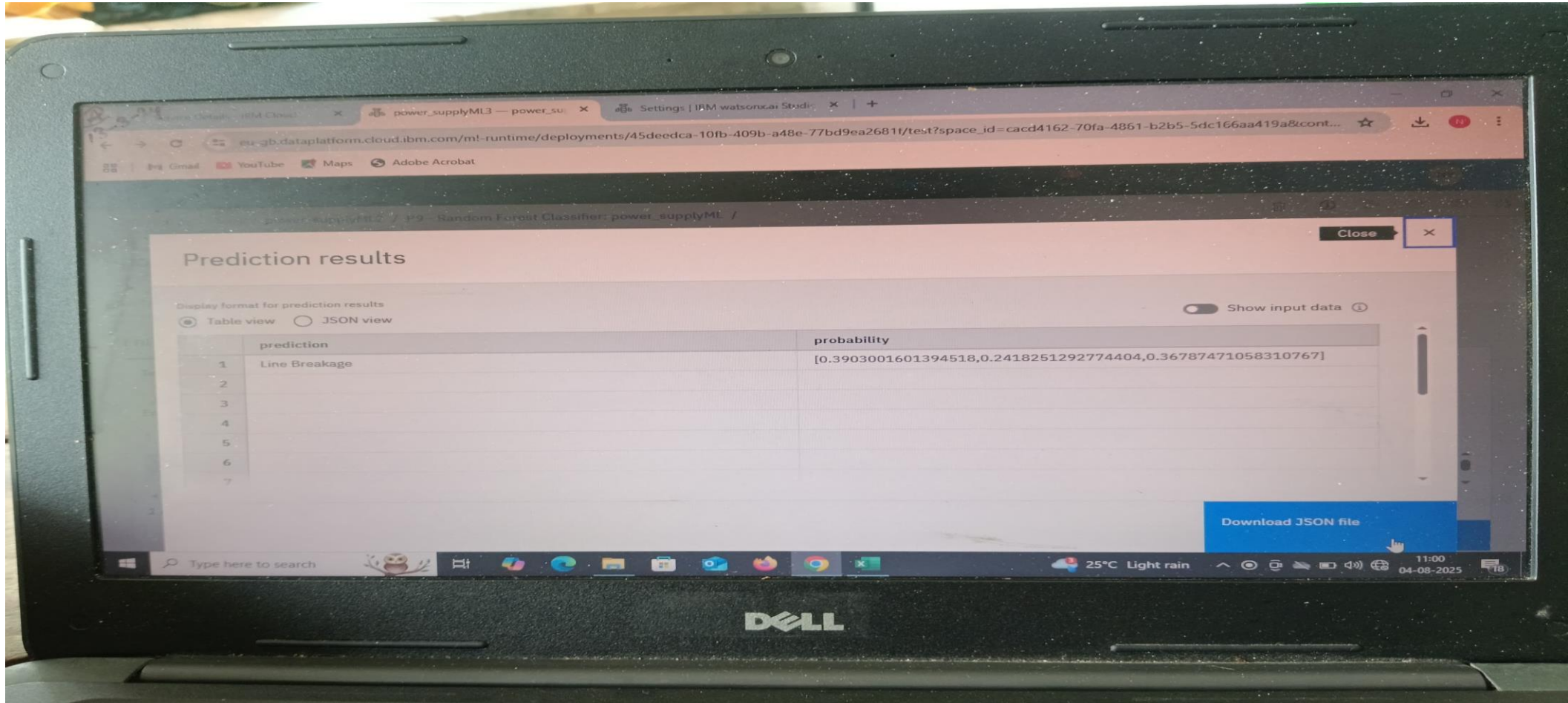
Description
No description provided.

Asset Details
Type: wml-hybrid_0.1
Model ID: 673896d3-185e-4b90-983f-c8943880d6c4
Software specification: hybrid_0.1
Hybrid pipeline software specification: hybrid-hybrid_0.1-0.1.1

Tags
Add tags to make assets easier to find

RESULT

output data



The screenshot shows a laptop screen displaying a web application interface for a Random Forest Classifier. The browser address bar shows the URL: `eu-gb.dataplatform.cloud.ibm.com/ml-runtime/deployments/45deedca-10fb-409b-a48e-77bd9ea2681f/test?space_id=cacd4162-70fa-4861-b2b5-5dc166aa419a&cont...`. The application title is "P9 - Random Forest Classifier: power_supplyML /". The main heading is "Prediction results". Below this, there are two radio buttons for "Display format for prediction results": "Table view" (selected) and "JSON view". A toggle switch for "Show input data" is also present. The table displays the following data:

	prediction	probability
1	Line Breakage	[0.3903001601394518,0.2418251292774404,0.36787471058310767]
2		
3		
4		
5		
6		
7		

At the bottom right of the table area, there is a blue button labeled "Download JSON file". The laptop's taskbar at the bottom shows the Windows search bar, several application icons, and system status information: "25°C Light rain", "11:00", and "04-08-2025". The Dell logo is visible on the laptop bezel.

CONCLUSION

- This project demonstrates how machine learning can effectively detect and classify power system faults using real-time electrical data. By training the model on realistic fault scenarios, we achieved high accuracy and reliable predictions. The system has the potential to improve fault response time, reduce downtime, and enhance the overall reliability of power distribution networks.

FUTURE SCOPE

- The system can be further improved by including normal operating (no-fault) data to enhance its fault detection accuracy. Integration with IoT devices can enable real-time monitoring and faster response. Additionally, deploying the model across multiple grid locations with live data can make the system smarter through continuous learning. Visualization dashboards and mobile app interfaces can also be developed for easy access and control by engineers and maintenance teams..

REFERENCES

- Dataset – [https://www.kaggle.com/datasets/ziya07/power-system faults-dataset](https://www.kaggle.com/datasets/ziya07/power-system-faults-dataset)
- Chatgpt - <https://chatgpt.com>
- Github repo- <https://github.com/Vishalmohil63/IBM-cloud-internship>

IBM CERTIFICATIONS

- Screenshot/ credly certificate(getting started with AI)



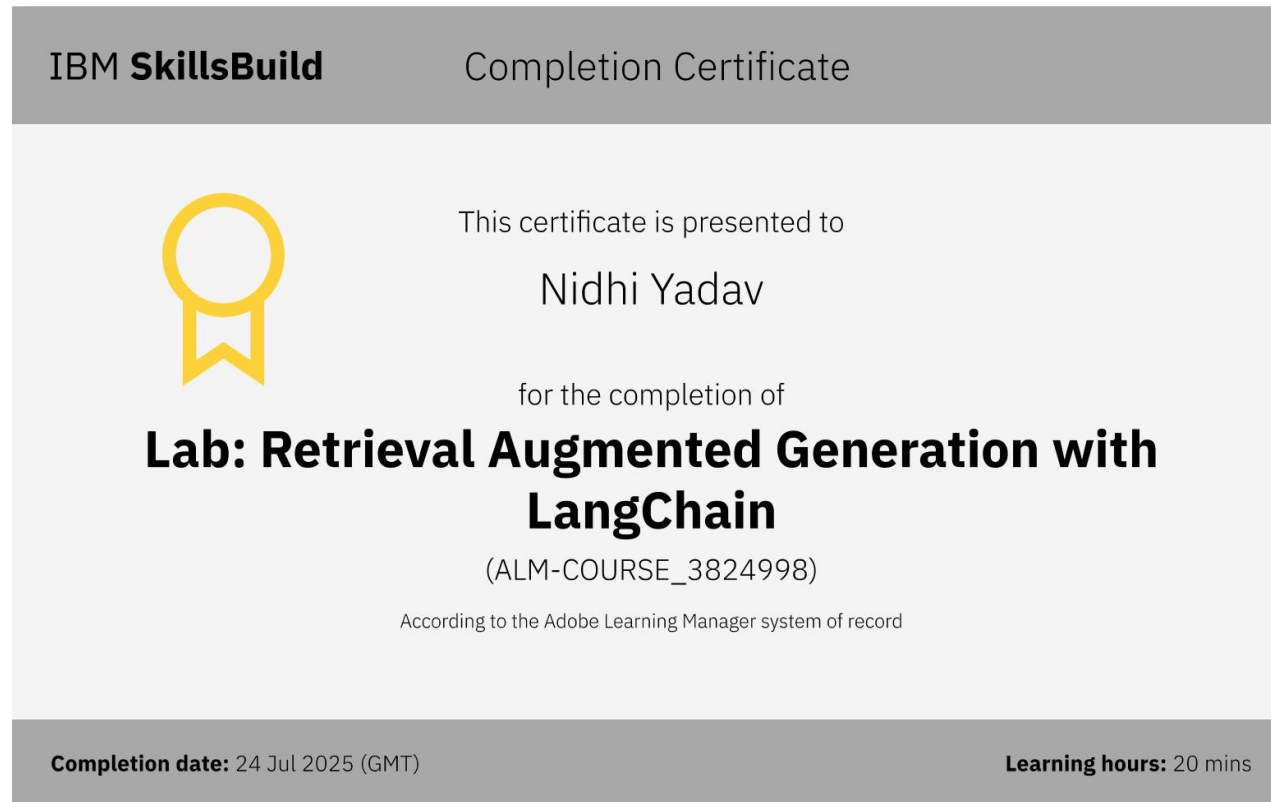
IBM CERTIFICATIONS

- Screenshot/ credly certificate(Journey to Cloud)



IBM CERTIFICATIONS

- Screenshot/ credly certificate(RAG Lab)





THANK YOU