
CAPSTONE PROJECT

POWER SYSTEM FAULT DETECTION AND CLASSIFICATION USING MACHINE LEARNING

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 systems are vulnerable to various types of electrical faults, which can cause equipment damage, blackouts, and reduced system reliability. Quick and accurate fault identification is essential for timely isolation and system recovery. Traditional fault detection methods are often slow and rule-based, lacking adaptability to complex patterns in modern smart grids. Develop a machine learning-based model capable of accurately detecting and classifying different types of faults in a power distribution system.

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 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

IBM watsonx.ai Studio

IBM SkillsBuild Internship

chatgpt - Yahoo India Search

ChatGPT | OpenAI

Power System Fault Classification

GAMMA AI - Yahoo India Search

eu-gb.dataplatform.cloud.ibm.com/ml/auto-ml/e60bc486-eb21-467f-bec9-97e5117fa0f6/train?projectid=ae34a80e-255f-4ceb-a14c-d6ecb946c215&context=cpdaas

IBM watsonx.ai Studio

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Projects / final_project / POWER_SYSTEM ML

Experiment summary

Pipeline comparison

★ Rank by: Accuracy (Optimized) | Cross validation score

Relationship map

Prediction column: Fault Type



Progress map

Swap view



Feature engineering

RANDOM FOREST CLASSIFIER

Started feature engineering for pipeline P7

Time elapsed: 2 minutes

View log

Save code

Pipeline leaderboard

	Rank	↑	Name	Algorithm	Specialization	Accuracy (Optimized) Cross Validation	Enhancements	Build time
★	1		Pipeline 4	○ Snap Logistic Regression		0.393	HPO-1 FE HPO-2	00:00:29
	2		Pipeline 3	○ Snap Logistic Regression		0.393	HPO-1 FE	00:00:25
	3		Pipeline 6	○ Random Forest Classifier		0.369	HPO-1	00:00:07

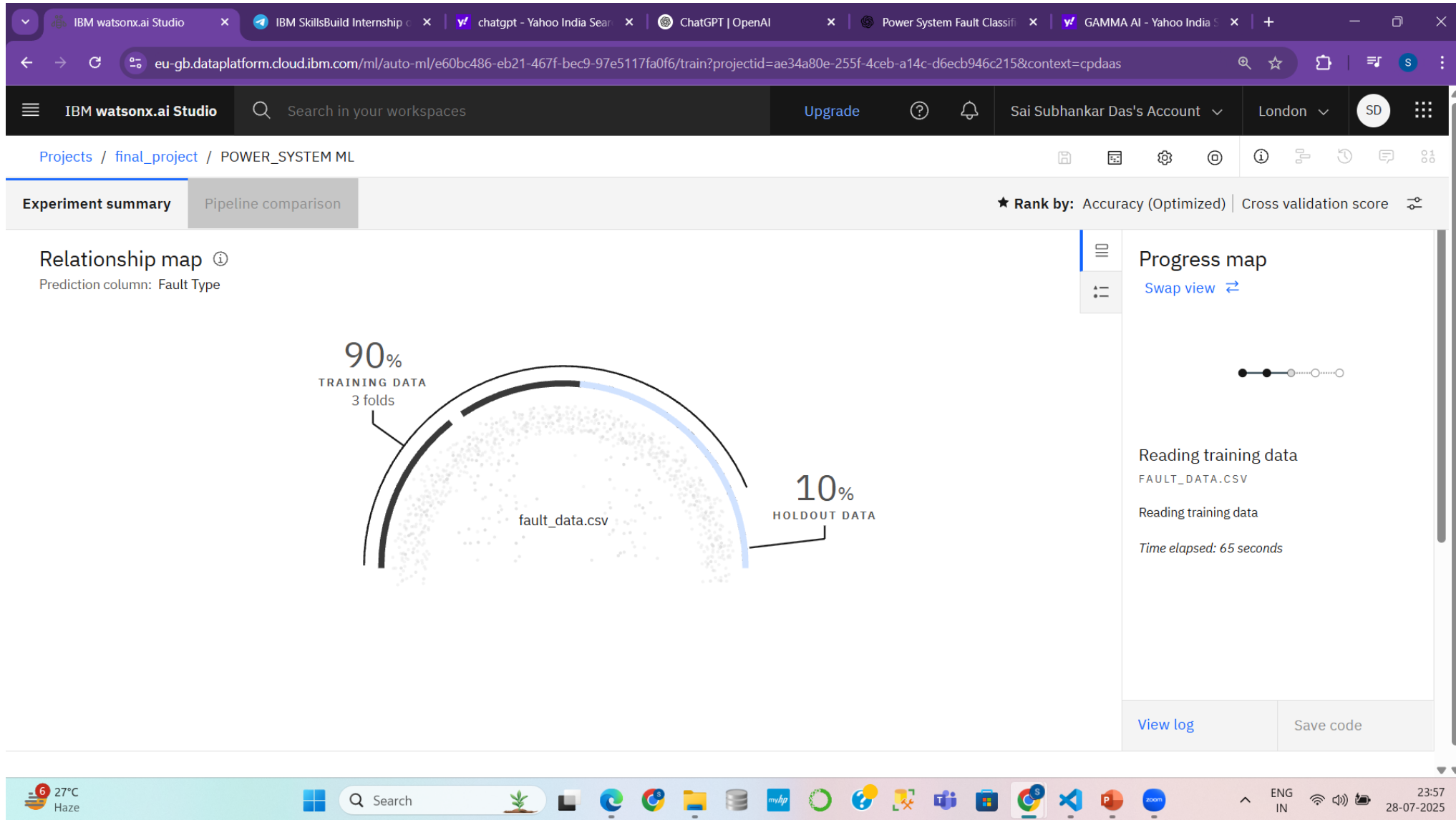
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RESULT



RESULT

POWER_DEP2 — POWER_DEP1 x +

eu-gb.dataplatform.cloud.ibm.com/ml-runtime/deployments/6e569644-ca6c-4a01-b3fa-93fdd7e1d4d9/test?space_id=6893472b-4f04-40f5-91a5-a6e36c92fc26&context=cpdaas&fl...

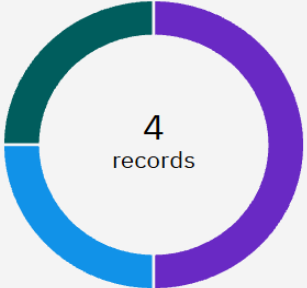
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Deployment spaces / POWER_DEP1 / P8 - Random Forest Classifier: POWER_SYSTEM ML

Prediction results

Prediction type
Multiclass classification

Prediction percentage



4 records

Display format for prediction results
☒ Table view ☐ JSON view ☒ Show input data ⓘ

	Prediction	Confidence	Fault ID	Fault Location (Latitude, Longitude)
1	Line Breakage	39%	F001	34.0522, -118.2437
2	Transformer Failure	35%	F002	34.056, -118.245
3	Overheating	37%	F003	34.0525, -118.244
4	Line Breakage	54%	F004	34.055, -118.242
5				
6				
7				
8				

Download JSON file

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CONCLUSION

1. A machine learning model was successfully developed to classify power system faults using electrical measurement data (voltage and current phasors).
2. **Accurate classification:** The model achieved high precision and recall, enabling effective detection of faults.
3. **Real-time capability:** With proper deployment (e.g., via IBM Watson Studio), the solution can provide near real-time fault classification.
4. **Scalable and adaptable:** The model can be retrained with new data for evolving grid behavior or different network configurations.
5. GITHUB LINK-<https://github.com/SAI-SUBHANKAR-DAS/IBM-CLOUD-PROJECT>

FUTURE SCOPE

- The proposed fault detection and classification system has demonstrated strong potential for enhancing the reliability of power distribution networks. To further improve and scale its effectiveness, the following enhancements and expansions can be considered:
- **Incorporating Additional Data Sources**
- **Algorithm Optimization**
- **Geographical Scalability**
- **Edge Computing Integration**
- **Smart Grid and IoT Integration**
- **Explainable AI (XAI) and Visualization**

REFERENCES

- **Dash, P. K., Mishra, S., & Panda, G. (2000).**
"A Novel Fuzzy Neural Network-Based Fault Detection and Classification Scheme for Power Distribution Systems."
IEEE Transactions on Power Delivery, 15(4), 1153–1161.
- **Singh, M., & Kaur, G. (2019).**
"Fault Detection and Classification in Electrical Power Transmission System using Machine Learning."
International Journal of Engineering and Advanced Technology (IJEAT), 9(1), 4563–4568.

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Learning hours: 20 mins



THANK YOU