MACHINE LEARNING 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

The increasing complexity and demand on modern power distribution systems necessitate reliable and intelligent fault detection mechanisms to ensure uninterrupted service and grid stability. Traditional methods of fault identification often lack the speed and adaptability required in dynamic environments. This project aims to develop a machine learning-based model capable of accurately detecting and classifying various types of faults within a power distribution network. Utilizing electrical measurement data—specifically voltage and current phasors—the proposed model will differentiate between normal operating conditions and fault scenarios such as line-to-ground, line-to-line, and three-phase faults.

PROPOSED SOLUTION

- The proposed solution involves developing a supervised machine learning model to detect and classify faults in a power distribution system using voltage and current phasor data.
- The process begins with data collection and preprocessing to ensure quality and consistency, followed by feature extraction to identify patterns relevant to different fault types. A labeled dataset containing normal and fault conditions (such as line-to-ground, line-to-line, and three-phase faults) will be used to train and validate multiple machine learning algorithms, including Support Vector Machines, Random Forests, and Neural Networks.
- The best-performing model will be selected based on accuracy and reliability. Once deployed, the model will enable real-time fault detection and classification, supporting faster decision-making and enhancing the overall stability and reliability of the power grid.

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:

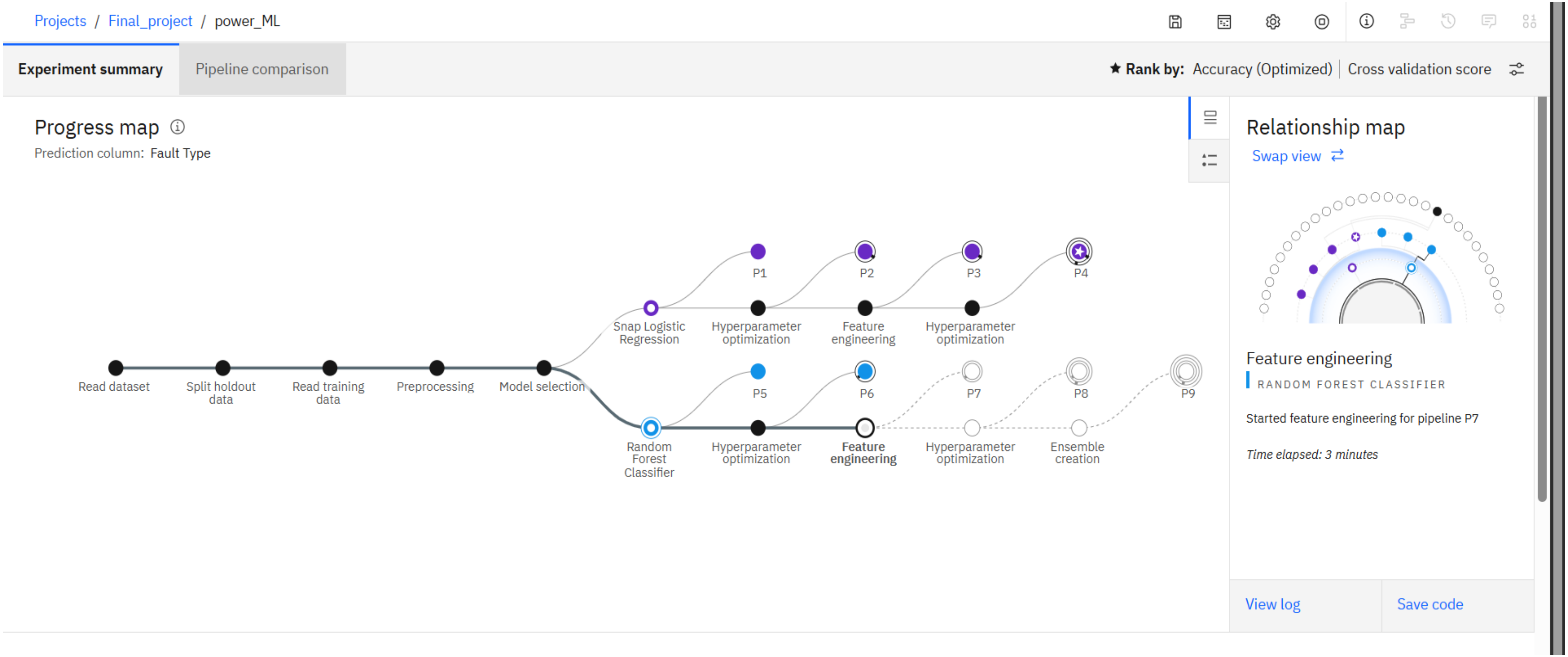
- System requirements :

  IBM Cloud

  IBM Watson studio for model development and deployment

  IBM Cloud object storage for dataset handling

RESULT



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RESULT

Power Fault

Deployed Online

API reference | **Test**

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 ×

	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	F007	34.076,-118.856	2005	250	50	32	20
2	F003	35.235,-119.993	1995	229	45	29	22
3	F022	33.864,-116.648	2032	267	53	30	19
4	F044	37.957,-118.223	1854	201	40	35	24
5							

4 rows, 12 columns

Predict

RESULT

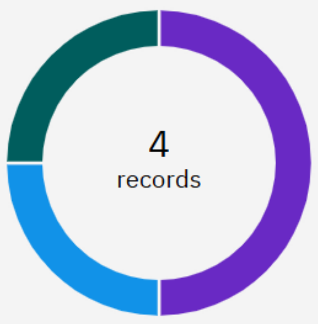
Prediction results

Close ×

Prediction type

Multiclass classification

Prediction percentage



Display format for prediction results

Table view JSON view Show input data

	Prediction	Confidence
1	Transformer Failure	38%
2	Line Breakage	34%
3	Transformer Failure	45%
4	Overheating	50%
5		
6		
7		
8		
9		
10		

Download JSON file

CONCLUSION

- In conclusion, the application of machine learning techniques for fault detection and classification in power distribution systems offers a promising solution to enhance grid reliability and operational efficiency. By leveraging electrical measurement data such as voltage and current phasors, the proposed model can accurately distinguish between normal and various fault conditions, enabling real-time identification and response. This data-driven approach not only reduces the reliance on manual fault analysis but also improves the speed and accuracy of fault diagnosis. Ultimately, the integration of intelligent fault detection systems contributes to the development of smarter, more resilient power grids capable of meeting the demands of modern energy infrastructure.

FUTURE SCOPE

- This project, developed on IBM Cloud, can be further enhanced by integrating more advanced machine learning or deep learning techniques to improve fault detection accuracy. Utilizing IBM Cloud’s AI and IoT services, the system can be expanded to support real-time monitoring and edge-based fault prediction. Future work can focus on integrating the model with SCADA systems for centralized grid management and extending its capabilities to locate faults and assess their severity. The solution can also be adapted to handle complex fault conditions, renewable energy integration, and dynamic grid environments.

REFERENCES

- IBM Cloud
- Watsonx.ai studio
- IBM Object Storage

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