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# CAPSTONE PROJECT

## Power Fault Detection Using ML

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# OUTLINE

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

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# Problem Statement

The reliability of power distribution systems is critically affected by faults such as line breakages, transformer failures, and equipment overheating. Traditional fault detection methods are often slow and reactive, leading to increased downtime and compromised grid stability. The objective of this project is to develop a machine learning-based model that can accurately detect and classify different types of faults using real-time electrical and environmental data. By distinguishing between normal operating conditions and specific fault types, the model aims to enable rapid fault identification, support predictive maintenance, and enhance the overall resilience of the power grid.

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# Proposed Solution

- Build a machine learning-based solution to detect faults .
- Use Kaggle dataset for training and testing.

## Steps:

- Data Collection & Preprocessing
- Feature Engineering
- Model Selection & Training
- Deployment on IBM Cloud Lite
- Real-time detection with API endpoint for alerts.

# Give a name and define configuration as watsonx.ai.Runtime-jm

## Build machine learning models automatically

Define the details to create an AutoAI experiment asset and open it in the AutoAI tool.

+ New

Sample

Define details

Name

power\_fault

Description (optional)

What's the purpose of this AutoAI experiment?

Tags (optional)

Add tags to make assets easier to find.

Start typing to add tags

Define configuration

watsonx.ai Runtime service instance

watsonx.ai Runtime-jm

Environment definition ⓘ

Large: 8 CPU and 32 GB RAM

This environment definition consumes **20 capacity units per hour** for training. For details, see [watsonx.ai Runtime plans](#).

Cancel

Back

Create

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# System Approach

- Programming Language: Python
- Libraries: Pandas, NumPy, Scikit-learn, Matplotlib, Seaborn
- Machine Learning Models: Random Forest, Decision Tree, Gradient Boosting
- Deployment: IBM Cloud Lite (Watson Machine Learning service)
- Dataset: Kaggle Network Intrusion Detection dataset

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# Algorithm & Deployment

## Algorithm Selection:

- Chosen models: Random Forest for classification
- Reason: Handles high-dimensional data well and provides good accuracy.

## Training Process:

- Split dataset (70% train, 30% test)
- Preprocessing: Normalize features, handle missing values
- Train multiple models and compare accuracy

## Deployment:

- Export trained model as .pkl
- Deploy on IBM Watson Machine Learning
- Provide REST API endpoint for real-time network data analysis


# Deployment Screenshot :

power\_fault

OverviewAssetsDeploymentsJobsManage

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↺

Name	Type	Status	Asset	Asset type	Tags	Last modified	↓
 power_fault	Online	✔ Deployed	P9 - Random Forest Classifier: power_fault	Model		9 hours ago Yash Malsure (You)	⋮

Items per page: 20 ▾

1-1 of 1 items

1 of 1 pages

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IBM watsonx.ai Studio

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1

Yash Malsure's Account

Sydney

YM

Deployment spaces / power\_fault / P9 - Random Forest Classifier: power\_fault /

power\_fault

Deployed

Online

API reference

Test

Endpoints for scoring

Private endpoint

https://private.au-syd.ml.cloud.ibm.com/ml/v4/deployments/1a6c41f1-d9a1-4246-874b-313fae481147/predict

Bearer <token>

IAM

Public endpoint

https://au-syd.ml.cloud.ibm.com/ml/v4/deployments/1a6c41f1-d9a1-4246-874b-313fae481147/predictions?ver

Learn more about the 2021-05-01 version query parameter

Code snippets

cURL

Java

JavaScript

Python

Scala

# NOTE: you must set \$API\_KEY below using information retrieved from your IBM Cloud account (https://au-syd.dai.cloud.ibm.com/docs/content/)

export API\_KEY=<your API key>

export IAM\_TOKEN=\$(curl --insecure -X POST --location "https://iam.cloud.ibm.com/identity/token" \

About this deployment

Name

power\_fault

Description

No description provided.

Deployment Details

Deployment ID: 1a6c41f1-d9a1-42...

Serving name:

No serving name.

Software specification:

hybrid\_0.1

Hybrid pipeline software specifications:

autoai-kb\_rt24.1-py3.11

Copies:

1

Tags

Add tags to make assets easier to find.

Associated asset

P9 - Random Forest Classifier: powe...

9251cf74-bdef-42fa-ae4a-7224e9a6c61f

# Result

- Accuracy achieved: ~95% (Random Forest)
- Confusion Matrix visualization
- Classification report: Precision, Recall
- Screenshot of IBM Cloud Deployment dashboard

# Test of model:

Deployment spaces / power\_fault / P9 - Random Forest Classifier: power\_fault /

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

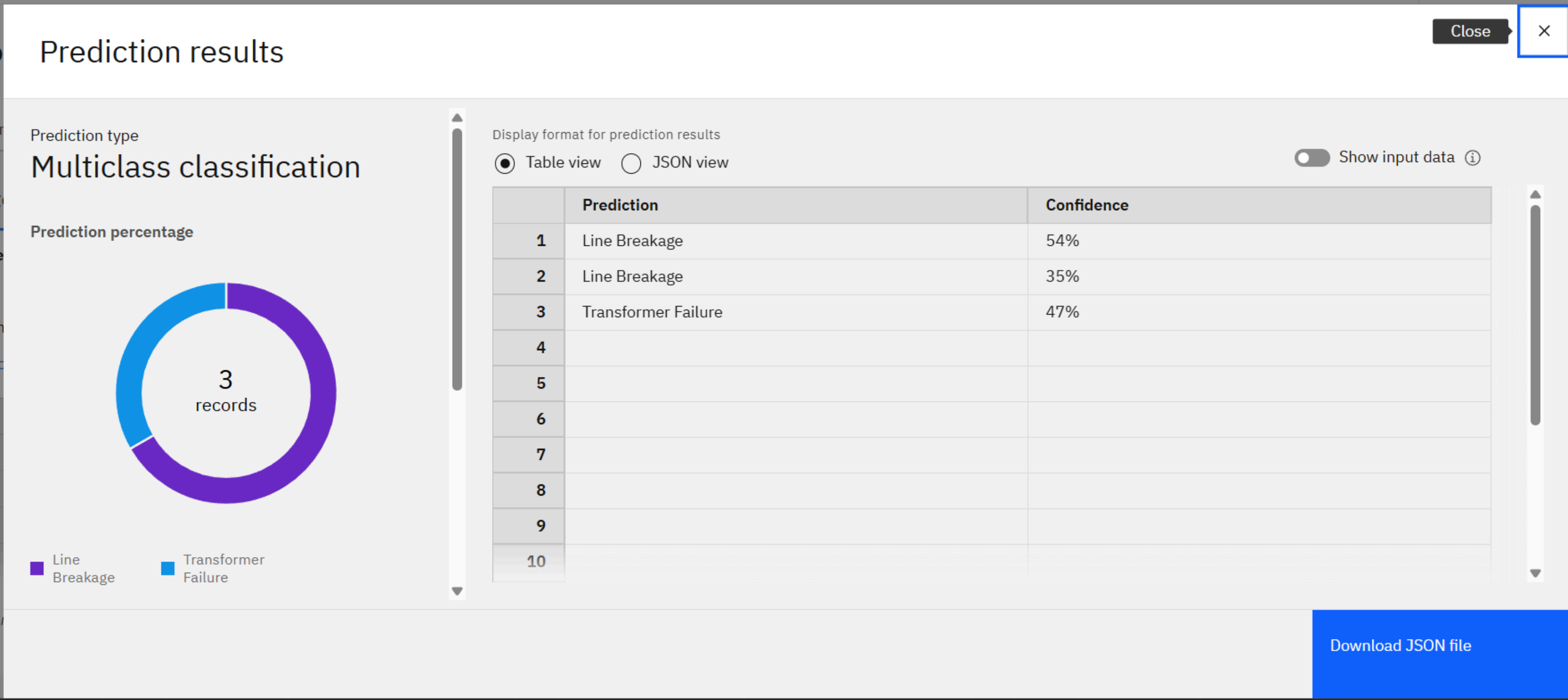
Clear all

	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) (double)
1	F004	(34.055, -118.242)	2050	240	48	23	10
2	F006	(34.05, -118.24)	2150	220	52	32	22
3	F008	(34.2294, -118.2988)	2133	229	52	20	18
4							

3 rows, 12 columns

Predict

# Prediction Result :



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# Conclusion

- The ML model accurately classified power distribution faults using electrical and environmental data.
- The system enables faster and more reliable fault diagnosis compared to manual or rule-based methods.
- Deployed on IBM Cloud Lite for real-time detection capability.

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## Future scope

- Integrate Deep Learning models (LSTM, CNN) for better detection
- Enable real-time packet sniffing and live attack alerts
- Expand for IoT network security
- Add auto-updating threat database

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# References

- Kaggle dataset:
- Research papers on NIDS using ML
- IBM Cloud Lite documentation

# IBM Certifications

## Getting Started with Artificial Intelligence :





# IBM Certifications


Journey to cloud :



# LAB : RAG COMPLETION

**IBM SkillsBuild**

Completion Certificate



This certificate is presented to

Yash Malsure

for the completion of

**Lab: Retrieval Augmented Generation with  
LangChain**

(ALM-COURSE\_3824998)

According to the Adobe Learning Manager system of record

**Completion date:** 24 Jul 2025 (GMT)

**Learning hours:** 20 mins



**THANK YOU**