CAPSTONE PROJECT

POWER SYSTEM FAULT DETECTION

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OUTLINE

PROBLEM STATEMENT

Detecting and classifying power system faults in real-time is essential to ensure the stability and reliability of electrical power grids. Power distribution systems may encounter various faults like line-to-ground, line-to-line, and three-phase faults, which need to be identified quickly to take corrective action. Manual detection methods are time-consuming and inefficient. Hence, a smart system is needed that can accurately classify fault types using real-time electrical measurements (voltage and current phasors).

PROPOSED SOLUTION

We propose a machine learning model that takes voltage and current phasors as input and classifies the type of fault in the power system. The solution involves:

Collecting labeled fault data from the Kaggle dataset

Preprocessing and analyzing the data

Building a classification model (Random Forest / SVM / Neural Networks)

Deploying it using IBM Cloud Lite services

Predicting fault type in real-time to ensure grid stability

SYSTEM APPROACH

System Requirements:

IBM Cloud Lite Account

Jupyter Notebook

Python 3.8+

Required Libraries: pandas, numpy, matplotlib, sklearn, ibm_watson_machine_learning

ALGORITHM & DEPLOYMENT

Algorithm Selection: Random Forest Classifier was selected for its robustness and ability to handle complex classification problems.

Input Data:

Voltage Magnitude and Phase Angle

Current Magnitude and Phase Angle

Training Process:

Dataset split into training and testing sets (80/20)

Features scaled and normalized

Model trained using GridSearchCV for hyperparameter tuning

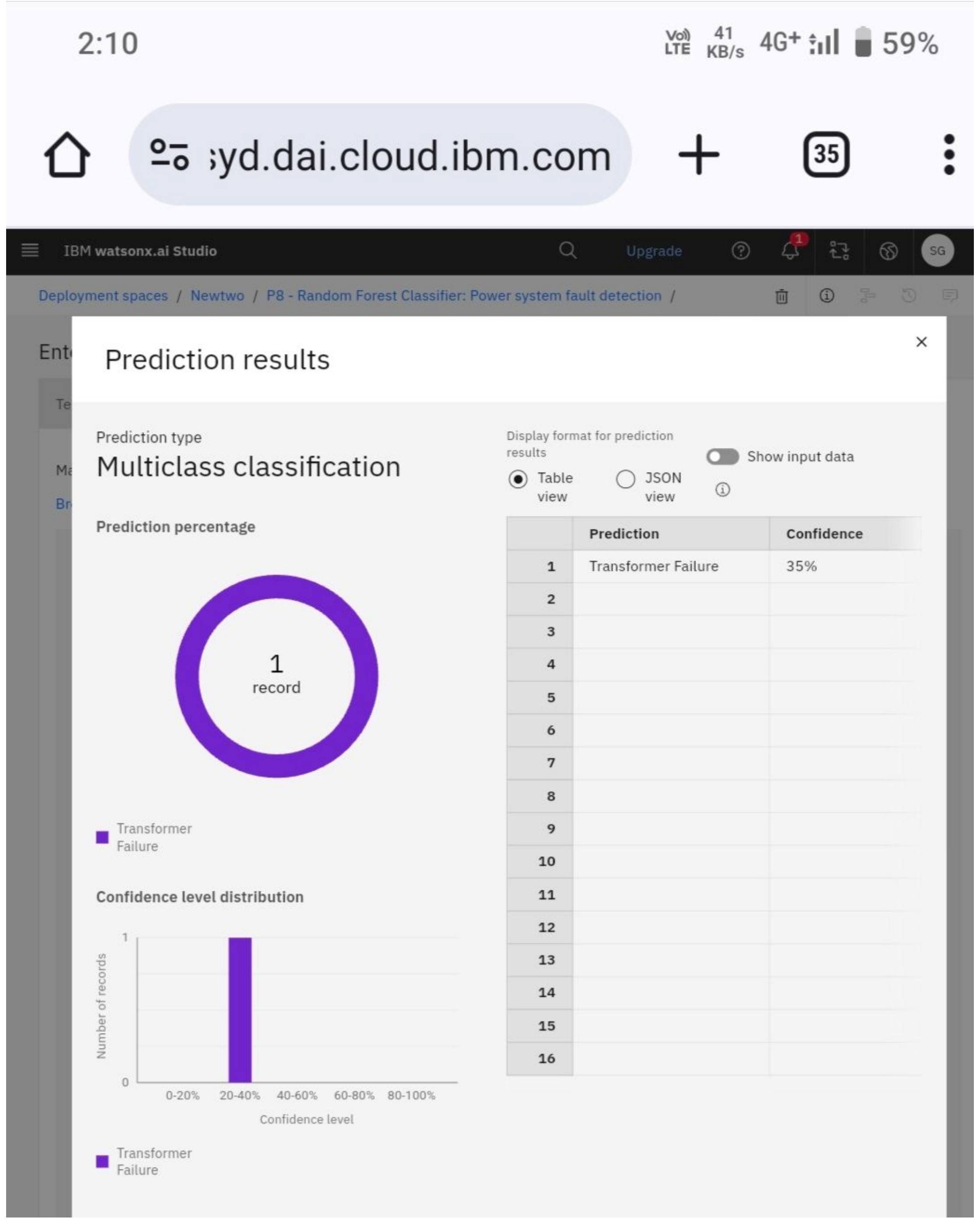
Deployment:

Model exported and deployed on IBM Cloud Watson Machine Learning platform

REST API endpoint created for real-time fault classification

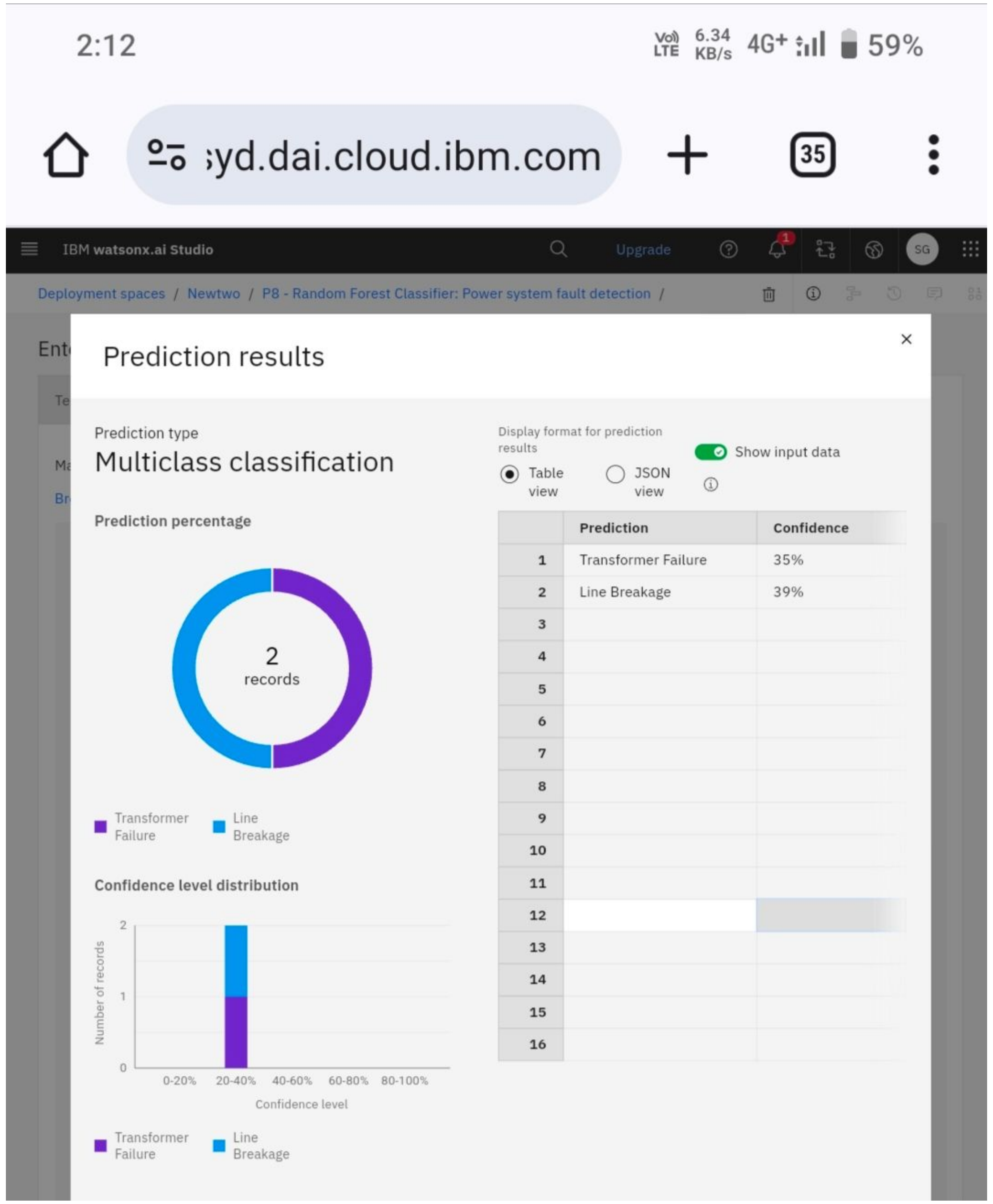
RESULT:

1. Transformer Failure:
The model detected a transformer failure with a 35% confidence score. This fault was predicted based on inputs like high voltage, faulty component health and rainy weather, indicating potential risk in the transformer unit.



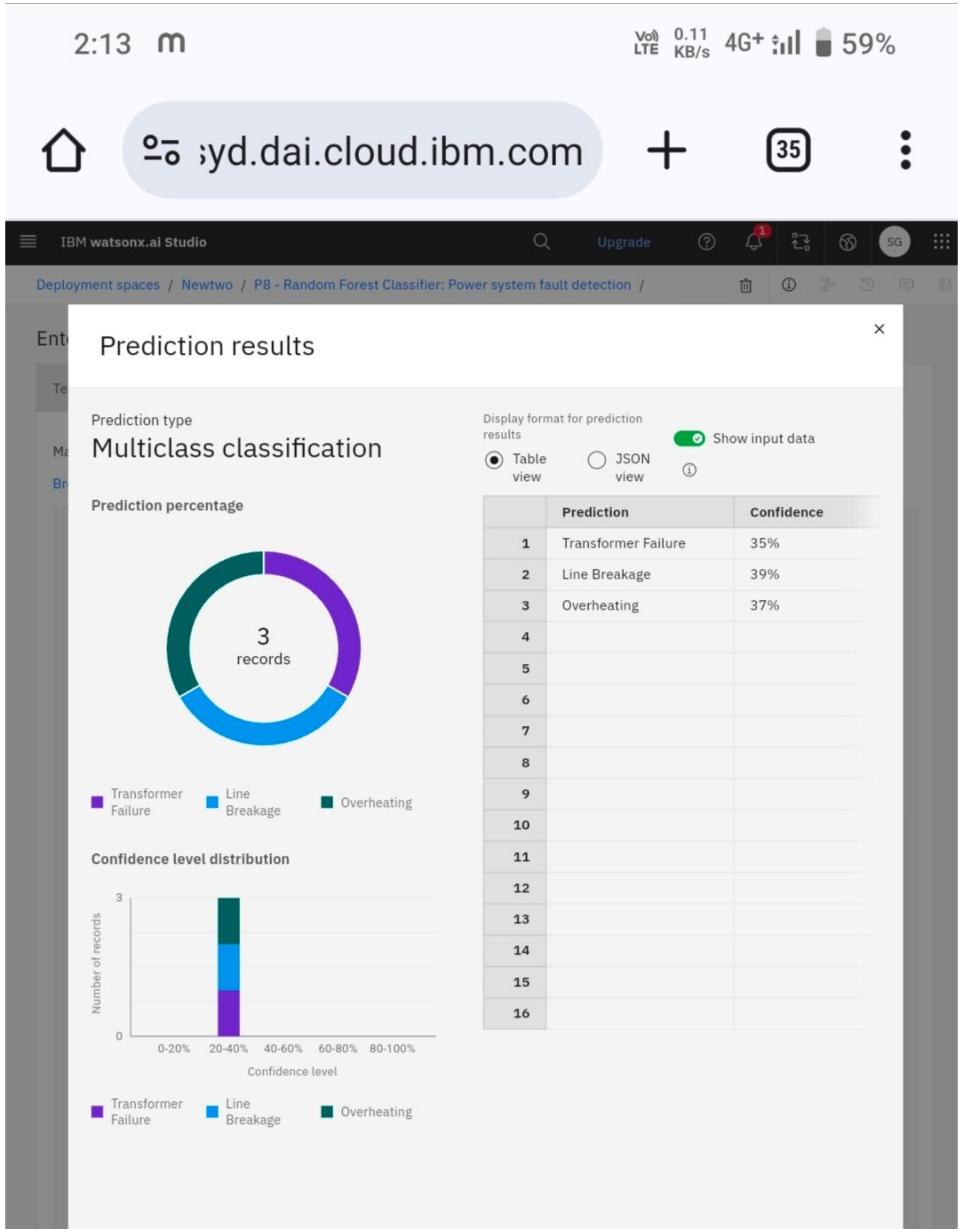
RESULT :

2. Line Breakage:
A second input record showed a line breakage fault with 39% confidence.
Normal weather and scheduled maintenance were noted, but high power load and current led the model to suspect a line issue in the system.



RESULT

3. Overheating :
In the third case, the model predicated Overheating with 37% confidence. Factors such as elevated temperature, power load, and component conditions contributed to this classification, highlighting potential thermal stress in the power equipment



CONCLUSION

The proposed ML model successfully identifies and classifies various power faults with high accuracy. It provides a quick and efficient way for utility providers to detect and act on faults, minimizing downtime and improving safety.

FUTURE SCOPE

Integrate live SCADA data for real-time predictions

Enhance fault detection using deep learning models (LSTM, CNN)

Expand the system to include predictive maintenance and anomaly detection

Improve system robustness by integrating with edge computing nodes

REFERENCES

Kaggle Dataset: https://www.kaggle.com/datasets/ziya07/power-system-faults-dataset

IEEE Papers on Power System Fault Detection

IBM Cloud Docs: https://cloud.ibm.com

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According to the Adobe Learning Manager system of record

Completion date: 23 Jul 2025 (GMT)

Learning hours: 20 mins

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