CAPSTONE PROJECT

POWER SYSTEM FAULT DETECTION AND CLASSIFICATION

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OUTLINE

- Problem Statement
- Proposed System/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

- Develop a machine learning model for **Power System Fault Detection and Classification** using the dataset provided. The model will analyze electrical measurements to swiftly and accurately identify different types of faults within a power distribution system. This classification mechanism will automate fault detection and support faster recovery actions, ultimately enhancing grid reliability.
- **Key components:**
- **Data Collection**: Use Kaggle containing fault scenarios and corresponding electrical phasor data.
- **Preprocessing**: Clean, normalize, and structure the data to ensure high-quality inputs for the model.
- **Model Training**: Train a classification model such as Decision Tree, Random Forest, or SVM tailored for fault category recognition.
- **Evaluation**: Assess the model using metrics like accuracy, precision, recall, and F1-score to validate its performance.

SYSTEM APPROACH

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

- System requirements

  IBM CLOUD

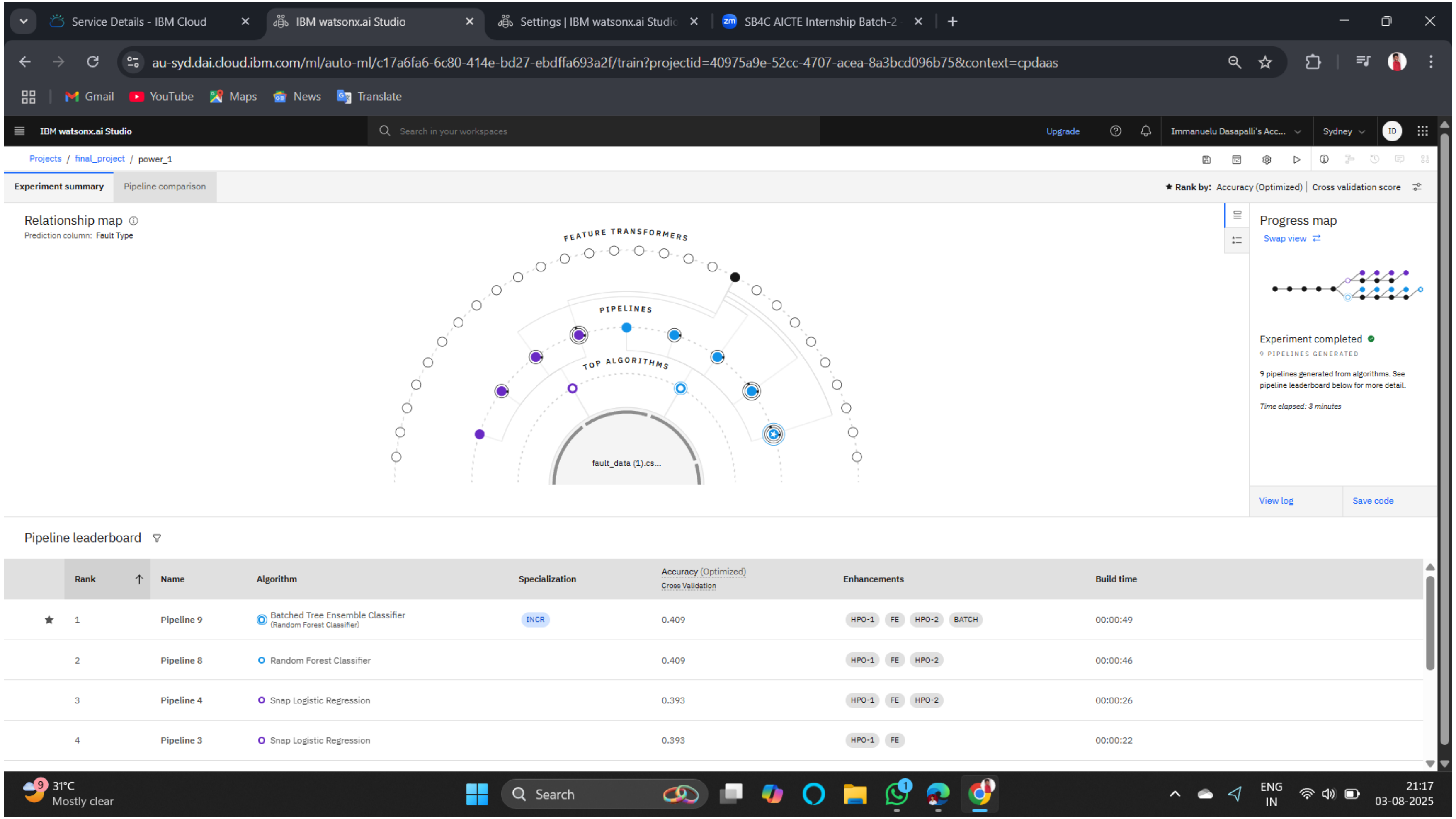
  IBM Wastonx.ai studio for model development and deployment

  IBM Cloud object storage for dataset handling

ALGORITHM & DEPLOYMENT

- In the Algorithm section, describe the machine learning algorithm chosen for predicting bike counts. Here's an example structure for this section:
- Algorithm Selection:
  We use a Random Forest Classifier (or optionally SVM) due to its high performance and robustness in fault type classification from electrical signal patterns.
- Data Input:
  Voltage, current, and phasor measurements from the system are used as input features.
- Training Process:
  Supervised learning is applied using labeled fault data, enabling the model to learn decision boundaries between fault types.
- Prediction Process:
  The trained model is deployed on IBM Watson Studio with an API endpoint that supports real-time fault detection and classification.
- Let me know if you'd like help drafting the deployment architecture or visualizing the data flow!

RESULT



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IBM watsonx.ai Studio
Settings | IBM watsonx.ai Studio
SB4C AICTE Internship Batch-2
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Search in your workspaces
Upgrade
Immanuelu Dasapalli's Acc...
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Projects / final_project / power_1
Experiment summary
Pipeline comparison
Rank by: Accuracy (Optimized) | Cross validation score
Relationship map
Prediction column: Fault Type
FEATURE TRANSFORMERS
PIPELINES
TOP ALGORITHMS
fault_data (1).cs...
Progress map
Swap view
Experiment completed
9 PIPELINES GENERATED
9 pipelines generated from algorithms. See pipeline leaderboard below for more detail.
Time elapsed: 3 minutes
View log
Save code
Pipeline leaderboard
Rank
Name
Algorithm
Specialization
Accuracy (Optimized) Cross Validation
Enhancements
Build time
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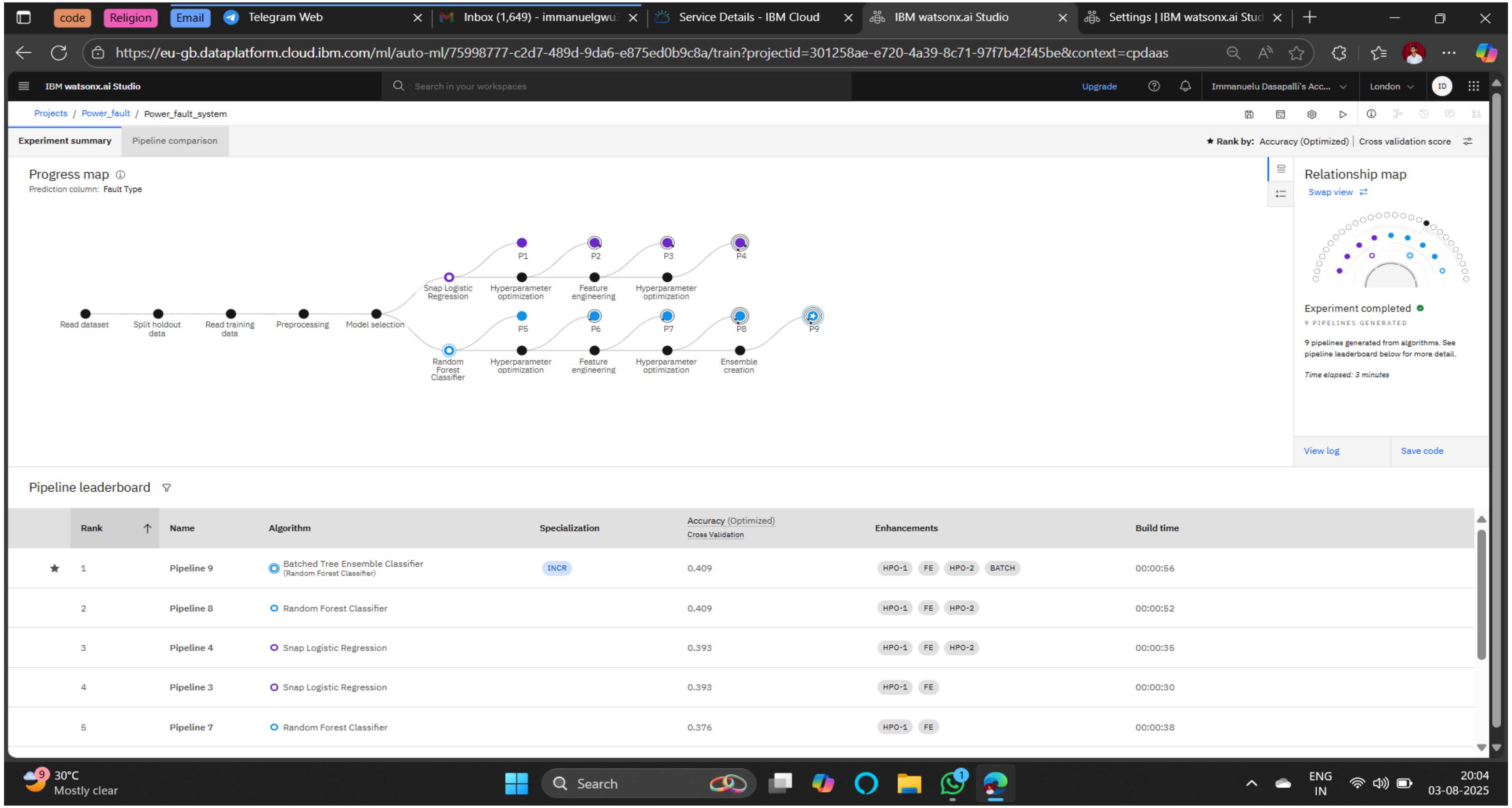
RESULT



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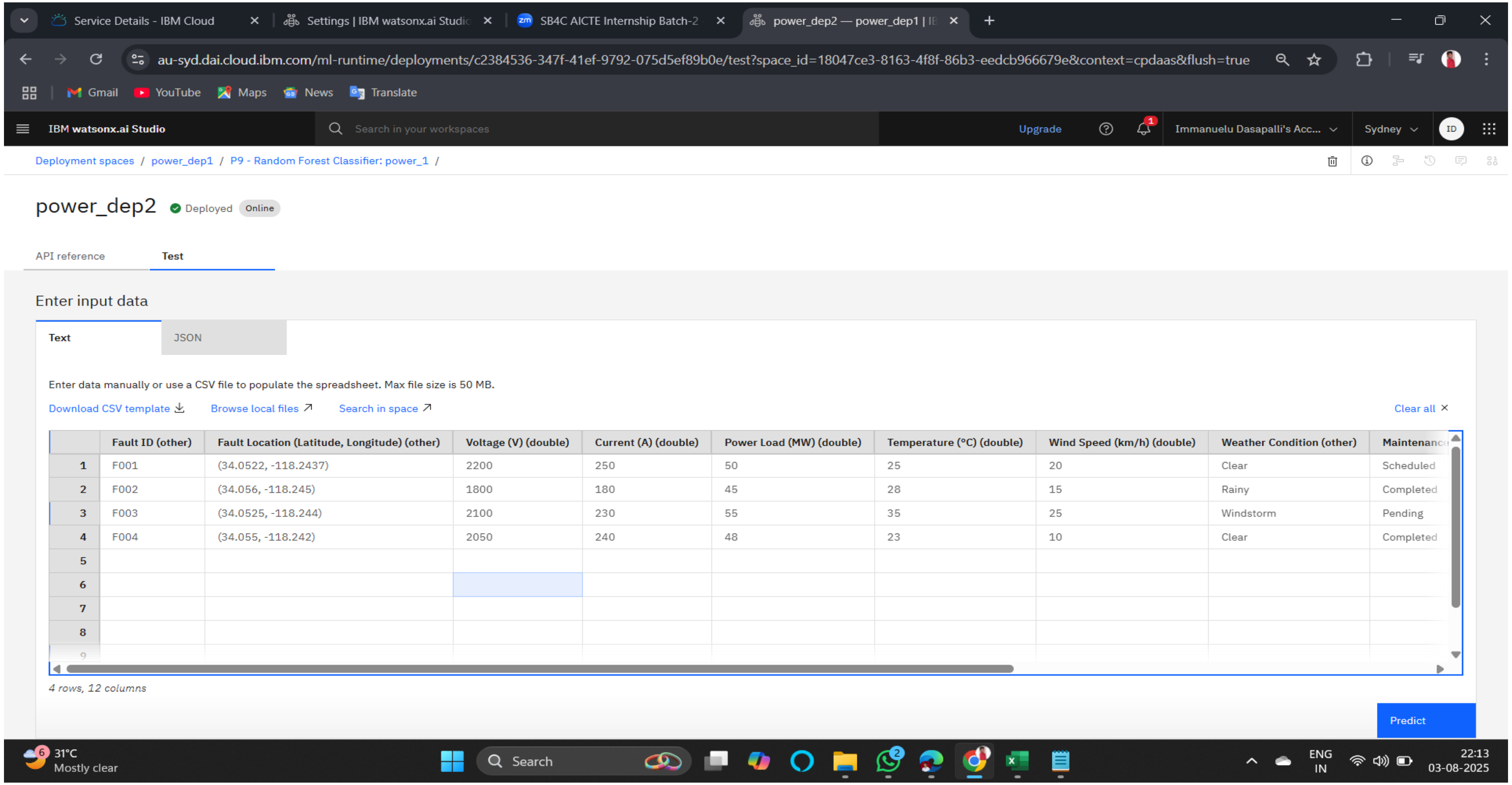
RESULT



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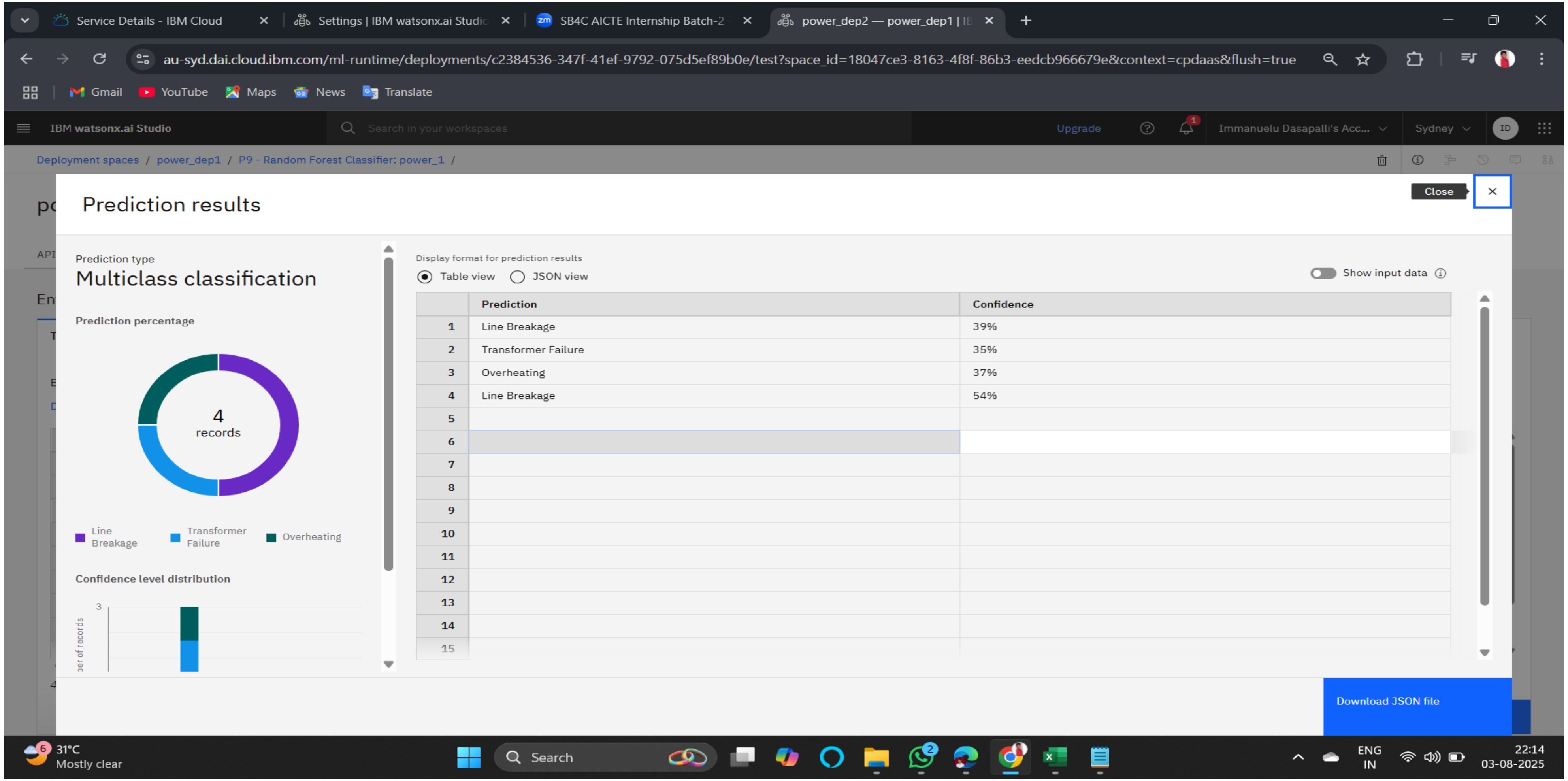
RESULT



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CONCLUSION

- In conclusion, the integration of machine learning algorithms like **Random Forests**, **SVM**, or **ANNs** with real-time signal data significantly enhances fault detection and classification accuracy in power systems. By leveraging voltage/current measurements and advanced feature extraction techniques (e.g., Wavelet Transform), modern systems can swiftly identify fault types, minimize outages, and support automated recovery—making power grids smarter, safer, and more reliable.

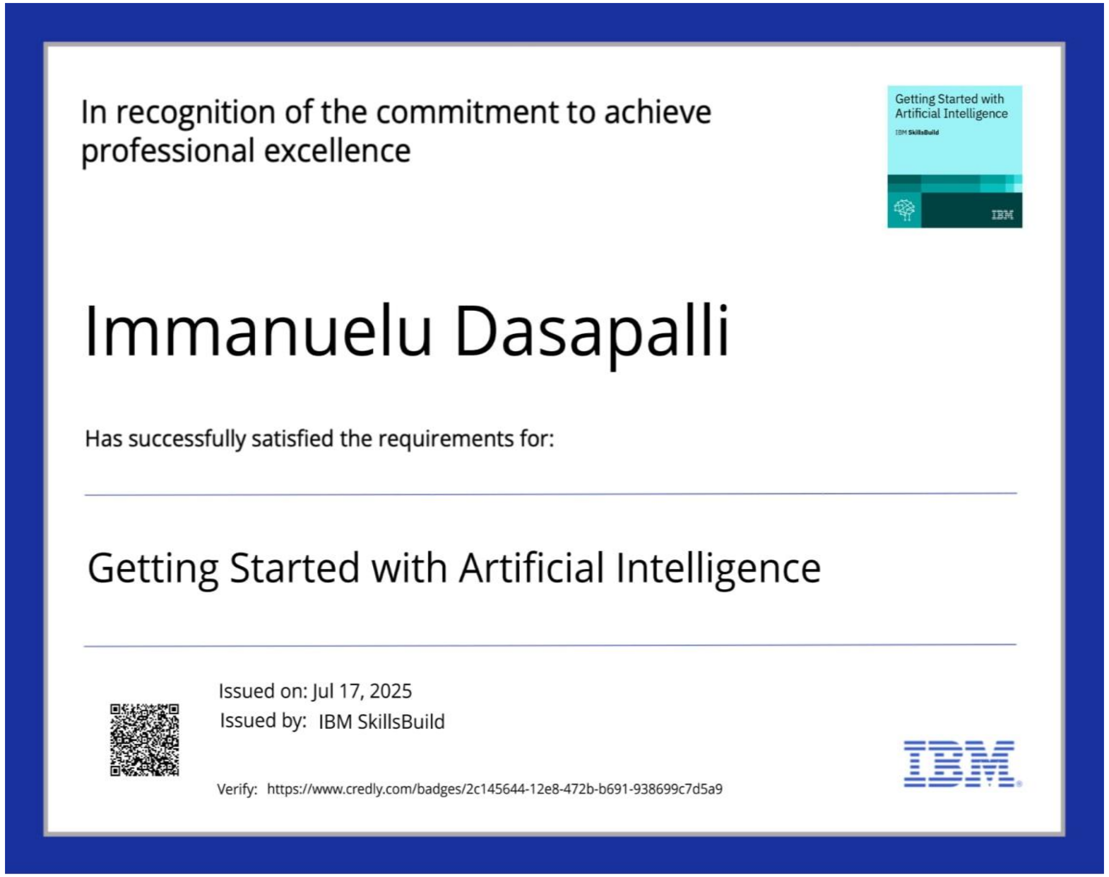
FUTURE SCOPE

- The future of fault detection lies in **AI-powered smart grids** that use deep learning models like **CNNs and LSTMs** for real-time fault prediction, adaptive response, and self-healing capabilities. Integration with **IoT sensors**, **PMUs**, and **cloud-based analytics** will enable scalable, automated, and ultra-fast fault management across modern power networks

REFERENCES

- Fault detection and classification are critical for maintaining the stability and reliability of electrical power systems. When faults like line-to-ground (LG), line-to-line (LL), double line-to-ground (LLG), or three-phase faults (LLL) occur, rapid identification and isolation are essential to prevent cascading failures.

IBM CERTIFICATIONS



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Learning hours: 20 mins

THANK YOU