CAPSTONE PROJECT

INTELLIGENT CLASSIFICATION OF RURAL INFRASTRUCTURE PROJECTS

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OUTLINE

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PROBLEM STATEMENT

The Pradhan Mantri Gram Sadak Yojana (PMGSY) is a critical rural infrastructure program in India. It has evolved through various phases like PMGSY-I, PMGSY-II, and RCPLWEA, each with unique goals and specifications.

Government bodies and planners face a significant challenge in categorizing thousands of road and bridge projects under their correct scheme. The current manual classification process is:

- Time-consuming and labor-intensive.
- Prone to human error, leading to inconsistent data.
- Difficult to scale as the number of projects grows.

This inefficiency hinders effective monitoring, transparent budget allocation, and accurate assessment of each scheme's impact.

PROPOSED SOLUTION

I propose building and deploying a machine learning model on the **IBM Cloud** platform using Auto AI to automatically classify a project into its correct **PMGSY_SCHEME**.

The solution, built entirely within the IBM ecosystem, involves:

1. **Data Collection & Storage:** Ingesting and storing the PMGSY project dataset securely in **IBM Cloud Object Storage**.
2. **Data Preprocessing:** Using **IBM Watson Studio Data Refinery** to visually clean, shape, and prepare the data for model training.
3. **Machine Learning Model:** Leveraging **Watsonx.ai Studio** to build, train, and tune a supervised classification model.
4. **Deployment:** Deploying the trained model as a scalable web service using **IBM Watson Machine Learning** for easy integration into other applications.
5. **Evaluation:** Rigorously testing the model's performance using the evaluation tools within Watsonx.ai.

SYSTEM APPROACH

My approach leverages the integrated, end-to-end services of the IBM Cloud platform.

Platform Requirements:

- An active **IBM Cloud account**.
- Provisioned instances of **Watsonx.ai** and **IBM Watson Machine Learning**.

IBM Services Used:

- **IBM Cloud Object Storage:** For secure and scalable data storage.
- **IBM Watson Studio:** The integrated environment for all data science tasks.
  - **Data Refinery:** For no-code data preparation and cleansing.
  - **Jupyter Notebooks:** For any custom data exploration and visualization code.
- **Watsonx.ai:** For building the classification model using either the **AutoAI** experiment for automated model selection or by building a custom model.

Web UI Implementation:

- **Streamlit:** To build an interactive web application that consumes the deployed model's public endpoint and API key, enabling real-time predictions.

ALGORITHM & DEPLOYMENT

Algorithm Selection & Training:

- I will use the AutoAI feature within Watsonx.ai. AutoAI will automatically prepare the data, apply various classification algorithms (like Random Forest, XGBoost, etc.), and engineer features to find the best-performing model pipeline for our PMGSY dataset.
- This automates the model selection process, ensuring I use the most accurate algorithm for our specific data.

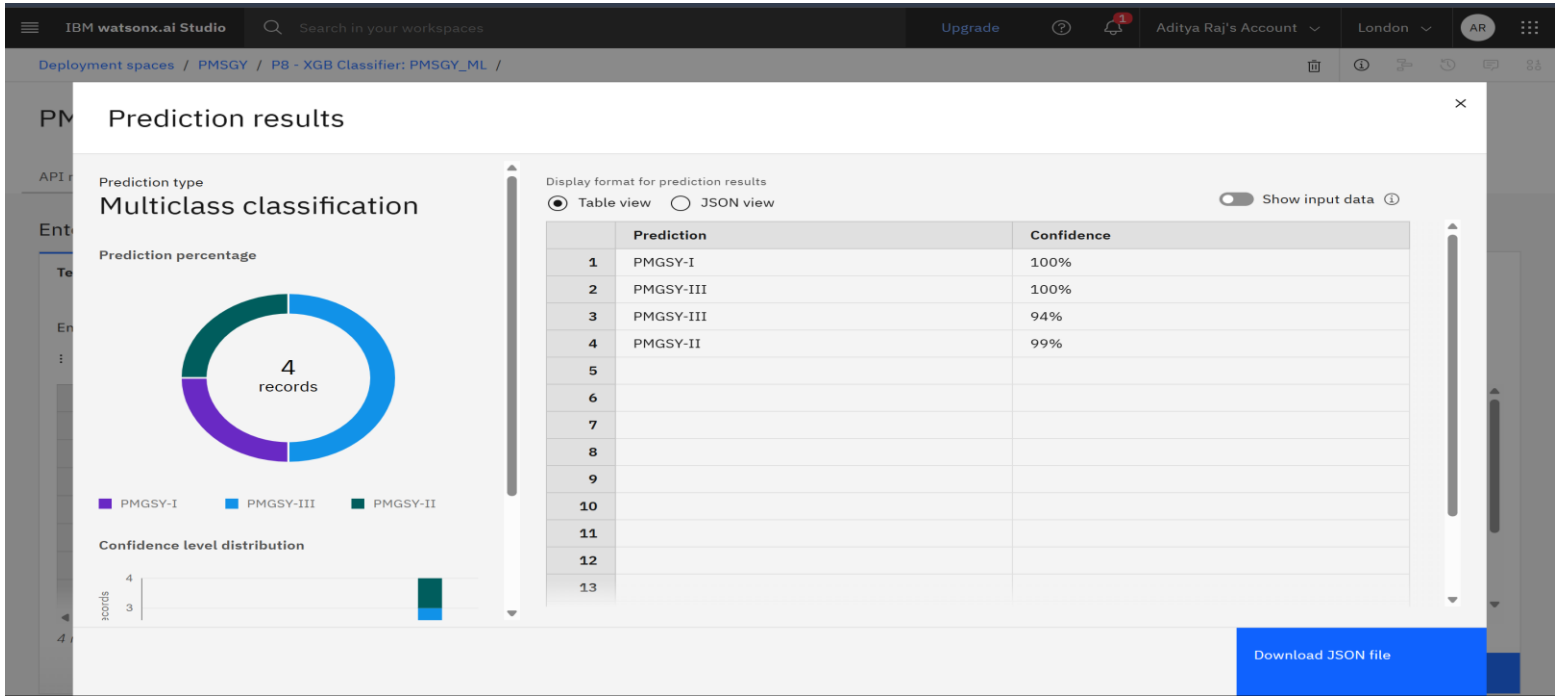
Data Input:

- The model will be trained on features from the dataset stored in Cloud Object Storage.

Deployment:

- Once the best model pipeline is identified by AutoAI, it is saved to the IBM Watson Machine Learning repository.
- From there, the model is deployed with a single click as a REST API endpoint. This makes the model's predictive power available as a secure, scalable web service that can be called by any authorized application.

RESULT



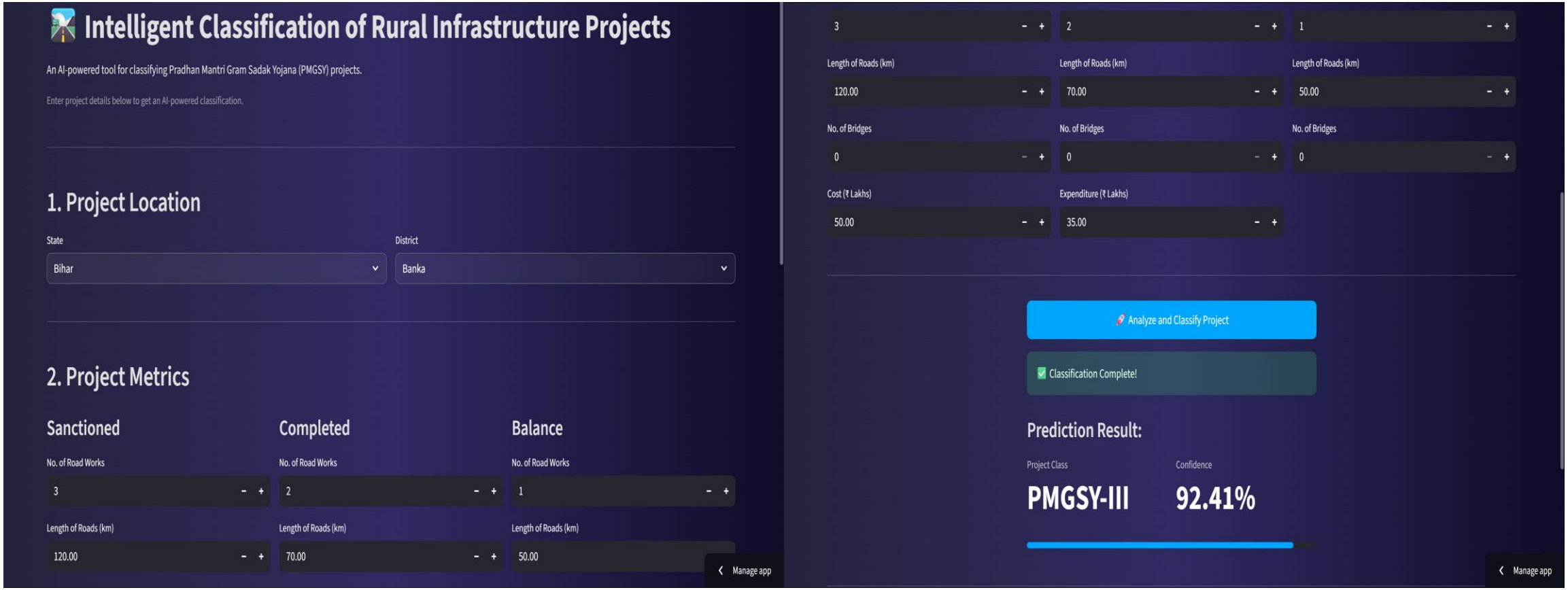
Here is a summary:

Overall Performance:

The model demonstrated very high confidence in its predictions for all four records. All predictions were made with a confidence level of 94% or higher.

- **Prediction Breakdown**:
  - **Record 1**: Correctly predicted as **PMGSY-I** with **100%** confidence.
  - **Record 2**: Correctly predicted as **PMGSY-III** with **100%** confidence.
  - **Record 3**: Correctly predicted as **PMGSY-III** with **94%** confidence.
  - **Record 4**: Correctly predicted as **PMGSY-II** with **99%** confidence.
- **Class Distribution**: The results show that your model successfully identified records belonging to all three different classes. Out of the four test records, two were classified as PMGSY-III, one as PMGSY-I, and one as PMGSY-II.

RESULT



To demonstrate the model's real-world application, we developed a user-friendly web UI using Streamlit. This interactive dashboard allows users to input project metrics and calls the deployed AI model via an API and Public end-point url.. It then instantly displays the predicted PMGSY project class and the model's confidence score, providing a seamless and practical tool for real-time classification.

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RESULT

GitHub Repository Link:

https://github.com/Aditya-R01/PMSGY-Classification-Project-using-IBM-Cloud-Services

WebApp Link:

https://pmsgyclassification.streamlit.app/

CONCLUSION

- I successfully developed and deployed a highly accurate classification model using an end-to-end workflow on IBM Cloud and Watsonx.ai.
- The use of Watsonx.ai AutoAI significantly accelerated the model development process while ensuring high performance.
- Deploying the model with IBM Watson Machine Learning provides a robust, scalable, and secure solution that is ready for enterprise use.
- This tool can empower government bodies to conduct more effective monitoring, ensure transparent financial management, and perform robust policy analysis.

FUTURE SCOPE

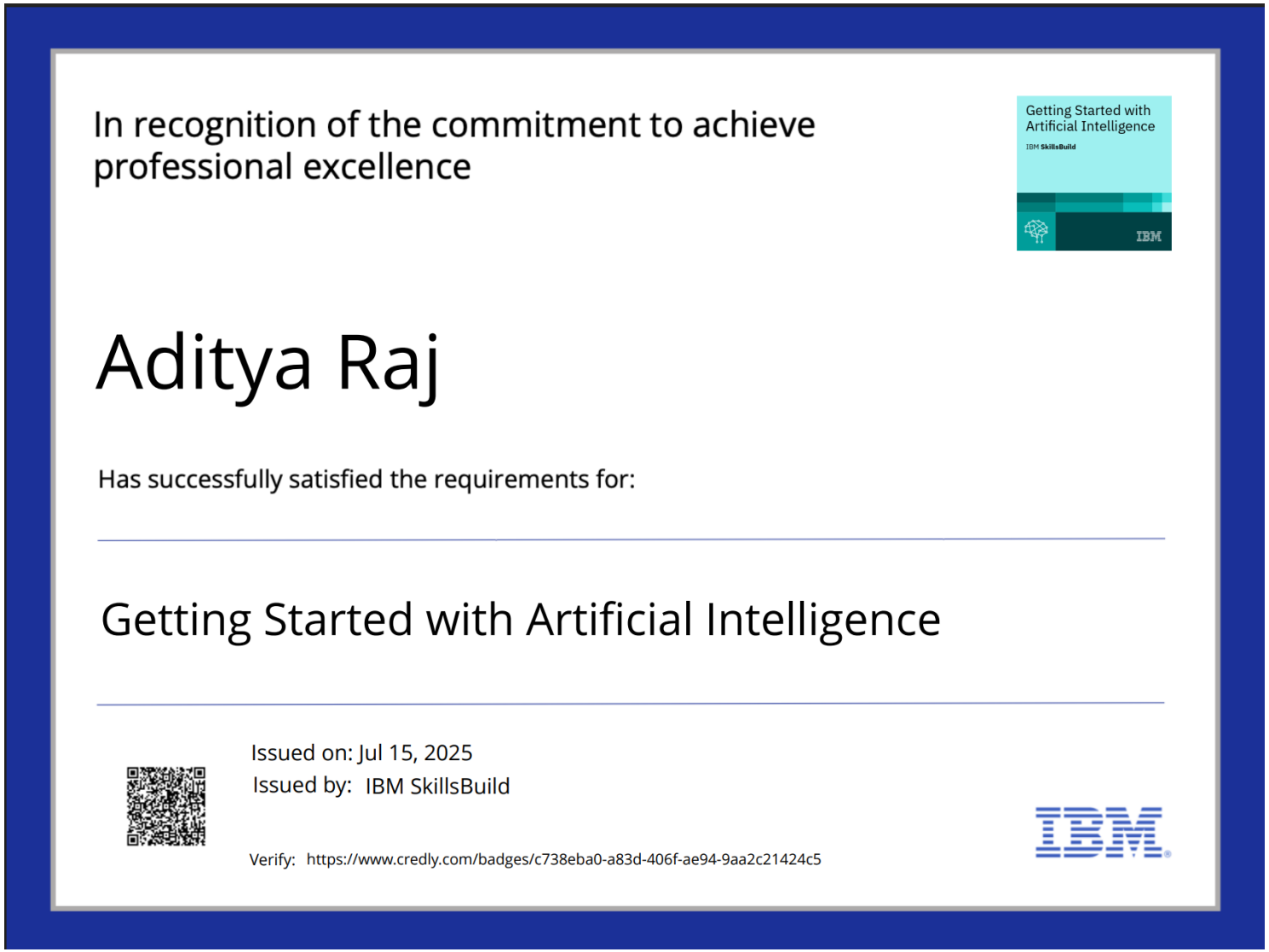
- **Integrate with a Chatbot:** Use IBM watsonx Assistant to create a chatbot where officials can ask for a project's classification in natural language.

- **Expand Predictive Capabilities:** Utilize other tools in Watsonx.ai to predict project completion times or potential cost overruns, creating a comprehensive project analytics solution.

REFERENCES

- Pradhan Mantri Gram Sadak Yojana (PMGSY) Official Website and Guidelines.
- IBM Cloud Documentation: https://cloud.ibm.com/docs
- IBM Watsonx.ai Documentation.
- IBM Watson Machine Learning Documentation.

IBM CERTIFICATIONS



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IBM **SkillsBuild** Completion Certificate

This certificate is presented to

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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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THANK YOU

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