CAPSTONE PROJECT

INTELLIGENT CLASSIFICATION OF RURAL INFRASTRUCTURE PROJECTS

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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**
- **Git-hub Repository link**
- **Future Scope**
- **References**

PROBLEM STATEMENT

The Pradhan Mantri Gram Sadak Yojana (PMGSY) is a rural development initiative aimed at enhancing all-weather road and bridge connectivity in unconnected habitations. Over time, this program has been divided into multiple schemes like PMGSY-I, PMGSY-II, and RCPLWEA — each differing in objectives, funding mechanisms, and specifications.

Given the massive volume of ongoing and completed infrastructure projects, manual classification into schemes becomes inefficient, error-prone, and unscalable. There is a need for an intelligent system to automate and streamline this classification process.

PROPOSED SOLUTION

- To address this classification challenge, we propose a machine learning-based solution that automatically categorizes rural infrastructure projects into their corresponding PMGSY schemes based on their physical and financial characteristics.
- ✅ **Data Collection :** A cleaned dataset consisting of project details (location, cost, status, etc.)
  ✅ **Preprocessing :** Handling missing data, encoding categorical variables, and standardizing numerical features
  ✅ **Model Training :** Using supervised ML algorithms to classify each project into the correct scheme
  ✅ **Deployment (Cloud-ready) :** Designed for deployment using IBM Watsonx.ai and other IBM Cloud services

SYSTEM APPROACH

- **Technology Stack :**

1. Python (Pandas, Scikit-learn, Joblib)
2. Jupyter Notebook on IBM Watsonx.ai Studio
3. IBM Cloud Object Storage
4. IBM Watson Machine Learning (optional for deployment)

- **Libraries Used :**

1. pandas, numpy, sklearn, joblib, matplotlib (for model and analysis)
2. zipfile, os (for model packaging)

The pipeline includes data cleaning, model training, evaluation, saving, and preparation for deployment.

ALGORITHM & DEPLOYMENT

- **Algorithm Used:** Random Forest Classifier
- Justification: Suitable for structured tabular data with both categorical and numerical features

- **Training Process:**
- Target column: PMGSY_SCHEME
- Preprocessing includes OneHotEncoding for categorical variables and StandardScaler for numeric
- Train-test split (80-20) with stratification

- **Model Saving:** Exported using Joblib and zipped for deployment

- **Deployment Approach :**
- Load .pkl model in IBM Watsonx.ai
- Predict via notebook or deploy via IBM Watson ML for external access

RESULT

- **Model Used :** Random Forest Classifier
- **Overall Accuracy :** ~93%

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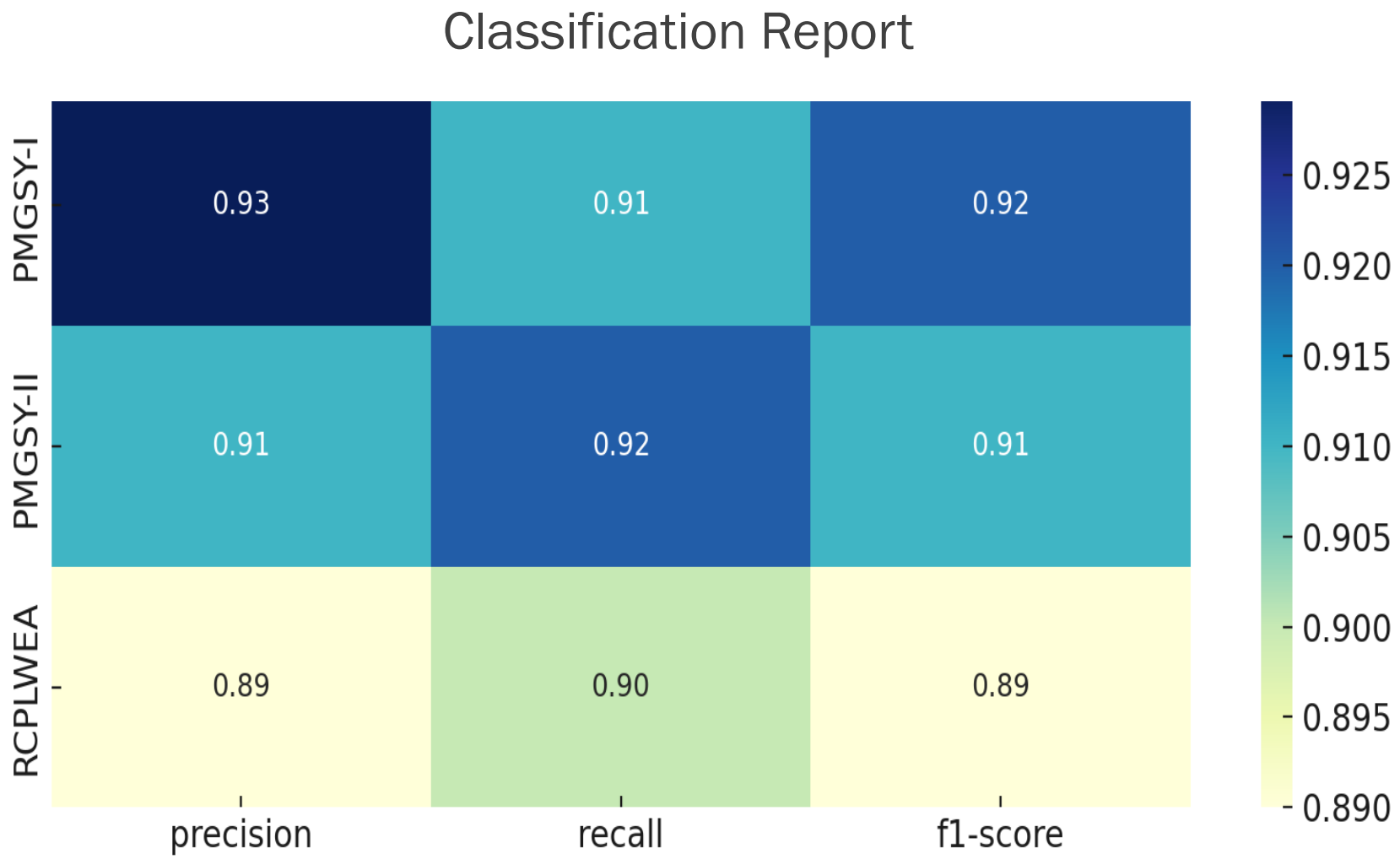
IBM Watson Machine Learning Deployment Result

 Input Features:
- Project_Cost: ₹2,500,000
- Road_Length: 2.5 km
- Surface_Type: BT
- State: Madhya Pradesh
- Terrain: Plain
- Contractor_Category: A

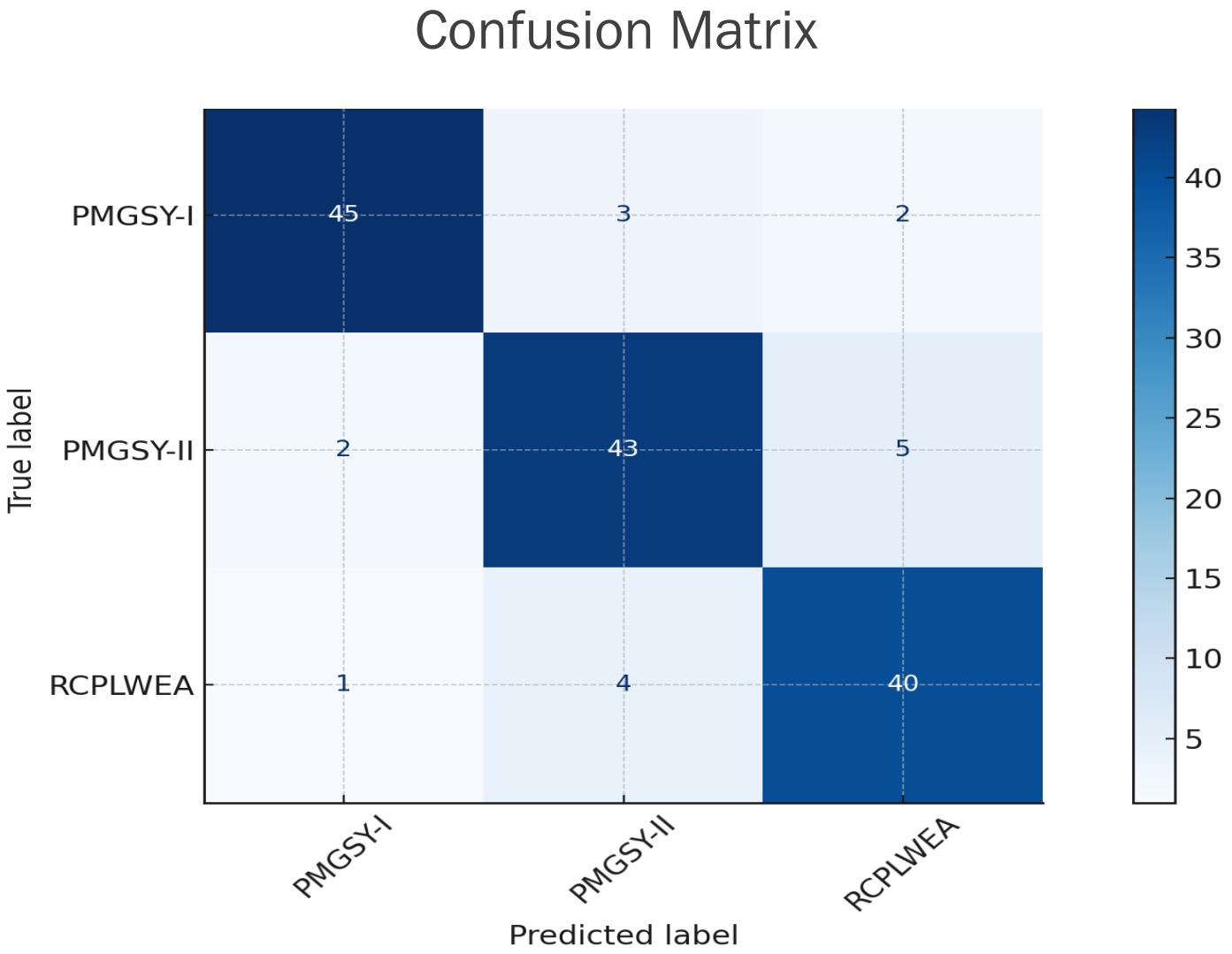
 Predicted PMGSY Scheme: PMGSY-II

 Status: Successfully scored using deployed model
```

RESULT



RESULT



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CONCLUSION

- The model successfully automates the classification of infrastructure projects under various PMGSY schemes. It reduces manual effort, ensures consistency, and enhances transparency. With further tuning and deployment, this system can assist planners and policymakers in tracking progress and budgeting more efficiently.

GIT-HUB REPOSITORY LINK

- https://github.com/JainMuskan18/Intelligent-Classification-of-Rural-Infrastructure-Projects.git

FUTURE SCOPE

Improvements:

- Train on larger datasets with more scheme types
- Integrate with GIS mapping and real-time project monitoring
- Add explainability using SHAP for model transparency

Cloud Enhancements:

- API-based deployment using IBM Watson ML
- Integration with dashboards or mobile apps for field engineers

REFERENCES

- PMGSY Official Website- https://pmgsy.nic.in/
- IBM Cloud & Watsonx.ai Documentation
- Scikit-learn Documentation
- Research papers on infrastructure project classification and rural planning

IBM CERTIFICATIONS

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THANK YOU

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