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# **CAPSTONE PROJECT**

## **INTELLIGENT CLASSIFICATION OF RURAL INFRASTRUCTURE PROJECT UNDER PMGSY**

**Presented By:**

**Student name : PADALA JAYANTH**

**College Name & Department : CENTURION UNIVERSITY OF  
TECHNOLOGY ANAD MANAGEMENT – COMPUTER SCIENCE  
ENGINEERING**

# OUTLINE

- Problem Statement
- Technology used
- Wow factor
- End users
- Result
- Conclusion
- Git-hub Link
- Future scope
- IBM Certifications

# PROBLEM STATEMENT

The Pradhan Mantri Gram Sadak Yojana (PMGSY) is a flagship Indian Government scheme aimed at developing rural road infrastructure to ensure all-weather connectivity to unconnected villages.

Over time, the PMGSY scheme has evolved into multiple phases:

PMGSY-I, PMGSY-II, RCPLWEA, etc.

Each of these sub-schemes has unique objectives, funding rules, technical specifications, and monitoring protocols.

## **Key Problem:**

Thousands of road and bridge construction projects need to be classified into the correct scheme. Manual classification is:

Time-consuming

Error-prone

Not scalable

## **Proposed Solution:**

To solve this challenge, we developed a machine learning model using IBM AutoAI that takes project characteristics (length, cost, duration, etc.) and predicts the appropriate PMGSY scheme. This automates classification and speeds up decision-making in government departments.

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# TECHNOLOGY USED

- **IBM Watson Studio** – for AutoAI model building
- **IBM AutoAI** – for automated machine learning pipeline generation
- **IBM Cloud Object Storage** – for uploading and managing datasets
- **IBM Watson Machine Learning** – for model deployment and serving
- **Dataset Source** – [AI-KOSH Dataset for PMGSY](#)

# IBM CLOUD SERVICES USED

The following IBM Cloud services were used to implement this solution:

## 1. Watson Studio

Provides a Jupyter Notebook and AutoAI interface for developing and evaluating machine learning models.

## 2. AutoAI

AutoAI automatically:

- Preprocesses the data
- Selects suitable ML algorithms
- Performs hyperparameter optimization
- Ranks models based on accuracy and other metrics

## 3. Cloud Object Storage

Used to upload and store the .csv dataset containing project data.

## 4. Watson Machine Learning (WML)

Used to deploy the trained model as an API for real-world inference and integration into apps or dashboards.

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# WOW FACTORS

What makes this project innovative and impactful?

Auto-classification of infrastructure projects with high accuracy

Uses AutoAI – no manual code needed for model selection or optimization

Reduces classification time from hours to seconds

Enhances transparency and accuracy in fund allocation under PMGSY

Can be deployed as a REST API for integration into government dashboards

Model is continuously improvable with new data

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## END USERS

This AI-based classification model can be used by:

- **Government Planning Officers** – For monitoring and scheme assignment
- **Rural Development Department Officials** – To track compliance and progress
- **Data Analysts in Public Sector** – For visualizing and reporting on infrastructure projects
- **MIS Dashboard Developers** – To integrate predictions into real-time decision systems

# RESULTS

## CREATING WATSONX.AI STUDIO

The screenshot shows the IBM Cloud catalog page for WatsonX AI Studio. The browser address bar displays `cloud.ibm.com/catalog/services/watsonxai-studio`. The page header includes the IBM Cloud logo, a search bar, and navigation links for Catalog, Manage, and the user's account (padala jayanth's Account). The main content area is titled "watsonx.ai Studio" and includes a description: "(Formerly known as Watson Studio) Develop powerful AI solutions with an integrated collaborative studio and industry-standard APIs and SDKs." Below this, there are tabs for "Create" and "About". The "Create" tab is active, showing a form to select a location and a pricing plan. The location dropdown is set to "Sydney (au-syd)". The pricing plan section shows a table with two plans: "Lite" and "Free". The "Lite" plan is selected, showing features like 1 authorized user, 10 capacity unit-hours monthly limit, and environment details. The "Free" plan is also shown with a checkmark. On the right side, there is a "Summary" section with details about the service, including location, plan, service name, and resource group. At the bottom right, there is a "Create" button and a link to "Add to estimate".

Summary

**watsonx.ai Studio** Free

Location: Sydney (au-syd)  
Plan: Lite  
Service name: watsonx.ai Studio-3c  
Resource group: Default

☒ I have read and agree to the following license agreements:  
[Terms](#)

**Create**

[Add to estimate](#)

Plan	Features and capabilities	Pricing
Lite	1 authorized user 10 capacity unit-hours monthly limit Environment = # of capacity units required per hour • 1 vCPU + 4 GB RAM = 0.5 • 2 vCPU + 8 GB RAM = 1 • 4 vCPU + 16 GB RAM = 2	Free



# RESULTS

## CREATING A PROJECT IN WATSONX AI

← → ↻ au-syd.dai.cloud.ibm.com/projects/new-project?context=cpdaas ☆ ⚙️ Verify it's you

📁 Gmail 📺 YouTube 📍 Maps 🚀 Create Auto Scaling... 📁 Volumes | EC2 Man... 📁 All Bookmarks

☰ IBM watsonx.ai Studio 🔍 Search in your workspaces Upgrade ⓘ 🔔 padala jayanth's Account ▾ Sydney ▾ 👤

### Create a project

Start with a new, blank project or select from where to import an existing project.

+ New

📁 Local file

📄 Sample

#### Define details

Name

AI\_RURAL INFRASTRUCTURE

Description (optional)

What's the purpose of this project?

Tags (optional)

Add tags

Add tags to make projects easier to find. To add tags, separate them with commas and press Enter.

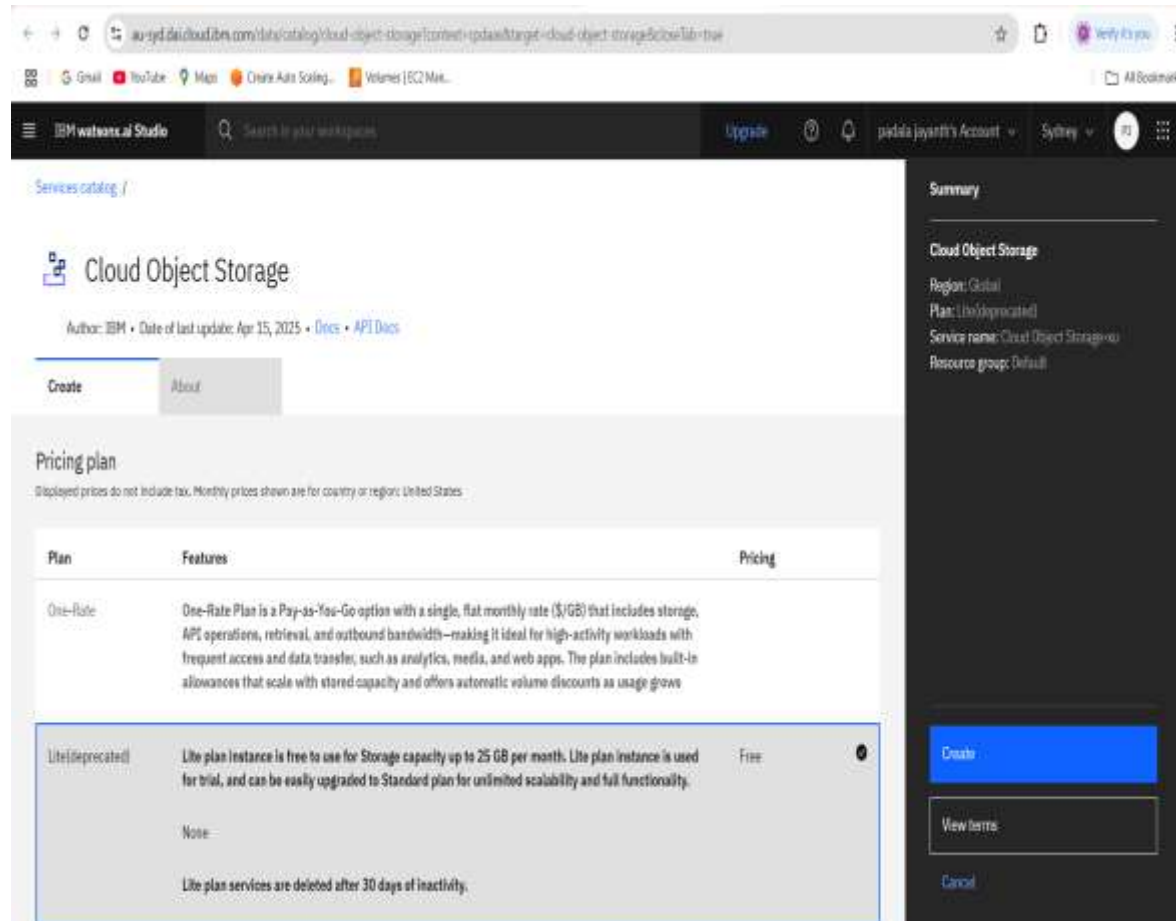
Define storage

Cancel

Create

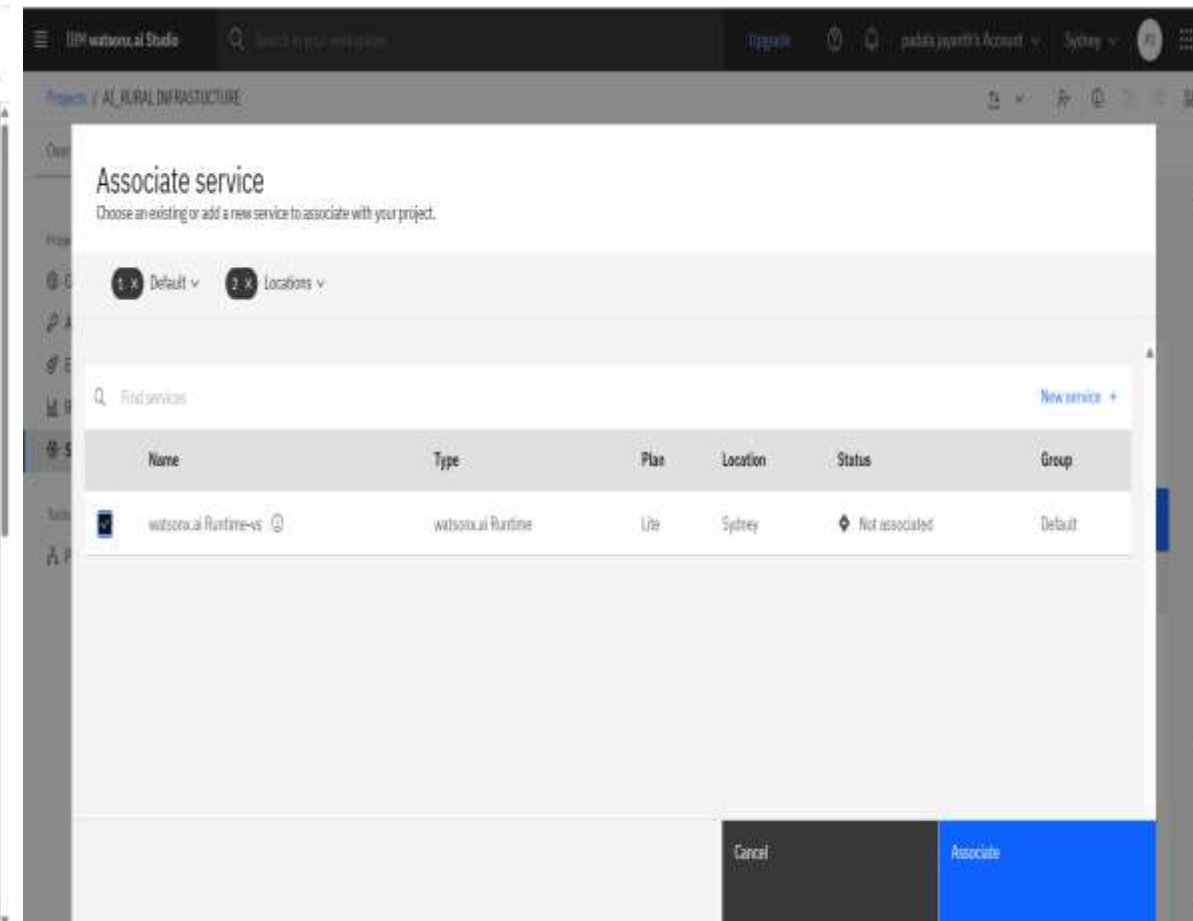
# RESULTS

## CREATING CLOUD STORAGE OBJECT & ASSOCIATE SERVICE



The screenshot shows the IBM Watson AI Studio interface for the Cloud Object Storage service. The page is titled "Cloud Object Storage" and includes a "Create" button. A "Pricing plan" section is visible, showing a table with two plans: "One-Rate" and "Lite(deprecated)". The "Lite(deprecated)" plan is highlighted, showing it is free and includes storage capacity up to 25 GB per month. A "Summary" sidebar on the right lists details: Region: Global, Plan: Lite(deprecated), Service name: Cloud Object Storage-v0, and Resource group: Default. At the bottom of the sidebar are "Create", "View terms", and "Cancel" buttons.

Plan	Features	Pricing
One-Rate	One-Rate Plan is a Pay-as-You-Go option with a single, flat monthly rate (\$/GB) that includes storage, API operations, retrieval, and outbound bandwidth—making it ideal for high-activity workloads with frequent access and data transfer, such as analytics, media, and web apps. The plan includes built-in allowances that scale with stored capacity and offers automatic volume discounts as usage grows.	
Lite(deprecated)	Lite plan instance is free to use for Storage capacity up to 25 GB per month. Lite plan instance is used for trial, and can be easily upgraded to Standard plan for unlimited scalability and full functionality.  Note:  Lite plan services are deleted after 30 days of inactivity.	Free

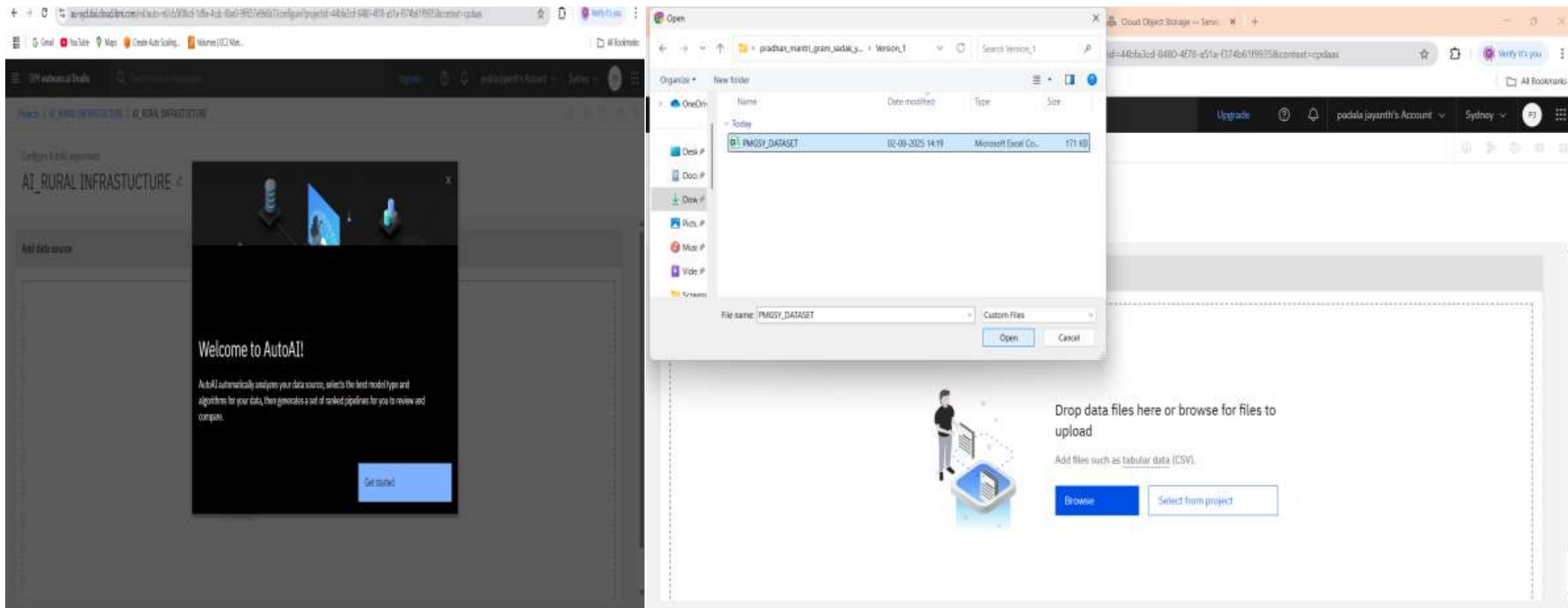


The screenshot shows the "Associate service" dialog in IBM Watson AI Studio. The dialog prompts the user to "Choose an existing or add a new service to associate with your project." It displays a table of existing services. The table has columns: Name, Type, Plan, Location, Status, and Group. One service is listed: "watsonai Runtime-v0" with Type "watsonai Runtime", Plan "Lite", Location "Sydney", Status "Not associated", and Group "Default". At the bottom right are "Cancel" and "Associate" buttons.

Name	Type	Plan	Location	Status	Group
watsonai Runtime-v0	watsonai Runtime	Lite	Sydney	Not associated	Default

# RESULTS

## AUTO AI & UPLOAD DATASET



# RESULTS

## CREATING USER API

← → ↺

au-syd.dai.cloud.ibm.com/settings/user-api-key?context=cpdaas

☆

🏠

Verify it's you

⋮

🗄️

Gmail

YouTube

Maps

Create Auto Scaling...

Volumes | EC2 Man...

All Bookmarks

☰ IBM watsonx.ai Studio

🔍 Search in your workspaces

Upgrade

?


🔔

padala jayanth's Account ▾

Sydney ▾

P3

⋮



padala jayanth

padalajayanth1234@gmail.com

[Edit IBMid profile](#)

Dark theme off

☐

Profile

Git integrations

User API key

✔ User API key is successfully created.

Your new key is stored in IBM watsonx.ai Studio and IBM Cloud.

✕

User API key

A user API key is required to authenticate runtime operations in IBM watsonx.ai Studio.  
Rotate keys as needed to create a new key and phase out the current key. [Learn more](#)

🗑️

Rotate

🔄

?

Name	Creation date	Status
cpd-apikey-IBMid-6970010DVF-2025-08-02T09:01:19Z	August 2, 2025 at 2:31:19 PM	✔ Active

# RESULTS

## ■ SELECTING PREDICTING COLUMN:-PMGSY\_SCHEME

The screenshot displays the IBM Watsonx.ai Studio interface for configuring an AutoAI experiment. The browser address bar shows the URL: `au-syd.dai.cloud.ibm.com/ml/auto-ml/cb5f08cd-1d9a-4cdc-8be0-9ff657e9b6b7/configure?projectId=44bfa3cd-8480-4f78-a51a-f374b61f9935&context=cpdaas`. The interface includes a top navigation bar with the IBM Watsonx.ai Studio logo, a search bar, and user account information (padala jayanth's Account, Sydney). The main content area is titled "Configure AutoAI experiment" and "AI\_RURAL INFRASTRUCTURE".

On the left, a file upload section titled "Add files such as tabular data (CSV)." contains a "Browse" button and a "Select from project" button. Below this, a file named "PMGSY\_DATASET.csv" is listed with a size of 170.49 KB and 15 columns.

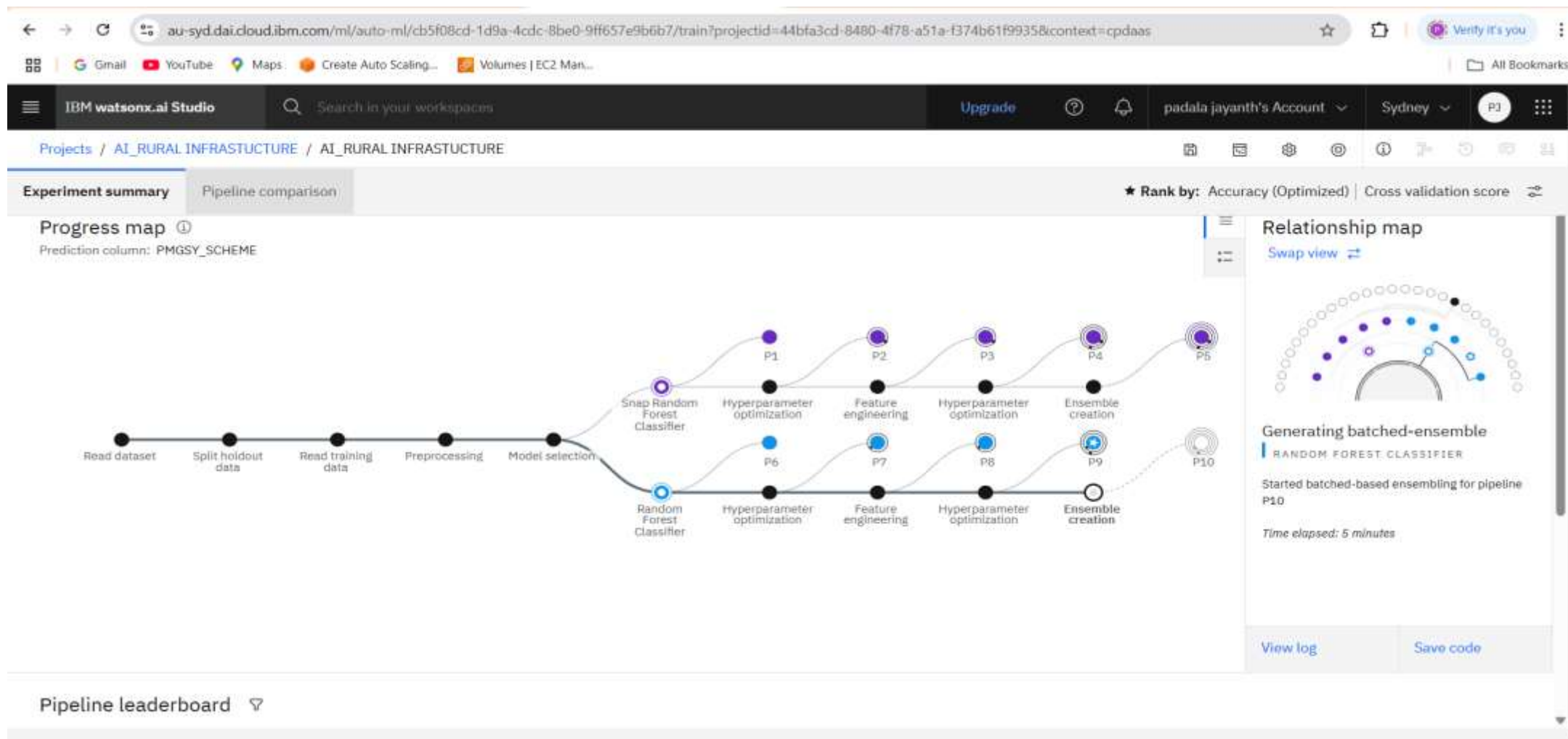
The main configuration area on the right includes the following options:

- Create a time series analysis?** (Enable this option to predict future activity over a specified date/time range. Data must be structured and sequential. [Learn more](#)) with "Yes" and "No" buttons.
- What do you want to predict?** (Prediction column ⓘ)
- Prediction column:** PMGSY\_SCHEME
- PREDICTION TYPE:** Multiclass Classification
- OPTIMIZED FOR:** Accuracy & run time
- CUH remaining:** 20 CUH

At the bottom, there is a "Run experiment" button and a link to "Experiment settings".

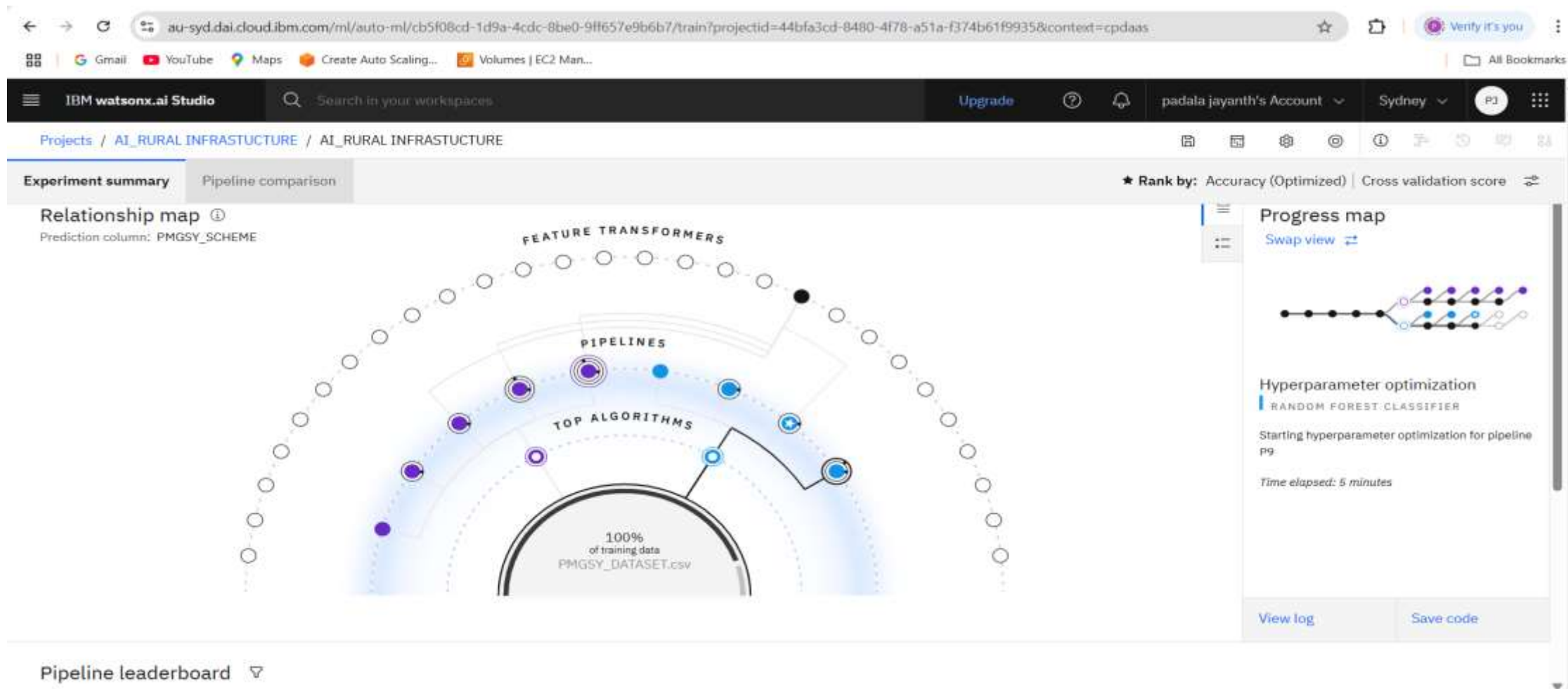
# RESULTS

## ■ RELATIONSHIP MAP



# RESULTS

## ■ PROGRESS MAP









# RESULTS

## PIPELINE LEADER BOARD

Pipeline leaderboard ▾

	Rank ↑	Name	Algorithm	Specialization	Accuracy (Optimized) Cross Validation	Enhancements	Build time
★	1	Pipeline 10	 Batched Tree Ensemble Classifier (Random Forest Classifier)	INCR	0.902	HPO-1 FE HPO-2 BATCH	00:00:53
	2	Pipeline 9	 Random Forest Classifier		0.902	HPO-1 FE HPO-2	00:00:49
	3	Pipeline 8	 Random Forest Classifier		0.902	HPO-1 FE	00:00:34
	4	Pipeline 5	 Batched Tree Ensemble Classifier (Snap Random Forest Classifier)	INCR	0.899	HPO-1 FE HPO-2 BATCH	00:01:28



# RESULTS

## DEPLOYED MODEL

The screenshot displays the IBM watsonx.ai Studio interface. The browser address bar shows the URL: `au-syd.dai.cloud.ibm.com/ml-runtime/models/3d043ea9-e215-4c5b-a698-dec0b70c41ec/deployments?space_id=2468ffb2-2f15-4e6c-8e61-945752fd5c84&context=cpdaas&dep...`. The page header includes the IBM watsonx.ai Studio logo, a search bar, and user account information for 'padala jayanth's Account' in 'Sydney'. The breadcrumb navigation shows the path: 'Deployment spaces / RURAL\_AI 1 / P10 - Random Forest Classifier: AI\_RURAL INFRASTRUCTURE'. The main content area is divided into two tabs: 'Deployments' (active) and 'Model details'. The 'Deployments' tab contains a table with one deployment entry:

Name	Type	Status	Tags	Last modified
AI_RURAL	Online	Deployed	Add tags +	23 seconds ago padala jayanth (You)

At the bottom of the table, it indicates 'Items per page: 20' and '1-1 of 1 items'. On the right side, the 'About this asset' panel is open, showing details for the deployment:

- Name:** P10 - Random Forest Classifier: AI\_RURAL INFRASTRUCTURE
- Description:** No description provided.
- Asset Details:**
  - Type: wml-hybrid\_0.1
  - Model ID: 3d043ea9-e215-4c...
  - Software specification: hybrid\_0.1
  - Hybrid pipeline software specifications: autoai-kb\_rt24.1-py3.11
- Tags:** Add tags to make assets easier to find.
- Source asset details:** (collapsed)
- Last modified:** 2 minutes ago by Service

# RESULTS

## PREDICTION RESULTS

The screenshot displays the IBM watsonx.ai Studio interface. The top navigation bar includes the logo, a search bar, and an 'Upgrade' button. The breadcrumb trail indicates the current workspace: 'Deployment spaces / RURAL\_AI\_1 / P10 - Random Forest Classifier: AI\_RURAL\_INFRASTRUCTURE /'. The main panel is titled 'Prediction results' and features a 'Display format for prediction results' section with 'Table view' selected and 'JSON view' as an alternative. A 'Show input data' toggle is also present. The results are presented in a table with 8 columns: 'prediction', 'probability', 'STATE\_NAME', 'DISTRICT\_NAME', 'NO\_OF\_ROAD\_WORK\_SANC', 'LENGTH\_OF\_ROAD\_WORK\_', and 'NO\_OF\_BRIDGES'. The first row shows a prediction of 'PMGSY-I' with a probability of '[0,1,0,0,0]' for 'ANDHRA PRADESH' in 'ANATAPUR', with 619 road work sanctions, a length of 2169.505, and 35 bridges. A 'Download JSON file' button is located at the bottom right of the results area. A floating notification box in the top right corner lists two JSON files: 'AI\_RURAL\_test\_result (1).json' (160 B, 4 minutes ago) and 'AI\_RURAL\_test\_result.json' (194 B, 7 minutes ago).

IBM watsonx.ai Studio

Deployment spaces / RURAL\_AI\_1 / P10 - Random Forest Classifier: AI\_RURAL\_INFRASTRUCTURE /

### Prediction results

Display format for prediction results

☒ Table view ☐ JSON view

☒ Show input data ⓘ

	prediction	probability	STATE_NAME	DISTRICT_NAME	NO_OF_ROAD_WORK_SANC	LENGTH_OF_ROAD_WORK_	NO_OF_BRIDGES
1	PMGSY-I	[0,1,0,0,0]	ANDHRA PRADESH	ANATAPUR	619	2169.505	35
2							
3							
4							
5							
6							
7							
8							
9							

Download JSON file

AI\_RURAL\_test\_result (1).json  
160 B • 4 minutes ago

AI\_RURAL\_test\_result.json  
194 B • 7 minutes ago

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## CONCLUSION

This project solves a real-world problem using the power of AI and IBM Cloud services.

- It automates a complex classification task
- Ensures government schemes are accurately tracked and managed
- Reduces errors and manual workload
- Scales easily to thousands of new infrastructure records

The approach demonstrates the value of combining open government data with enterprise-grade cloud AI tools like AutoAI.

# FUTURE SCOPE

- **Add Location Features:** Include GPS coordinates for better regional prediction
- **Time-Series Integration:** Track how schemes evolve across time
- **Explainable AI (XAI):** Add interpretability for planners
- **Integration with GIS/MIS Tools:** Real-time visualization and alerts
- **Scale to Other Schemes:** Adapt model for Pradhan Mantri Awas Yojana, Jal Jeevan Mission,

# IBM CERTIFICATIONS

## GETTING STARTED WITH AI

In recognition of the commitment to achieve  
professional excellence



**Padala Jayanth**

Has successfully satisfied the requirements for:

**Getting Started with Artificial Intelligence**



Issued on: Jul 16, 2025  
Issued by: IBM SkillsBuild

Verify: <https://www.credly.com/badges/eaca77e8-4e0c-4e08-9115-6027dcd35415>



# JOURNEY TO CLOUD

In recognition of the commitment to achieve  
professional excellence



## Padala Jayanth

Has successfully satisfied the requirements for:

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### Journey to Cloud: Envisioning Your Solution

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Issued on: Jul 18, 2025

Issued by: IBM SkillsBuild

Verify: <https://www.credly.com/badges/40c1ac7e-2108-455f-8f76-3de5b0ecdfe1>



# RAG WITH LANGCHAIN CERTIFICATE



## GITHUB LINK

- GITHUB LINK :- [padalajayanth/RURAL\\_INFRASTRUCTURE\\_PMGSY](https://github.com/padalajayanth/RURAL_INFRASTRUCTURE_PMGSY)





**THANK YOU**