GEOSPATIAL REMOTE SENSING PLATFORM FOR ENVIRONMENTAL MONITORING AND ANALYSIS

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Team Members:

- Swapnil Gupta (2101640100269)
- Tanmay Gupta (2101640100271)
- Tanya Tiwari (2101640100273)
- Varini Awasthi (2101640100281)
- Yashika Vaish (2101640100289)

Supervisor:
Dr. Mohit Kumar Pandey
(Associate Professor)

AGENDA

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PROBLEM

In today's rapidly urbanizing world, environmental challenges such as climate change, deforestation, and biodiversity **loss are intensifying.**

There are few to no advanced, unified platforms for satellite image analytics.

Current solutions lack

- **Integration**
- **Accessibility**

PAIN POINTS

- **No Unified Solution for Image-Based Insights:** Current platforms rarely support seamless image upload with automated analysis.
- **Lack of Custom Analysis:** Existing solutions lack flexibility to adapt analyses for specific regional or environmental needs
- **Limited User-Friendly Interface**: Current platforms do not have user-friendly interface, limiting accessibility for policymakers, researchers, and environmentalists.

OUR SOLUTION

- Comprehensive Remote Sensing Platform that includes **tools for analysis.**
- **Intuitive Interface**, designed for non-experts to access and analyze environmental data.
- Integration of **machine learning models** and **image processing** for insights
- Easy-to-access **Cloud-Based** Infrastructure

ARCHITECTURE

ML Pipeline Architecture

Data Ingestion → Preprocessing → Model Inference → Postprocessing → Results Storage

WebApp Microservices Architecture

1. API Gateway Service
2. Data Processing Service
3. ML Model Service
4. Visualization Service

SYSTEM ARCHITECTURE

(Technical Overview)

ML Processing Layer
- Model serving infrastructure
- Real-time inference
- Batch processing

image data or a reference
(cloud storage link)

HTTP request

uploading images, requesting processed results, or fetching visualization data.

Saves model outputs

Raw data and cached inputs

Backend Layer
- API Gateway
- Data processing pipeline

Frontend Layer
- React/Next.js
- Visualization components

Processed Result

Database Queries

Retreival

Data Storage Layer
- Cloud storage
- Caching
- Database systems

(Triggers real-time inference or batch processing)

(File Storage & Retrieval)

Model Outputs: segmentation masks, classification results

CURRENT PROGRESS

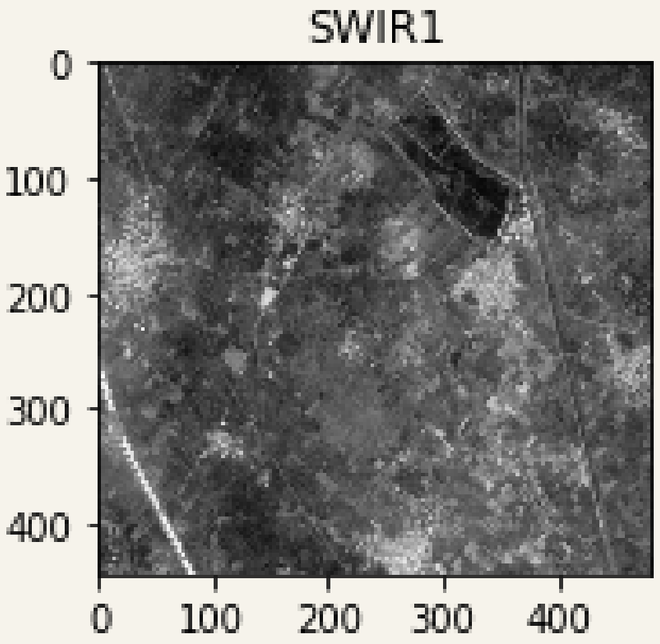
Models Developed:

- Forest Area Segmentation – Identifying forest Area
- Deforested Area Detection
- Water Bodies and costal Area Detection
- Road Segmentation – Extracting road networks.
- Infrastructure Classification – Identifying built-up areas.
- Image Scene Classification – Classifying geographical scenes.

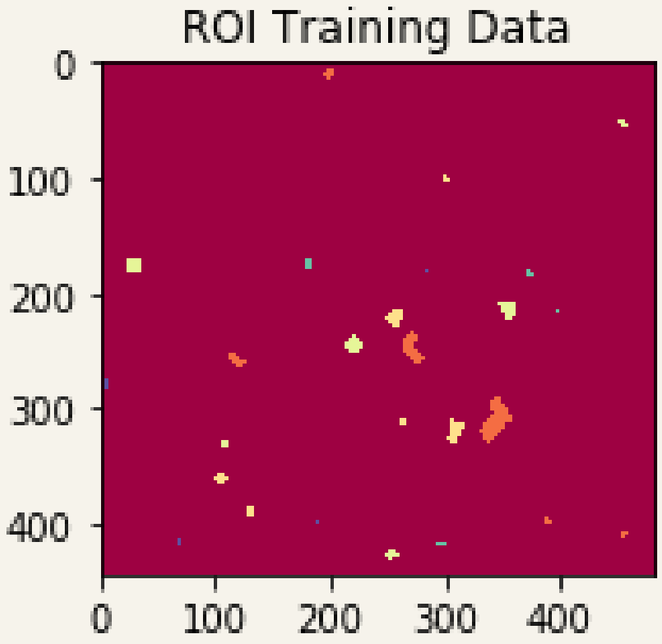
Dataset: Kaggle, GitHub, OpenStreetMap, Sentinel-1 (Satellite Images)

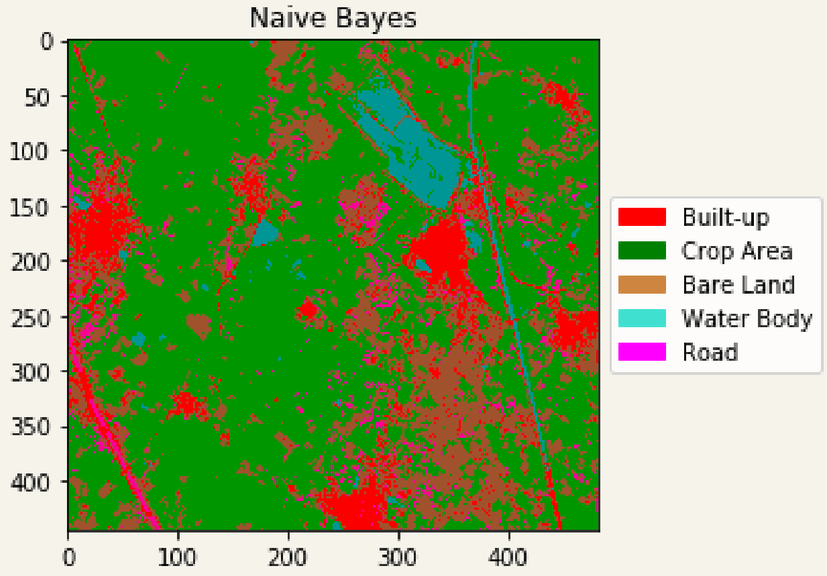
Results from these Models

- Infrastructure Classification
- Water Bodies and costal Area Detection
- Forest Area Segmentation



(input image)

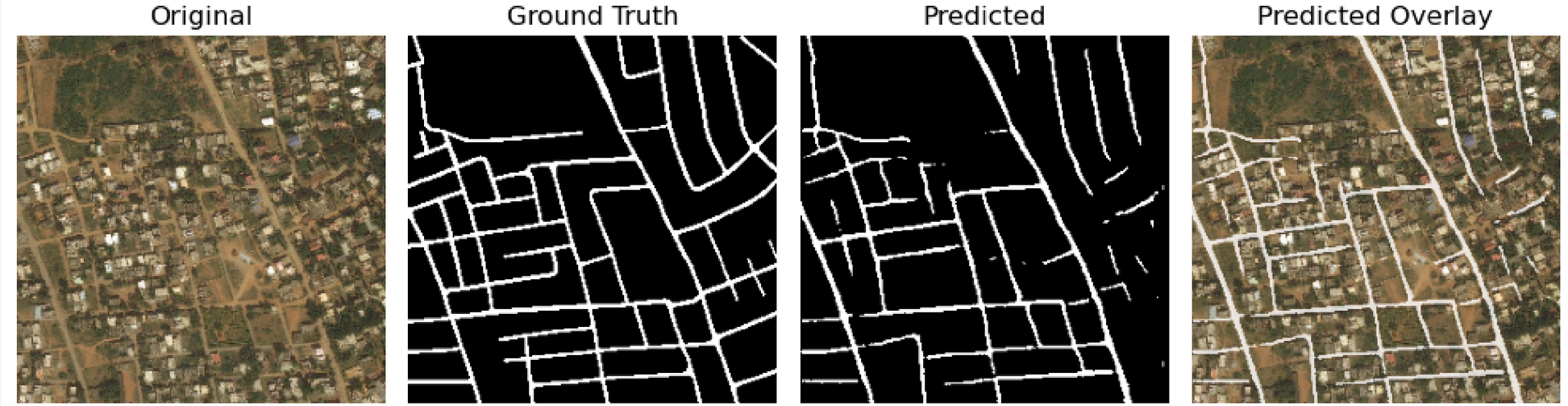




(output mask)

Results from Road Nextrowk Extraction

- Dataset imported from Kaggle

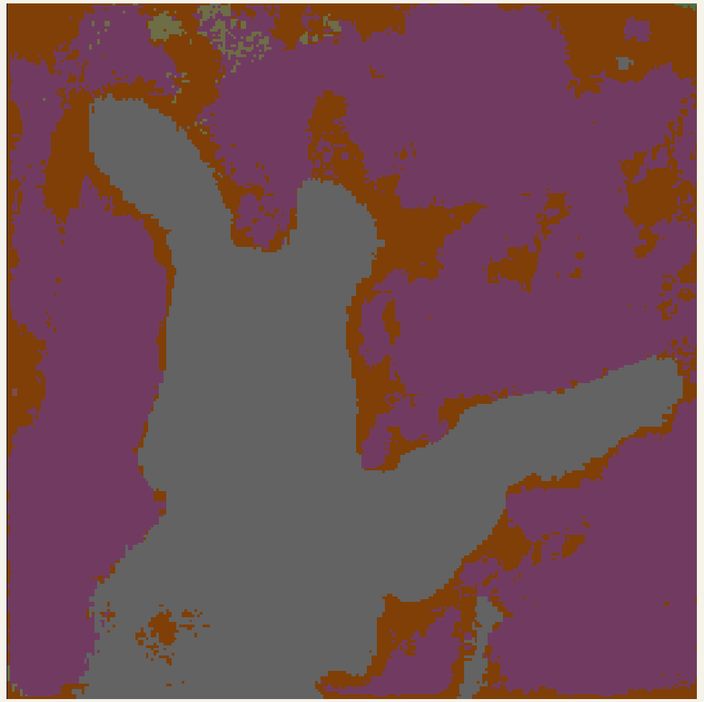


(input image) (road extraction) (predicted mapping) (Predicted Overlay)

Results from Deforestation Detection Model -

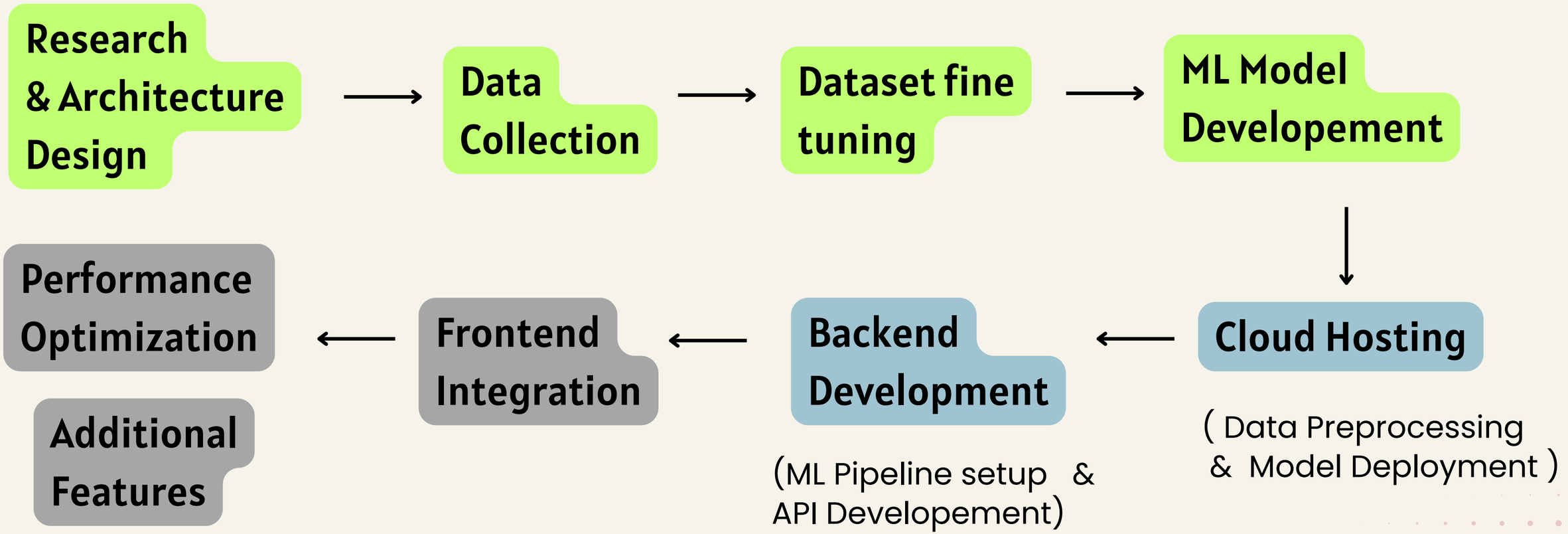
- Pixel count of forest class is 20437
- The forested area is 31.18% and deforested area is 68.82%

(input image)



(output mask)

DEVELOPMENT ROADMAP



FUTURE SCOPE

- Adding new features, such as more visualization options, customizable parameters, or additional datasets.

- To integrate more Machine Learning model for harnessing the results to draw the inference and predict the putcomes such as floods, droughts etc.

- To enhance the efficiency, speed, and accuracy of the entire ML pipeline, focusing on real-time responsiveness and scalability.

THANK YOU