Machine learning based approach to analyzing potential growth patterns of Rajpipla

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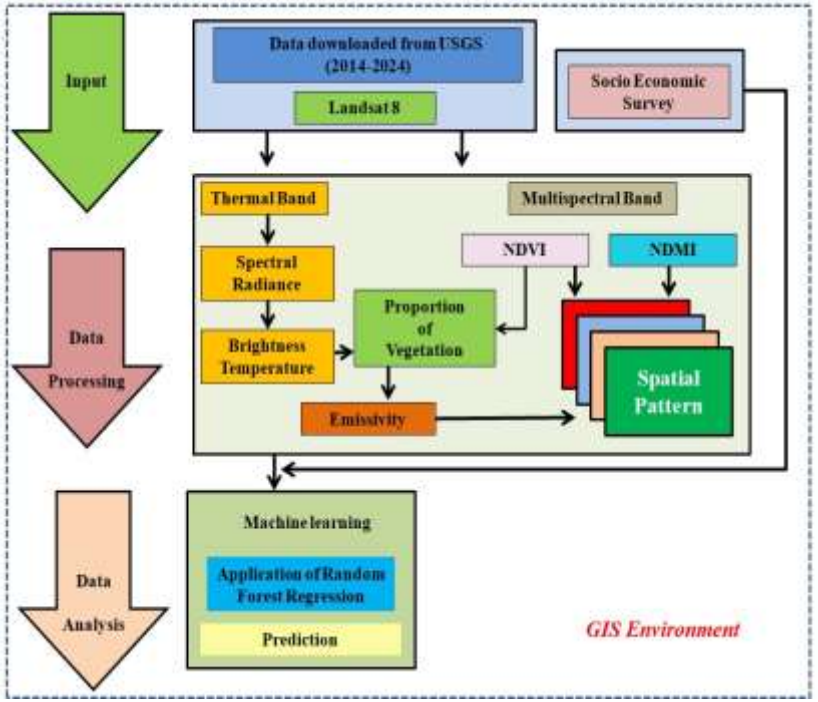
02 DEC 2024 to 02 April 2025

OBJECTIVES:

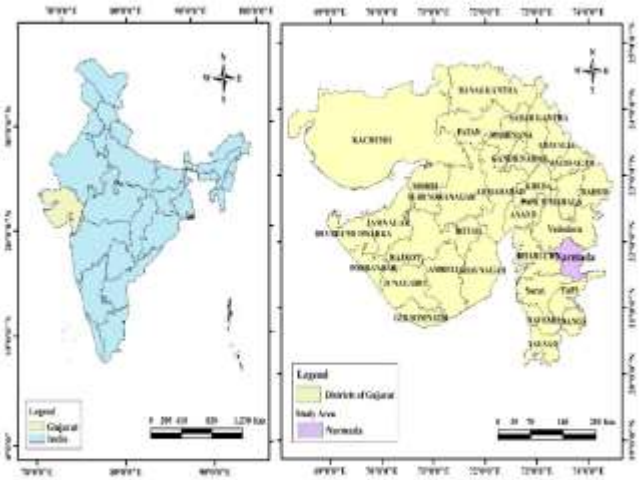
- This study aims to assess the land use and environmental changes in Rajpipla using remote sensing and machine learning techniques. It investigates seasonal variations in vegetation (NDVI), moisture (NDMI), and surface temperature (LST) from 2014 to 2024. It integrates socio-economic surveys to examine the impacts of rapid tourism-led urbanization. The objective is to develop predictive models to support sustainable development in ecologically sensitive areas.

METHODOLOGY FLOW CHART:



RESULTS:

- The study revealed rapid urban expansion in Rajpipla due to tourism development, leading to notable environmental changes. Land Surface Temperature (LST) rose significantly in built-up areas, especially during summer, with values exceeding 50°C. Vegetation health (NDVI) and moisture levels (NDMI) declined in dry seasons, while monsoon brought temporary recovery. Spatial patterns confirmed the emergence of urban heat islands and vegetation stress zones.
- Random Forest Regression models accurately predicted LST using NDVI and NDMI as key predictors. Survey results indicated increased employment in tourism but also highlighted land displacement and affordability issues.
- Environmental degradation was reported, including deforestation and reduced groundwater retention. The integrated analysis emphasized the urgent need for sustainable, moisture-sensitive, and inclusive urban planning.



CONCLUSION:

✓ This study reveals a strong inverse relationship between vegetation/moisture indices (NDVI/NDMI) and LST, confirming urban-induced heat intensification. Rapid infrastructure growth around the Statue of Unity has led to ecological stress and displacement. Random Forest models proved effective for prediction and scenario analysis. Sustainable planning integrating community insights and environmental data is crucial for Rajpipla's future.