LAND USE AND LAND COVER CLASSIFICATION USING MACHINE LEARNING MODELS

Baton Rouge is experiencing rapid urbanization and environmental changes, creating a critical need for precise land use and land cover (LULC) classification to support sustainable urban development and resource management. Traditional LULC classification methods can be labor-intensive and may lack the necessary accuracy for effective decision-making in rapidly evolving urban settings.

This project aims to implement a supervised image classification framework using 2024 Sentinel-2 imagery to accurately classify LULC types in part of Baton Rouge into three main classes, built_up area, bare_lands and waterbodies. By employing Random Forest, Support Vector Machine (SVM), Classification and Regression Trees (CART) and XGBoost models, this study will evaluate the predictive power of each model. The classification will leverage Sentinel-2 bands, specifically:

1. 10 m resolution bands: Band 2 (Blue), Band 3 (Green), Band 4 (Red), and Band 8 (NIR).
2. 20 m resolution bands: Band 5 (Vegetation red edge 1), Band 6 (Vegetation red edge 2), Band 7 (Vegetation red edge 3), Band 8A (Narrow NIR), Band 11 (SWIR 1), and Band 12 (SWIR 2).

Additionally, calculated indices such as NDVI (Normalized Difference Vegetation Index), NDWI (Normalized Difference Water Index), and NDBI (Normalized Difference Built-up Index) will be incorporated as predictors.

The objectives of this project are:

1. To preprocess Sentinel-2 imagery and extract relevant features, including spectral bands and calculated indices (NDVI, NDWI, and NDBI), as input predictors.
2. To develop and train Random Forest, SVM, CART, and XGBoost models for accurate classification of distinct land use types.
3. To compare model performance regarding accuracy, computational efficiency, and robustness for LULC classification in Baton Rouge.
4. To analyze spatial patterns in the classified LULC types to gain insights into urban development and environmental characteristics of the region.

This comparative analysis of machine learning models will contribute to advancing remote sensing applications, offering practical insights for LULC management in Baton Rouge and similar urban environments.

Methods to be Used;

1. Support Vector Machine;
2. Random Forest;

3. Classification and Regression Trees (Cart) and
4. XGBoost