Imagery Anaysis Assignent - Shaifali

This project focuses on building a complete reproducible workflow for analyzing Sentinel-1 and Sentinel2 data using Python, SNAP and standard geospatial libraries. The goals include:

- Setting up an isolated environment
- Autodownload Sentinel-1 and Sentinel-2 datasets
- Preprocessing SAR data
- Performing change detection
- Preparing code and documentation for open reproducibility on GitHub

2. Environmental Setup

A new conda environment (assignment) was created to ensure consistent execution. Package management was handled through an environment.yml file which allows reproducibility on any system.

Packages installed include:

- Rasterio
- Pandas
- Geopandas
- Matplotlib
- Numpy
- Scipy
- Jupyterlab
- Glob

3. Sentinel-1 Processing

SAR preprocessing was done in SNAP for VV band.

The following steps were performed :

- Orbit file correction
- Radiometric calibration
- Multilooking
- Range-Doppler terrain correction Rest of the processing was done in Python
- Reading the Tiff files
- Resizing the files
- Calculating the log ratio for change detection
- Otsu thresholding

4. Sentinel-2 Processing

Sentinel-2 bands were processed through Python.

- Reading the datasets for detecting change
- Cloud masking
- Resampling the bands
- Calculating NDVI

5. Result and conclusion

Both S1 and S2 data were successfully preprocessed and processed. Change detection was performed for both the satellite datasets. A full EO data downloading, preprocessing and change detection workflow using SNAP and Python was demonstrated. The provided GitHub repository structure ensures future extensibility and replicability. S2 tells you what land cover changed. S1 tells you how the surface structure and moisture changed.

Interpretation of S2 processing:

- Bright patches: Positive spectral change due to
  1. Increase in vegetation dryness,
  2. Post harvest agricultural activity,
  3. Construction activity,
  4. Vegetation stress,
  5. Increase in atmospheric haze or suspended particulate matter,
  6. reduction in residual water levels.
- Dark patches: No change

Interpretation of S1 processing:

- Bright patches: Increased backscatter due to
  1. Vegetation growth
  2. Rainfall patterns
  3. Deposition of sediments due to water movement
- Dark patches: Low backscatter due to:
  1. Flooded areas
  2. Wet soil
  3. Removal of vegetation
  4. Smoothening of the land due to water wash-off
- Grey patches: minimal to no change.