Module: Advanced Remote Sensing Innovations (ARSI)

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Module component: Photogrammetry and advanced image analytics

a) Topic title:

Monitoring forest growth in a natural rejuvenated windthrow area.

b) Research hypothesis/study objectives:

The objective of this study is analysing the height increment of the natural rejuvenated trees. From this height increment analysis, we will be able to identify the nature of the rejuvenated trees.

c) Data required:

UAV Ortho-mosaics are needed for conducting this research. These UAV data are provided by the lecturer.

d) Software/coding environment:

The software that are going to be used for this research are Pix4D mapper and QGIS/ArcMap.

e) Methods

- UAV generated images will be processed using Pix4D mapper to create Ortho mosaic.
- QGIS/ArcMap will be used to process these data generated from Pix4D mapper to create a Digital Surface Model (DSM) and Digital Terrain Model (DTM).
- Georeferencing the generated DSMs.
- Canopy Height Model (CHM) will be calculated to make analysis on the heights of rejuvenation.

Module component: Remote Sensing Change Detection Principles

a) **Topic title:**
Soil Surface Moisture change detection using Optical Multispectral and C- Band SAR Electromagnetic satellite data in Phnom Penh, Cambodia.

b) **Research hypothesis/study objectives:**
The study area has been highly affected by urbanisation in recent years. We want to check how the soil moisture level has changed in these years.

c) **Data required:**
For the task we will use Sentinel 1 C band SAR images and Sentinel 2 Multi-Spectral Images which will be accessed through Google Earth Engine Python API.

d) **Software/coding environment:**
Both the data will be accessed and processed via Google Earth Engine Python API in Jupyter Notebook interface. Part of the analysis might include QGIS and SNAP tool.

e) **Methods:**
We want to calculate the Soil Moisture using TU Wien Change Detection model by analysing changes in backscatter intensity of Sentinel 1 SAR images. The approach was suggested in (Bauer-Marschallinger et al., 2019). The algorithm correlates variations in backscatter intensity with corresponding alterations in soil moisture content.
To derive absolute soil moisture values, the lowest and highest backscatter values are associated with 0% and 100% soil moisture, respectively, for a specific pixel. We will consider the historical highest backscatter as most weight and historical lowest value as driest soil moisture value.
The process can be described as the following equation-

Surface soil moisture (SSM) in terms of backscatter intensity can be expressed as follows:

$$SSM = \frac{\sigma^{o} - dry_{ref}}{wet_{ref} - dry_{ref}}$$

where,

σ^{o} is backscatter intensity of pixel,

dry_{ref} is historical minimum back scatter intensity of same pixel

wet_{ref} is historical maximum back scatter intensity of same pixel

In order to avoid water bodies and built-up areas affecting the highest and lowest value, we will mask them using NDWI and NDBI generated from Sentinel 2 Multispectral Images.

References

There are no sources in the currBauer-Marschallinger, B., Freeman, V., Cao, S., Paulik, C., Schaufler, S., Stachl, T., Modanesi, S., Massari, C., Ciabatta, L., Brocca, L., & Wagner, W. (2019). Toward Global Soil Moisture Monitoring With Sentinel-1: Harnessing Assets and Overcoming Obstacles. IEEE Transactions on Geoscience and Remote Sensing, 57(1), 520–539. https://doi.org/10.1109/TGRS.2018.2858004ent document.