IP: Application Development
Final project

Post-Fire Environmental Monitoring in Greece

Team members: Madeline Mulder, Parinda Pannoon, Stamatina Tounta

Project Focus: Development of a GUI in eCognition for conducting indices analysis and change detection in areas affected by wildfires.

Case Study

For this project, two **Sentinel-2 MSI L2A** images from the area of "Schinos" in Corinthos, Greece were utilized, to study a **wildfire** that broke out in the area on **May 19th 2021**. The images were pre-processed and they are provided to the user. However, the user can also import their own data, as long as the bands match (according to table 2).


Timestep1


Timestep2

Table 1: Utilized Data

Sentinel-2 MSI data	
Right after the fire (Timestep 1)	23.05.2021
Few years after the fire (Timestep 2)	29.06.2023

Data Preprocessing

Data preprocessing was carried out in the SNAP software and included subsetting the images to the study area as well as reducing the bands to only the ones that are useful for index calculation, according to the table below:

Table 2: Sentinel-2 Band Subset

Sentinel-2 Band	Band Name
Band 2	Blue
Band 3	Green
Band 4	Red
Band 8	NIR
Band 11	SWIR 1
Band 12	SWIR 2

GUI Sections

Start

The **data needs to be loaded carefully**: the image from **Timestep 1** must be loaded **first** and the one from **Timestep 2 second**, so that the image bands (layers in eCognition) match those set in the rule set.

This section allows users to rename the eCognition image layers as the Sentinel-2 band names for ease of use. The layers are later used in the rule set to calculate indices etc. It also creates the starting layout for the project which consists of two linked maps which have been split horizontally for timestep 1 and timestep 2.

Segmentation

This section allows users to define their own **segmentation parameters** (scale parameter, shape and compactness) and conduct multiresolution segmentation for both timesteps.

Timestep 1 Indices

This section allows users to calculate the **MNDWI**, **NBR**, and **NDVI** for timestep 1. Users can also define a threshold for each index in order to classify image objects as water, burned area, or vegetation. Included in this section is the option to remove classification so that users can change the classification threshold multiple times to receive different results.

Timestep 2 Indices

This section allows users to calculate the MNDWI, NBR, and NDVI for timestep 2. Users can also define a threshold for each index in order to classify image objects as water, burned area, or vegetation. Included in this section is the option to remove classification so that users can change the classification threshold multiple times to receive different results.

Export Classification Results

This section allows users to export the results of the classifications based on the indices mentioned above as vector files in a shapefile format. The users can choose to export the total burned area, area covered by vegetation and water area for each timestep.

Change Detection

In this part, the user can perform **change detection** using different Maps. The purpose is to define how much of the burned area has recovered (vegetation re-growth) after two years. For the change detection, we will have **two data sets at different time steps**. After loading them we will create a Map within one project for each time step and apply a classification on each single time step separately. This is what was performed above. In a final step, we synchronized the two classifications into one Map (main) and compared them to reveal areas of changes and also no changes.

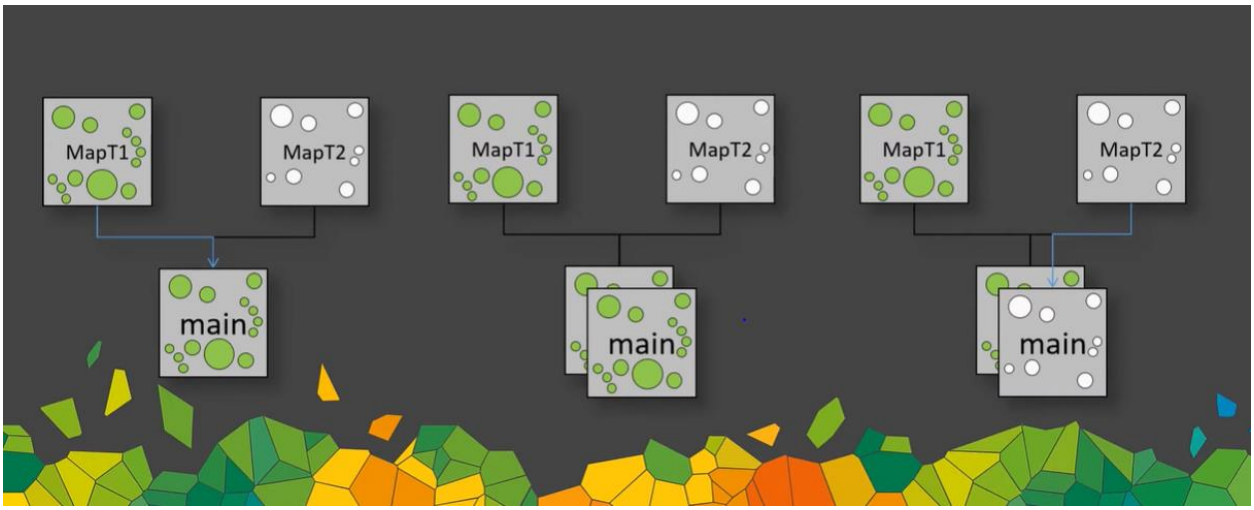

Fig. 1: Change detection structure

Steps:

- Copy and create 2 maps: T1 & T2
- Do analysis on each map individually (segmentation, index calculation, classification)
- Synchronize maps T1 & T2 to the main map
- T1: "synchronize map" algorithm
    - T2: first copy level T1 on main map and create T2 level above (otherwise we would overwrite the existing T1 level), then use "synchronize map" algorithm (from map_T2 synchronize to the main map creating level T2)

Perform change detection

- Create objects with the same extent on level T1 and T2: "convert to sub-objects" algorithm ("cuts" object in the super-level based on objects found in the sub-level)
- Create a third level to classify change ("copy level" algorithm) above level T2
- Remove the classification from the third level (it is there because we copied level 2)
- Create relevant classes
- Assign conditions in the "class description" and use the "classification" OR
- use the "assign class" algorithm

Statistics

In this section users can calculate different statistics derived from features, like the **average (mean) burned area** (km^2), the **mean NDVI** for the whole scene as well as the **changed and unchanged area** (km^2) after performing the change detection.

Reset

This section resets the project to the starting layout with two linked, horizontally split maps for timestep 1 and timestep 2. The alias names assigned in the start section remain, but the previously created classifications, levels, and image objects are all deleted.

Team Member Contribution

For this project all team members met together in-person or virtually and worked in-tandem to complete the project. The following is a breakdown of team member contribution to the project by percentage:

Madeline Mulder: 33%

Parinda Pannoon: 33%

Stamatina Tounta: 33%