Change detection and segmentation
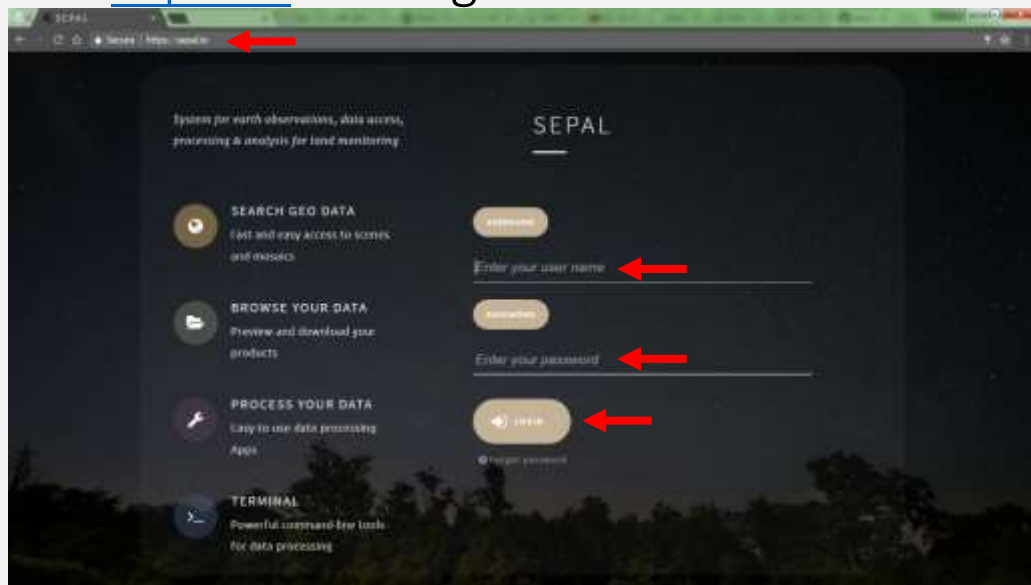
Tutorial and resources

Bogor, Indonesia

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Go to sepal.io and login

Start the SEARCH tab

There are four fields in SEPAL
SEARCH   for imagery and creating mosaics
BROWSE   through your personal folders and visualize your data
TERMINAL   to access all the command line possibilities of the LINUX server
PROCESS   access pre-loaded tools and chains of processing
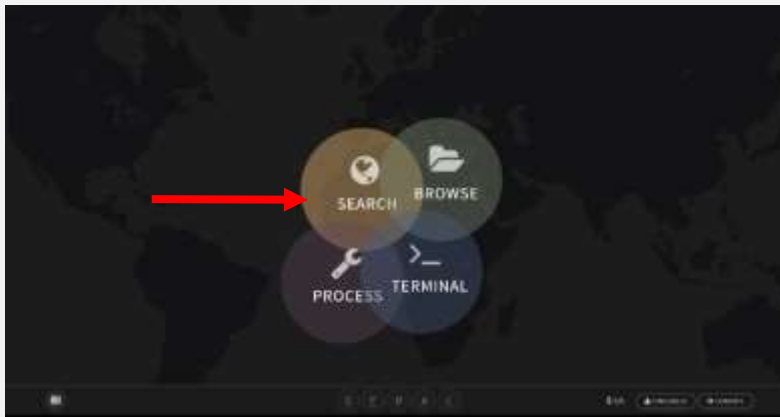
Use SEPAL to create an image composite

- The search tab creates a best pixel mosaic for the area of interest based user specified parameters.

- The mosaic is intended for applications for vegetation monitoring. The output image composite is preprocessed and can be downloaded to the SEPAL workspace

- Select date and draw polygon in area of interest

Use SEPAL to create an image composite

- Select date and draw polygon in area of interest
- The search algorithm will search for images closest to the target date for the area of interest

Use SEPAL to create an image composite

- Set parameters for selection of scenes
- The bubbles with 0 inside show the number of images available per scene
- To populate the available imagery click on auto-select

Use SEPAL to create an image composite

1. A trade off between the cloud cover and proximity to the target date. 100% cloud cover (the ... all the way to the left) will allow scenes with any amount of cloud cover to be included in the mosaic.

2. Choose the satellites to include. Any of the Landsat satellites will be combined. A separate mosaic is created for Sentinal2 imagery

3. Select the target year. It is automatically set to only search images within the year of the target date. The target year can be expanded to include images from other years. Images from other years will still prefer dates closest to the target day and month.

4. Specify the minimum and maximum number of acquisitions included. The minimum number is set to 1 to include at least 1 acquisitions per scene. In a year Landsat has 23 acquisitions, if searching within one year and if the min is set to 23 all the available acquisitions will be included in the composite

5. Submit to populate the scenes with available acquisition that best match the custom parameters

Use SEPAL to create an image composite

- The scenes are populated with imagery now

- To preview the composite click on PREVIEW

Use SEPAL to create an image composite

1. Select a band combination
   - False color (NIR, SWIR 1 and Red) was used in the example
2. Click on PREVIEW

Use SEPAL to create an image composite

- Click on one of the scenes to add or subtract the acquisitions

Use SEPAL to create an image composite

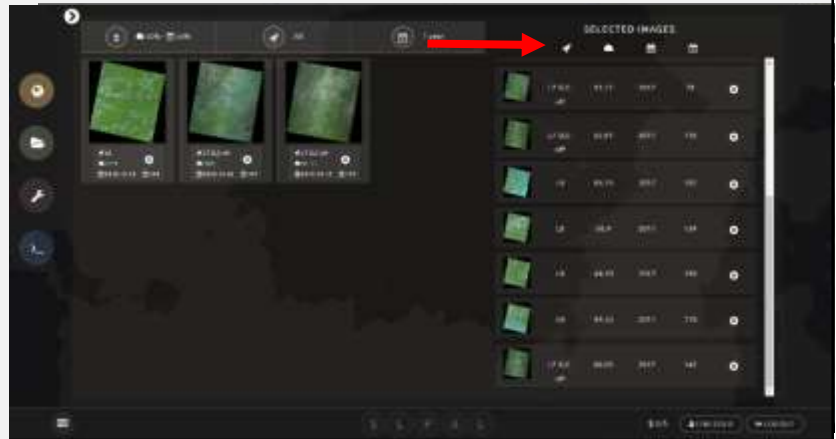- Information about the images selected

 Satellite (for example Landsat 8)

 Percentage cloud cover

 Year of acquisition

 Number of days from the target date

Use SEPAL to create an image composite

- Once you are happy with the image composite, retrieve the mosaic (the retrieve button on the left) and select at least the red, NIR and SWIR 1 bands.

- Click submit to download the image to composite to your SEPAL account

  - A spinning wheel in the bottom left corner will appear, indicating the imagery is being downloaded
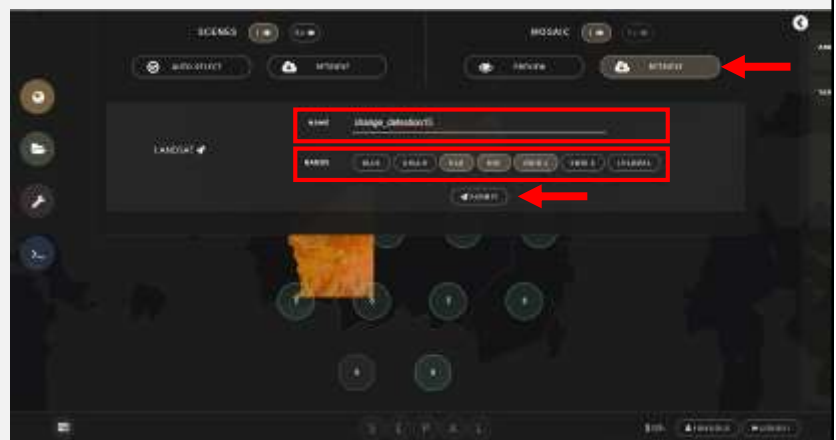
Use SEPAL to create an image composite

- Repeat the same steps to create an image composite for the same area with a different year

- Wait for the downloads to finish and click on the spinning wheel to check the progress of the download

- The image composites will download into the download folder in your SEPAL account

Use command line to download test data set and for some image processing

- Click on the terminal icon to access all the command line possibilities of the LINUX server

Use command line to download test data set and for some image processing

- In the command line first start an 'instance'
- Select the t2.small by typing 1 and hit enter where it says Select (1):

Chain of commands: Downloading data

In the command line type the following commands to download the data

1. Change working directory
   - cd downloads
2. Create a directory
   - mkdir testdata
3. Change working directory to the new directory
   - cd testdata
4. Download data
   - wget https://goo.gl/8rN7mq
5. Rename data
   - mv 8rN7mq test.zip
6. Unzip data
   - test.zip
7. Remove unnessary files and directories from the downloaded unzipped folder
   - rm -r __MACOSX/
   - rm test.zip
8. See what the file properties are
   - gdalinfo indo_test_2016.tif

Change detection in Geoprocessing tools

Chain of commands: Thresholding the change detection

9. Use oft-calc to threshold the change detection from the geoprocessing kit
   - oft-calc change_detection_1516.tif negative.tif
     - 1
     - #2 1.78 < 0 1 ?

9.1 ALTERNATIVE METHOD: Use gdal_calc.py to threshold the change detection from the geoprocessing kit
   - gdal_calc.py -A downloads/testdata/change_detection_1516.tif -A_band=2 --co=COMPRESS=LZW --type=Byte --outfile=negative.tif --calc='(A<-1.78)*1+(A>=-1.78)*0'

Segmentation
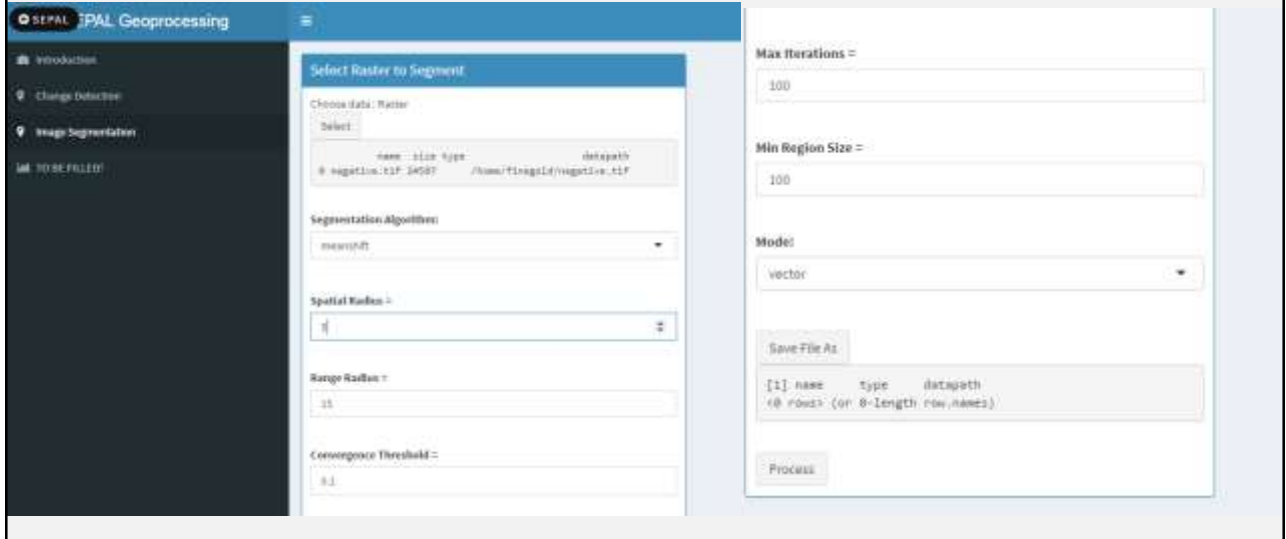
Convert segments to raster

10. Get the pixel size from the thresholded change detection copy the pixel size for the next step
    - gdalinfo negative.tif

11. Rasterize the segmentation output. We need to do this for the next step which requires the segments to be in a raster format
    - gdal_rasterize -a DN -l segs_100 -ot UInt16 -tr 0.000269494585236 0.000269494585236 segs_100.shp segs_100.tif

12. Give the segments the values from the change detection. Use the segments as a mask. Count the pixel values under each segment and assign the value that occurs the most within the segment.
    - oft-segmode.bash segs_100.tif negative.tif neg_segs.tif

1. Turn the output segments back into polygons. The output will be polygons with values 0 and 1. 1 is change, 0 is stable
    - gdal_polygonize.py neg_segs.tif -f "ESRI Shapefile" neg_shape.shp neg_shape -change

OFT

- <u>Oft-calc:</u> based on an input raster file, oft-calc creates an output raster file as result of a simple calculation between the original bands. The bands used for the calculation must be all stacked in the input raster file.
  - http://www.openforis.org/OFwiki/index.php/Oft-calc
- <u>Oft-stack:</u> builds an image stack from input files in the order of appearance. By default, the output format and type of the first input file is used. The images need to have exactly the same size (same number of rows and columns in same location)
  - http://www.openforis.org/OFwiki/index.php/Oft-stack
- <u>Oft-segmode.bash:</u> Burn the mode of the values of a given raster into defined zones from another raster (zonal statistics)
  - http://www.openforis.org/OFwiki/index.php/Oft-segmode.bash

Orfeo toolbox

- <u>Change detection:</u> This application detects change between two given images.
  - https://www.orfeo-toolbox.org/CookBook/Applications/app_MultivariateAlterationDetector.html
- <u>Segmentation:</u> Performs segmentation of an image, and output either a raster or a vector file. In vector mode, large input datasets are supported.
  - https://www.orfeo-toolbox.org/CookBook/Applications/app_Segmentation.html

GDAL

- gdalinfo: Lists various information about a raster dataset.
  - http://www.gdal.org/gdalinfo.html
- gdal_calc.py : Command line raster calculator (same functionality as oft-calc) with (normal) numpy syntax. Use any basic arithmetic supported by numpy arrays such as +-*\ along with logical operators such as >. Note that all files must have the same dimensions, but no projection checking is performed.
  - http://www.gdal.org/gdal_calc.html

BASH command line

- Cheat sheet
  - https://files.fosswire.com/2007/08/fwunixref.pdf
- Practice command line:
  - http://rik.smith-unna.com/command_line_bootcamp/?id=veobin7g4ec

- `ls`: Show directory contents, lists names of files.
- `mkdir`: Creates a directory of the specified name.
  - `mkdir foo` creates a directory called "foo".
- `cd`: Change directory. Change to certain directory name if provided.
  - `cd foo` takes you to the directory foo.
  - Changes to home directory if no directory specified.
- `pwd`: Displays the name of the working directory.
- `rm`: Removes a specified file. This action is permanent. There is no recycle bin.
- `rmdir`: Removes a directory.
- `history`: Display a listing of the last commands you've run.
- `cp`: Copy specified file to a new named file. Use `-r` flag to copy a directory.
- `mv`: Rename a specified file or directory.