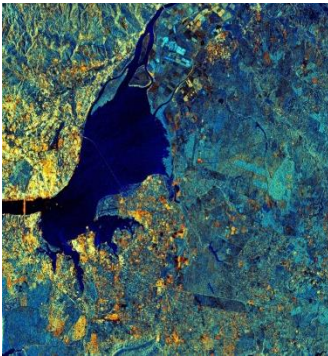


The 2017 European Challenge for FabSpacers

WHAT



Help Public, Private and NGOs to estimate the population of an area of interest by using Copernicus Earth Observation data (Sentinel-2 Images).

And win a bootcamp to further develop your idea into a business opportunity!

This Challenge is being tackled in FabSpaces across Europe. The local winners will get to present their work at CLEF 2017, taking place on 11-14 September, 2017 in Dublin, Ireland.

JOIN US TO SOLVE THIS CHALLENGE
SUBMIT YOUR SOLUTION – Deadline 25th of April 2017

Calling Researchers, Students and Entrepreneurs interested in exploring Earth Observation, and other geospatial data!

PARTICIPATION FREE OF CHARGE

To register, contact your local FabSpace at

info@fabspace.uniroma2.it or fabspace@biclazio.it

Contribute to humanitarian aid and present your work at CLEF 2017!

Motivation

FABSPACE 2.0 at ImageCLEF

ImageCLEF aims to provide an evaluation forum for the cross-language annotation and retrieval of images. Motivated by the need to support multilingual users from a global community accessing the ever growing body of visual information, the main goal of ImageCLEF is to support the advancement of the field of visual media analysis, indexing, classification, and retrieval.

For the 2017 edition, ImageCLEF and FABSPACE 2.0 organise ImageCLEFremote, a pilot task on remote sensing image analysis.

Objective of the challenge

FabSpace 2.0 Exploring Sentinel Copernicus Images

The aim of the pilot task is to explore Earth Observation and other geospatial data, e.g. as provided by the Copernicus program¹, in order to estimate the population of an area of interest.

Population estimation is fundamental to provide any services for a particular region. For instance, before engaging any rescue operation or humanitarian action, NGOs need to estimate the number of local population as accurately as possible. Traditional approaches as census data is possible but time consuming and expensive. The analysis of multi spectral satellite data is a quicker and cheaper process to estimate population. Counting the number of buildings can provide a first estimate; however, it may not be enough since people in various places in the globe do not live the same way, the population may vary in summer and winter in different touristic places, or population may vary where there is easy access to public services or amenities etc.

In this pilot task, participants will have to estimate the population for different areas in two regions. To achieve this goal, we provide a set of satellite images (Copernicus Sentinel 2). A satellite image may not cover the whole study region for which they correspond. Therefore, we provide more than one satellite image for each region of interest. Moreover, the initial satellite images may cover a large area, much larger than the areas of study. We pre-processed the satellite images and clipped them to the bounding box of the areas of interest. The boundaries of the areas of interest are provided as shapefiles. The clipped satellite images are provided as well as the metadata of the original images (before clipping).

However, participants are allowed to use any other resource they think might help to reach the highest accuracy. In addition, The FabSpace online platform and personnel will provide support on demand. In their working note and publication associated to the task, participants will have to describe the resources they used to solve the task and to indicate how effectively the Sentinel 2 images helped.

¹ <http://www.copernicus.eu/>

Dataset

The data set consists in the geographic information as:

- ESRI shape file: one for the region; each region is in turn divided into several areas for which the population has to be estimated. The projected shape file of the region has the necessary attributes.
- City of Lusaka: The subareas are based on Operational Divisions, a unit defined by Médecins Sans Frontières in 2016. This organization divided the city of Lusaka in 83 units. For this region, the data set consists of: (1) ESRI shape file including locational and attributes information, (2) Sentinel 2 satellite images covering the area in two images and for each image there are 1 to 12 bands, (3) XML meta data associated to image files.
- West Uganda: In Uganda there is 17 subdivisions and for this region data sets consists of: (1) ESRI shape file including locational and attributes information, (2) Sentinel 2 satellite images covering the area in five images and for each image there is 1 to 9 bands, (3) XML meta data associated to image files.

The remote sensing imagery provided comes from the Sentinel 2 platform. The imagery is multi spectral, cloud-free satellite downloaded from Sentinel Data Hub (<https://scihub.copernicus.eu/dhus/#/home>). As previously described, the images have been clipped to match the bounding box of the areas of interest. The bands for images from this platform have different spatial resolutions: 10 meters for bands B2 (490nm), B3 (560nm) B4 (665 nm) and B8 (84nm). 20 meters for bands B5 (705nm), B6 (749nm) B7 (783nm), B8a (865nm) B11 (1610nm) and B12 (2190nm). For the analysis, participants will probably use Red, Green and Blue bands or in some cases near infrared bands which are 10 meters resolution.

Information regarding the original image is provided in XML files. These files contain information like capture time/date, sensor mode, orbit number, the id of quality files, etc. Further information regarding the Sentinel 2 products, as well as file structure can be found in the Sentinel 2 User handbook (https://sentinel.esa.int/documents/247904/685211/Sentinel-2_User_Handbook).

The original data source Sentinel Data Hub provides information free of charge with a easy to use interface. However, in order to facilitate the access to the data, we have identified a number of images with low cloud cover that cover the area of interest. We have pre-processed these images so that they cover only the areas of interest. The use of the proposed images is not mandatory. The images we offer are stored in zipped files with the following folder structure:

[NAME OF THE STUDY REGION]: Lusaka or Uganda.

[shp]: This folder contains a shapefile with the boundaries of the study areas.

[sentinel2]

[ID_OF_SATELLITE_IMAGE]: Original id of the image as in the Sentinel Data Hub.

[bands]: This folder contains the bands of the image. Each band is a GeoTiff file. Each band corresponds to a certain electromagnetic bandwidth captured by the sensor.

[xml]: This folder contains the XML files that contain information regarding the images. The information applies to the original source (before image clipping). By using the information in this file a user can obtain the original dataset.

In this challenge, we are interested in quantifying the population in two regions of interest geographically separated (Lusaka and West Uganda). To achieve this task the participants will identify relevant datasets:

- Remote Sensing Imagery suggested by the organizers of the challenge.
- Other remote sensing imagery available to the participants.

- Datasets of a nature other than remote sensing, available to the participants.

Expected outcomes

Participants will be allowed to submit up to 10 runs.

A run consists of a csv file. This file will contain for each row:

- The id of the operational zone,
- The estimated population (number of individuals),
- The maximum estimated population,
- The minimum estimated population,
- The estimated number of dwellings (optional, keep empty if not estimated)
- The maximum estimated number of dwellings (optional, keep empty if not estimated),
- The minimum estimated number of dwellings (optional, keep empty if not estimated),
- The run name

- A one page pdf document describing the methodology used by the participants has also to be submitted

Each one of the runs must be submitted in a separated file that contains the estimations for both regions. The result for each area should be in a single line (thus each line ends with a carriage return).

Registration and submission

PLEASE, REGISTER BEFORE 21th of April 2017

Registration for ImageCLEF 2017 is open on

<http://clef2017-labs-registration.dei.unipd.it/registrationForm.php>

and will stay open until 21.04.2017.

The participant runs (outcomes) should be sent to email address: info@fabspace.uniroma2.it **before next 25th April 2017, h 17.00 CET. The submitting participant should be already register to ImageCLEF 2017 before next 21th April, as above specified.**

Evaluation

The evaluation will be partly based on the methodology used by the participants (weighting factor 50%). A board formed by Earth Observation experts from University of Rome "Tor Vergata" will review procedure and will evaluate it according to the following criteria:

- level of exploitation of Earth Observation data
- level of automation
- generalization capabilities to other regions

The evaluation will be also based on the comparison between the estimations and ground truth (weighting factor 50%).

For the city of Lusaka, the ground truth comes with a categorical evaluation measure of the population estimation. For West Uganda, the ground truth corresponds to estimations that are based on a combination of Volunteered Geographic information (VGI) working on BING imagery (2012) with additional ground work. Both have been provided by NGOs.

To evaluate prediction accuracy, we will evaluate using several measures:

- The correlation (Pearson) between the participant's run and ground truth,
- The deviations (sum of deltas) between the participant's run and ground truth.

The ground truth has two origins. Even more, in one specific area, we have a qualitative evaluation of the estimation. To provide a better estimation of system accuracy, we will also split the results in three subsets. 1) for West Uganda, 2) for Lusaka operational zones with an evaluation equal to Good (23) or Acceptable (37) and 3) For Lusaka in which the estimations have been qualified as Doubts (9), High doubts (6) and Unknown (8).

Contacts and questions:

For more information and if you have any further questions, please send them to:

- info@fabspace.uniroma2.it
- fabspace@biclazio.it

The FabSpace team at University of Rome "Tor Vergata" will be available to provide technical support in tackling this challenge.



Conditions:

Please note that people (students, researchers, etc.) will work on the challenges as volunteers and in an academic context. The intellectual property of the provided solution will remain property of the FabSpace participants that have developed it. The stakeholder will retain the right of free usage of the provided solution; however, will not be authorized to commercialize it or to give it to other stakeholders, except if a written contentment of the owner(s) is given. In case the solution proposed for a challenge would result in commercial exploitation by one or several FabSpace participant, the stakeholder will keep free usage of the solution. Neither the FabSpace partners nor the FabSpace participants have any performance obligation.

