Satellite Imagery and the **DataFactor** project

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ESA Report

DataFactor Project: Outline

- R & D project financed by the MISE (Ministero Italiano per lo Sviluppo Economico, Italian Ministry for Economic Development) focusing on Open Data

- Goal: extract valuable information for Italian policymakers from open data sources (such as national statistics, Open Street Map, Open Weather Map, public administration data ...)

- 42 Months project, 2 main partners: TopNetwork & Expleo

Satellite Imagery: a Database for Italy

- Gather Sentinel 2 data for Italy for 2016 to today, build an on-prem database that can be analyzed and queried

- S2 data has been retrieved on a province-by-province base, for 110 Italian provinces

- Each province has been divided into 500x500 pixels squares, that is 5km side for the highest resolution S2 bands (R, G, B and NIR)

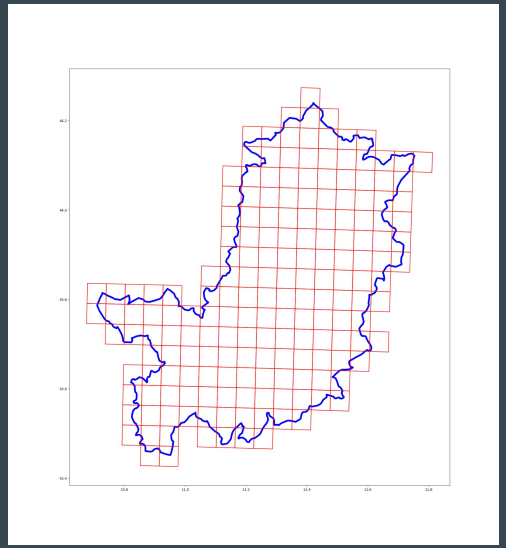
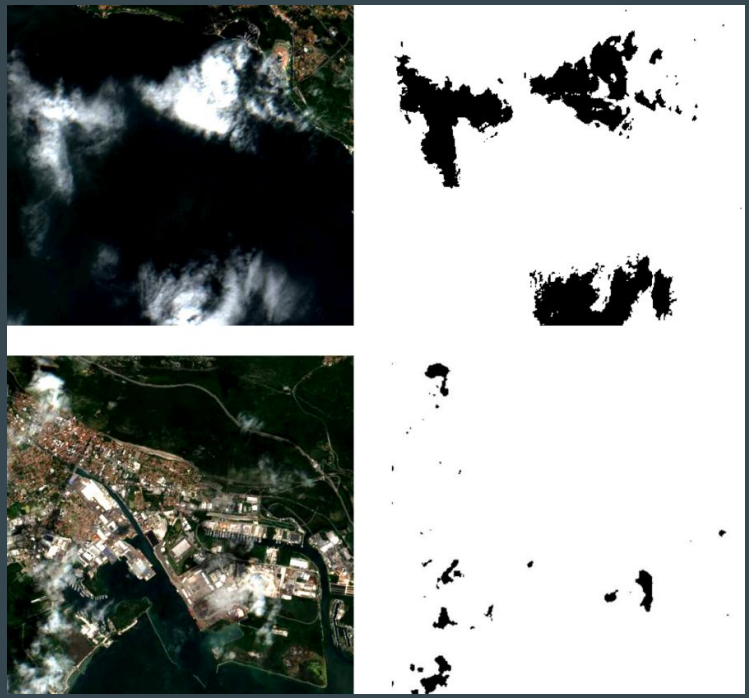


Fig: The province of Firenze, divided into 5x5 km squares

AI Applications: UNet Segmentation

- For an efficient image cleaning strategy, we adapted the UNet of Sorour (2019) to the Sentinel 2 data

- The UNet is then used to identify cloud coverage and merge the clean patches over a timespan up to 1 month to obtain a clean ground image



Cloud Masks over Trieste

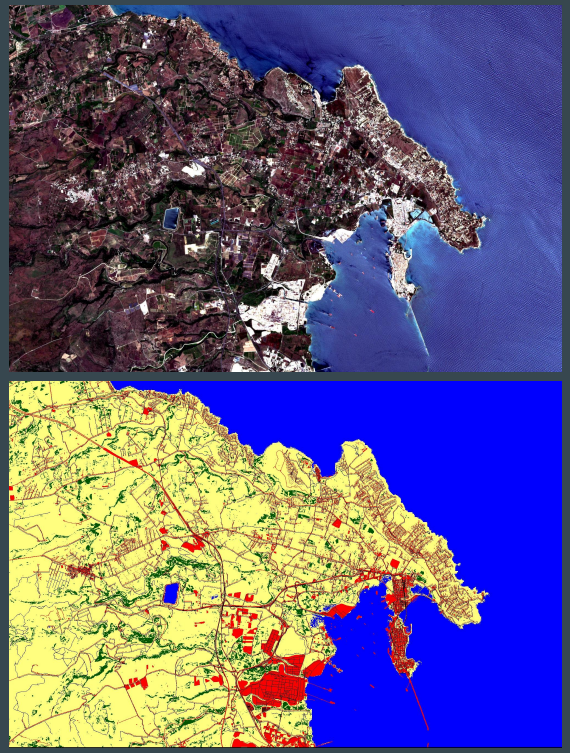
Image Labeling for Training

To analyze satellite imagery, we labeled Sentinel 2 images from scratch in order to create a large training - test dataset focused on Italy.

We used 4 classes for the labeling:

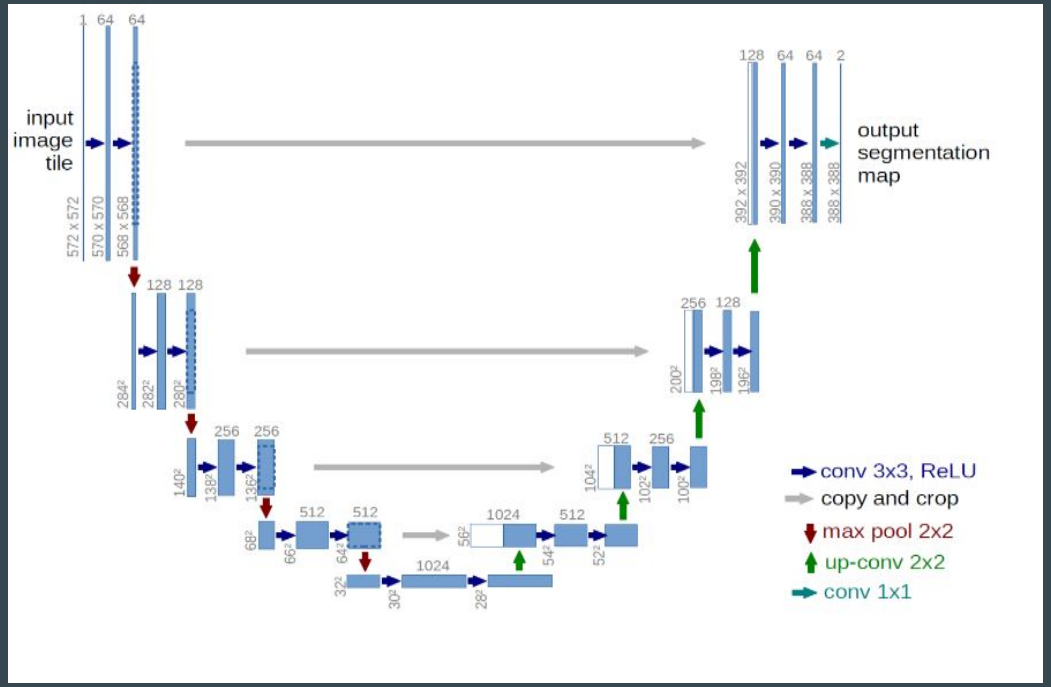
- land (grass, agriculture or else)
- buildings
- water
- forests

The images were split into 500x500 squares, and the total number of images obtained in this way is 3000.



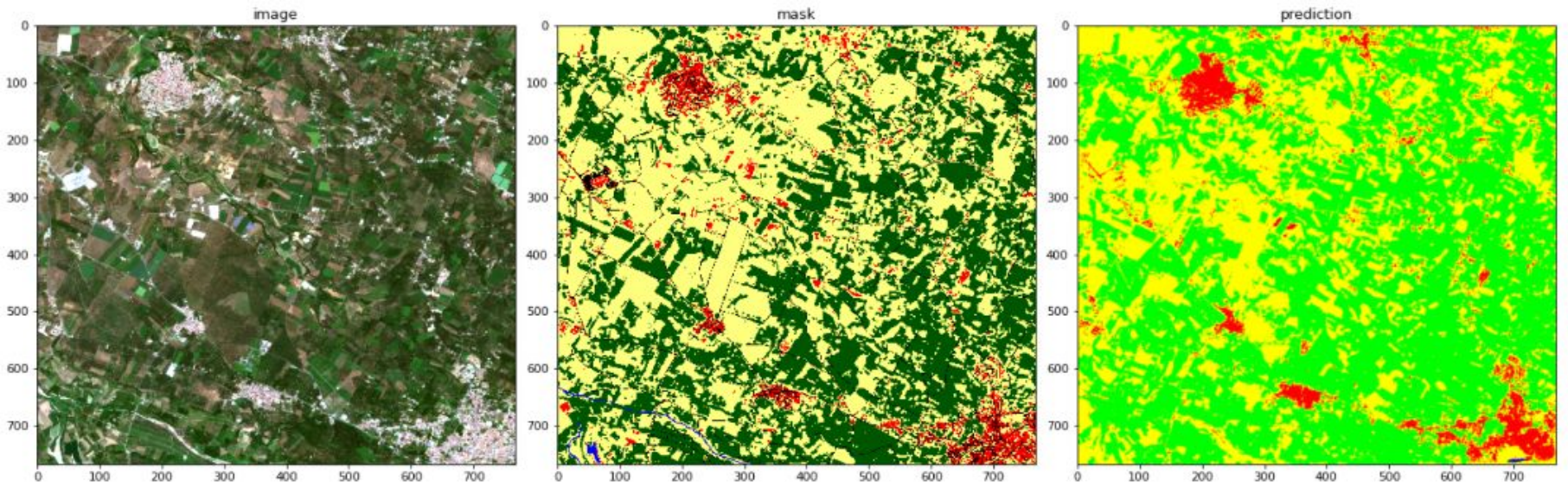
UNet for Cloud Segmentation

- UNet are common architectures based on deep neural networks, used to segment images
- Input training data has been provided by 2250 Sentinel 2 images with 4 bands (R, G, B and NIR) and 10m resolution, with a 750 images validation set



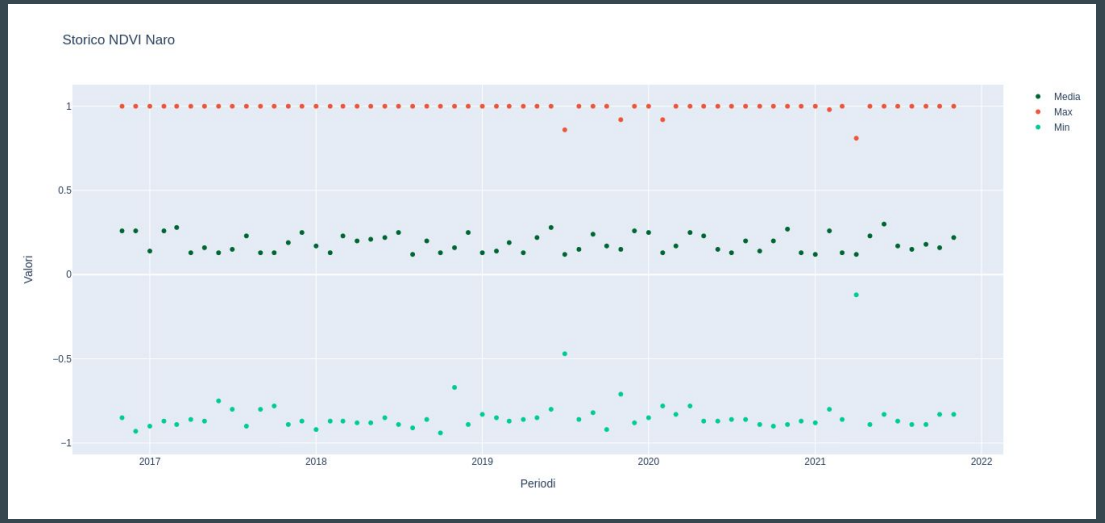
UNet architecture for image segmentation

UNet for Land Use Classification



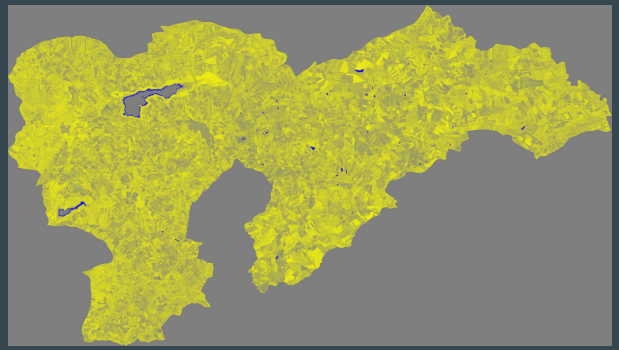
Example application of UNet segmentation on a 768x768 patch

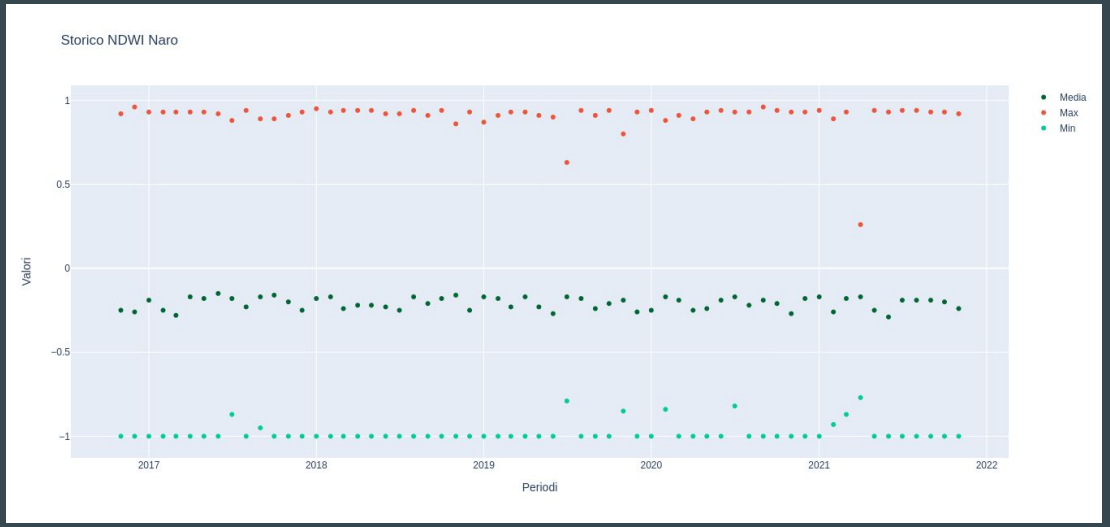
Composite index: NDVI



A snapshot of the municipality of Naro in Sicily, with RGB - NDVI (left panels) and time series for median NDVI values

Composite index: NDWI





A snapshot of the municipality of Naro in Sicily, with RGB - NDWI (left panels) and time series for median NDWI values

Next steps

- Apply the segmentation model to the full imagery database

- Study trends in greening / deforestation across the different italian provinces from 2016

- Improve segmentation results adding more multispectral bands (with lower resolution)