# Analysis of Aerial Images to Detect Urban Areas, Photovoltaic Panels, and Vegetation Types

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Emiliano Tramontana, 21.02.2024

# Team

- Prof. Giuseppe Pappalardo (INF/01)
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- Dott. Alessandro Midolo (Assegnista di ricerca, altri fondi propri)
- Dott. Daniele Marletta (Dottorando)

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# Previous Work, 2021

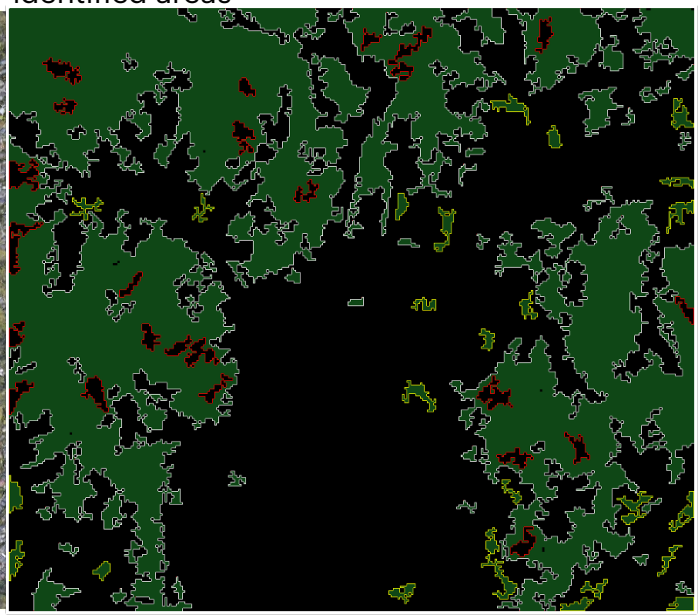
- Goals: identify two categories (urban and green) in an image, compute the size of the several identified areas, and check whether they are connected

- R. Spina, E. Tramontana. An Image-Processing Approach for Computing the Size of Green Areas in Cities. In Proceedings of ACM International Conference on Computer and Communications Management (ICCCM), July 16–18, 2021

- R. Spina, E. Tramontana. An automated classification system for urban areas matching the 'city country fingers' pattern: the cases of Kamakura (Japan) and Acireale (Italy) cities. Journal of Urban Ecology (Oxford University Press), Volume 7, Issue 1, 2021

original image

identified areas

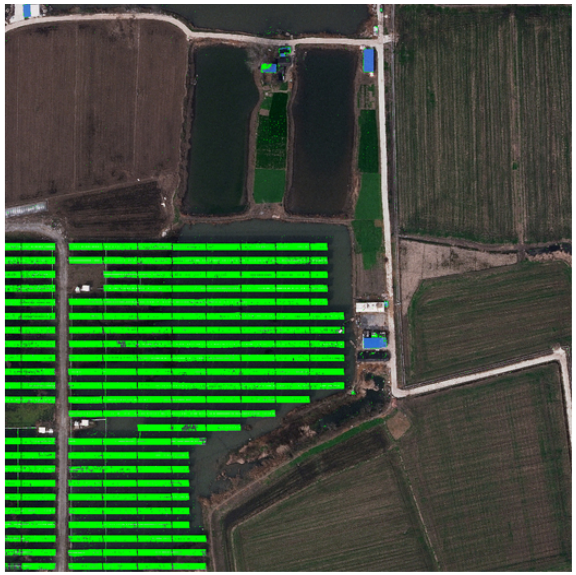


# Previous Work, 2023

- Detect photovoltaic (PV) panels from images (lots of RGB colours are in PV panels and background/surrounding areas). An external dataset was used, the proposed solution is robust, accurate, and much faster than machine—learning—based approaches
- D. Marletta, A. Midolo, E. Tramontana. Detecting Photovoltaic Panels in Aerial Images by Means of Characterising Colours. Technologies 2023, 11(6), 174; https://doi.org/10.3390/technologies11060174

panels in the aerial image

found panels were marked in green



# Goals for the Current Work

- Detect vegetation from aerial images to distinguish among different plants and the state of vegetation health
  - A great amount of colour gradations are found in plants and elsewhere in the background/surrounding area
- *Obtain detection without resorting to a machine-learning (ML) approach, though comparing to ML-based approaches*
  - The expected benefits are: explainability, fast execution

# Proposed Approach

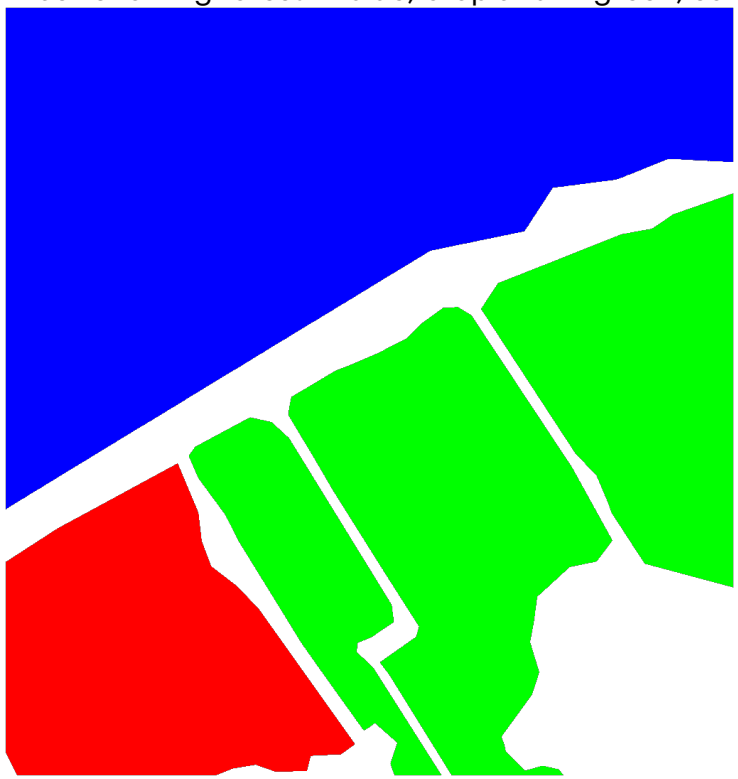
- Phase 1: Collect and select colours for each plant (using annotated datasets)
- Phase 2: Use list of colours for plant detection
- Phase 3: Exclude pixels that are a minority using a moving tile

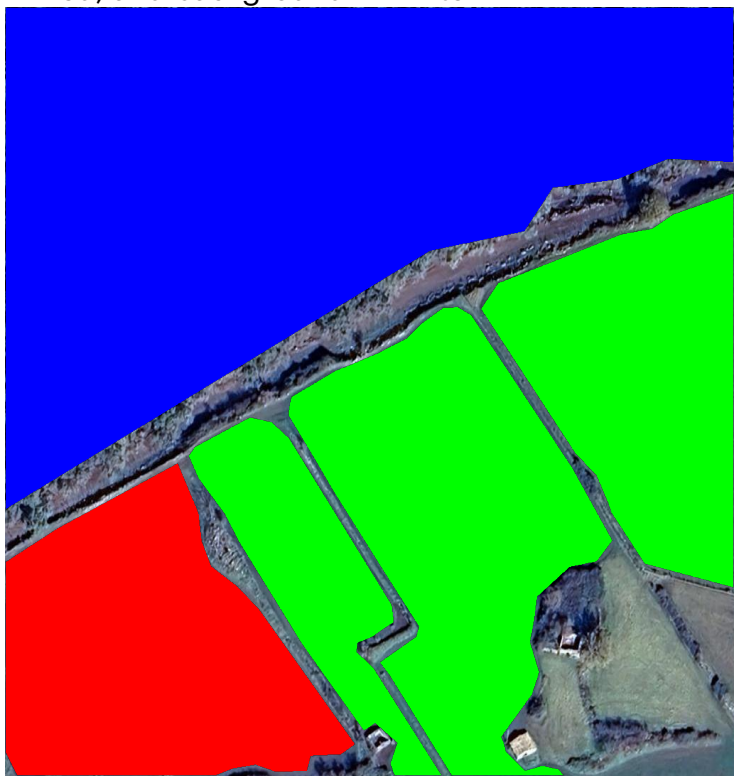
# Phase 1: Collect and Select Colours

- Phase 1: RGB colours collection from annotated images. If a RGB is in more than one plant type, then it is considered a colour of a plant, if it is found much more often in that plant

original image

mask showing forest in blue, cropland in green, soil in red, and background in white



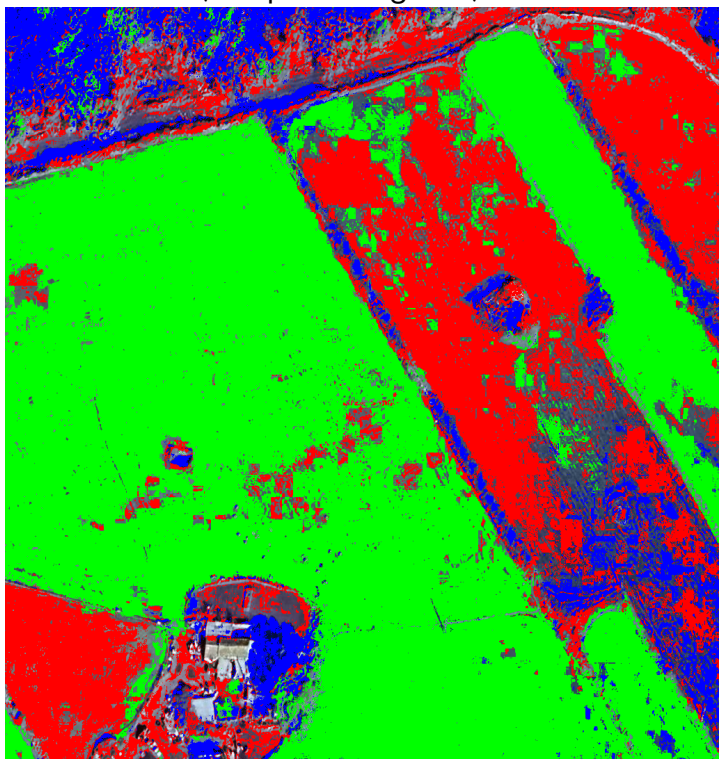


# Phase 2: Plant Detection

- The set of selected colours is searched in an unknown image, and the pixels found are marked in blue for forest, green for cropland, red for drylands

original image

forest in blue, cropland in green, soil in red



mask