



UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II

itee^{PhD}
information technology
electrical engineering



Giovanni Giacco

Artificial Intelligence in Earth Observation applications

Tutor: Carlo Sansone

Cycle: XXXVI

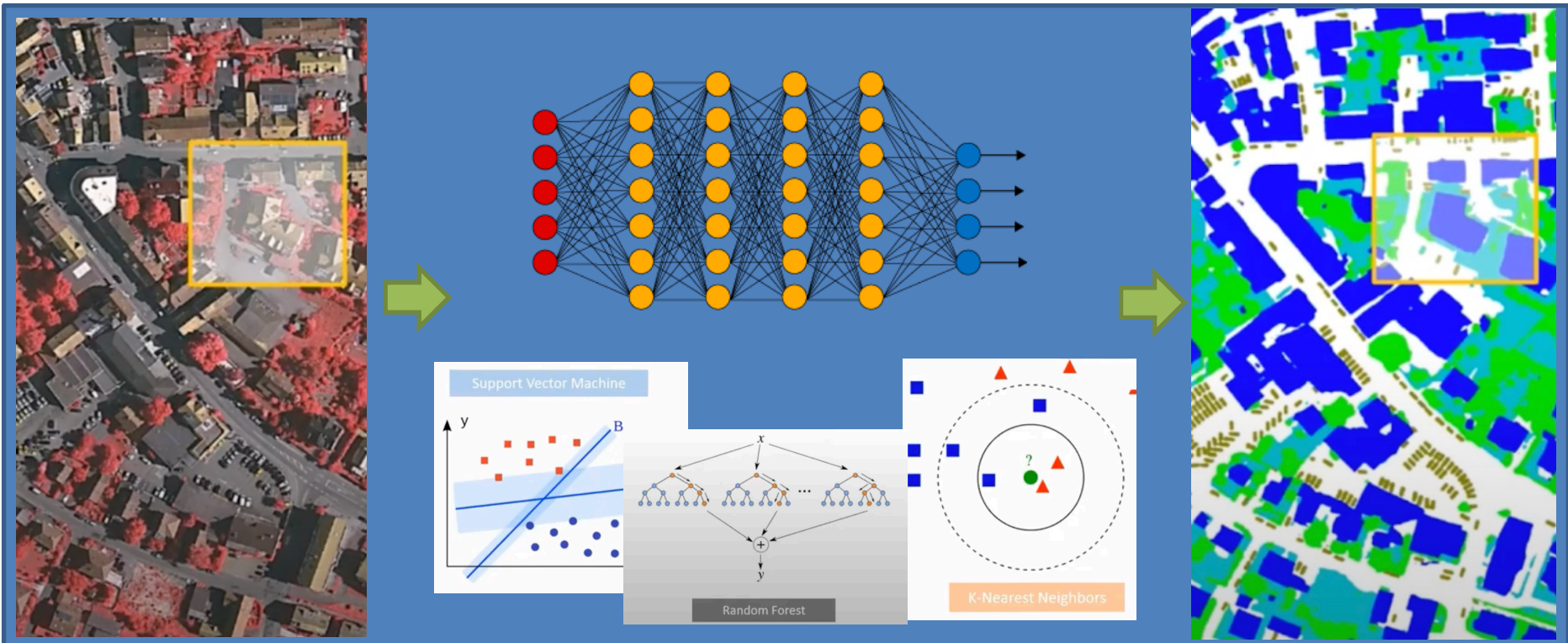
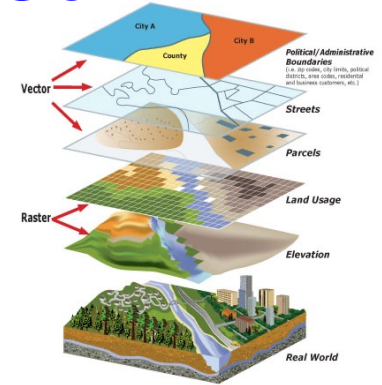
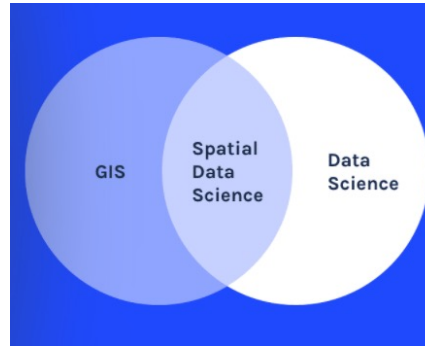
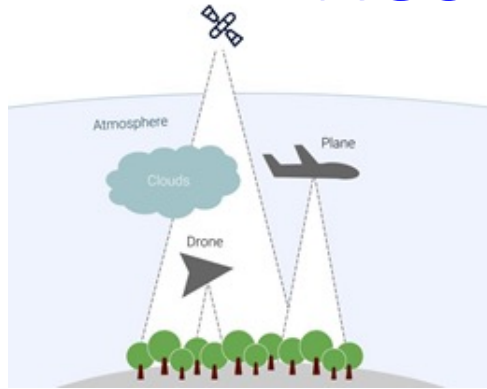
Year: First

My background

- **Master Degree:** *Computer Engineering* at University of Naples Federico II
 - Thesis: “*Deep Learning for Land Cover classification using Multispectral Sentinel-2 Satellite Imagery*”
- **Research laboratory**
 - PATTERN ANALYSIS AND INTELLIGENT COMPUTATION FOR MULTIMEDIA SYSTEMS (PICUS LAB)
- **PhD start date:** 01/11/2020
- **Scholarship type:** no scholarship
- Currently working for **LATITUDO4.0**[®] (no company funded scholarship)



Research field of interest



Summary of study activities

- Ad hoc PhD courses / schools
 - Statistical Data Analysis for science and engineering research
 - Scientific Programming and Visualization with Python
- Courses borrowed from MSc curricula
 - Big Data Analytics and Business Intelligence
 - Image processing for Computer Vision
- Seminars
- Others
 - Geographic Data Science by Dr. Dani Arribas-Bel, University of Liverpool
 - Analisi dei dati multispettrali e iperspettrali, Fondazione E. Amaldi, ESA ambassador

Research activity: Overview(1/3)

Problem:

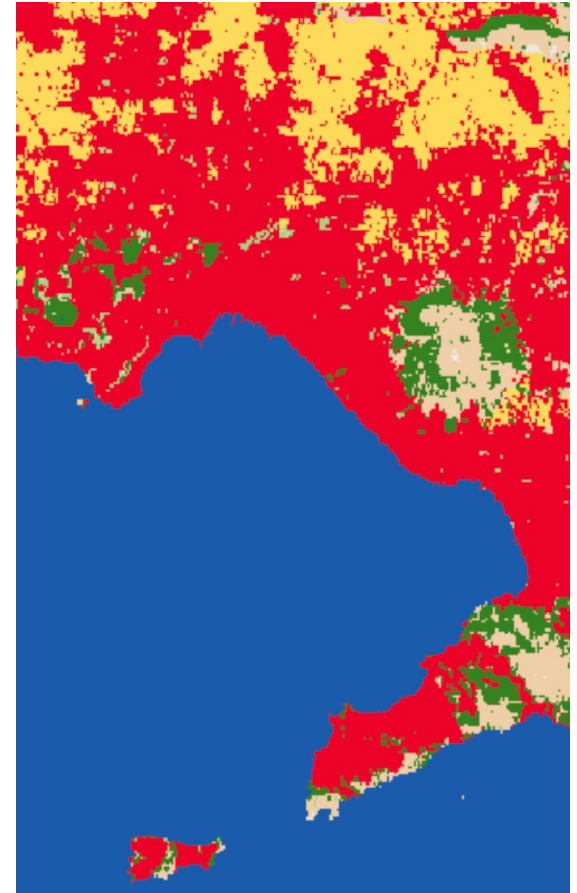
- continual mapping and monitoring of impervious surfaces and land cover land use (LCLU)
- catch the variety of land cover in built-up areas with Sentinel-2 satellite imagery

Objective:

- Land cover classification in the urban context
- Assess how Sentinel-2 spatial resolution can address the variety of land cover in built-up areas

Proposed contribution:

- A novel dataset for the segmentation task based on Sentinel-2 data
- Deep learning architecture based on a U-Net backbone, residual blocks and the FuseNet principle, to exploit Sentinel-2 multispectral content



Research activity: Overview(2/3)

Problem:

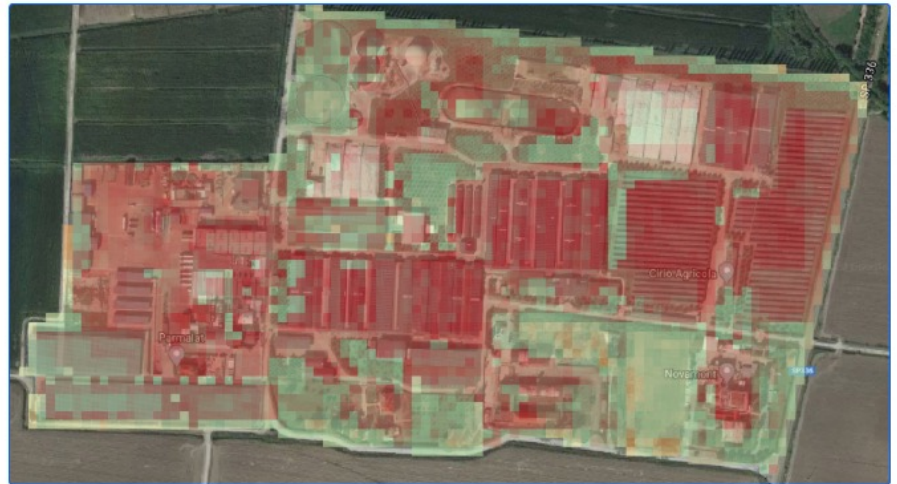
- Urban UHI monitoring is possible through thermal satellite remote sensing of land surface temperature (LST) ...
- ... BUT spatial resolution of Landsat-8 thermal bands, i.e. 10000 m² for a single pixel, does not address the necessity to monitor LST in the urban context

Objective:

- Downscaling Land Surface Temperature to 10 m

Proposed contribution:

- Machine learning approach based on a Catboost regressor using as features (i) Sentinel-2 multispectral bands, (ii) multispectral indexes



Research activity: Overview(3/3)

Problem:

- Cracks localization on buildings surface to assess post-earthquake damages by using drone imagery

Objective:

- Automatic cracks detection
- Automatic compilation for some section of the AeDES form used by the Civil Protection in Italy

Proposed contribution*:

- A novel dataset
- Crack detection through a Deep Learning approach
- Windows detection to understand where the crack is located and estimate its gravity related to where it occurs

* Work in collaboration with the **Department of Structures for Engineering and Architecture (DiSt)** at Unina



Livello-estensione	Danno ⁽¹⁾									
	D4 - D5 Gravissimo			D2 - D3 Medio Grave			D1 Leggero			
	>2/3	1/3 - 2/3	<1/3	>2/3	1/3 - 2/3	<1/3	>2/3	1/3 - 2/3	<1/3	
Componente strutturale- Danno preesistente	A	B	C	D	E	F	G	H	I	Nulla
1 Strutture verticali	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Solai	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 Scale	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 Copertura	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 Tamponature - Tramezzi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 Danno preesistente	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Products

Papers in preparation:

- Giacco Giovanni, Stefano Marrone, Giuliano Langella, Carlo Sansone; *“Land Cover Classification in the urban context by using multispectral Sentinel-2 Satellite Imagery”*
- Giacco Giovanni, Giulio Mariniello, Domenico Asprone, Edoardo Cosenza, Carlo Sansone; *“Automatic compilation of the AeDES form for the assessment of building post-earthquake damages by using drone imagery”*

THANK YOU
FOR YOUR ATTENTION

