



Faculty of Geodesy  
University of Zagreb



Ministarstvo znanosti  
i obrazovanja



Projects:  
GEMINI  
3D-FORINVENT



# Advanced remote sensing for land cover detection and green infrastructure monitoring

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# Introduction

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- ▶ Green infrastructure (GI) is a network of natural and semi-natural areas, features and green spaces in rural and urban areas that collectively provide society sustainable, healthy living environment
- ▶ 2/3 Europe population live in urban areas
- ▶ GI provides various benefits such as:
  - ▶ environmental (air pollutants, land quality)
  - ▶ social (health and human well-being, green cities, tourism and recreation opportunities)
  - ▶ adaptation and mitigation to climate change (heat island)

# Research projects and groups

- ▶ **GEMINI – Geospatial monitoring of green infrastructure using terrestrial, airborne and satellite imagery**

- ▶ Prof. Damir Medak
- ▶ 2017 – 2021



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- ▶ **3D-FORINVENT – Retrieval of Information from Different Optical 3D Remote Sensing Sources for Use in Forest Inventory**

- ▶ Ivan Balenović, PhD
- ▶ 2017 – 2021



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- ▶ **MySustainableForest – Operational sustainable forestry with satellite-based remote sensing**

- ▶ Ivan Pilaš, PhD
- ▶ 2018 – 2021

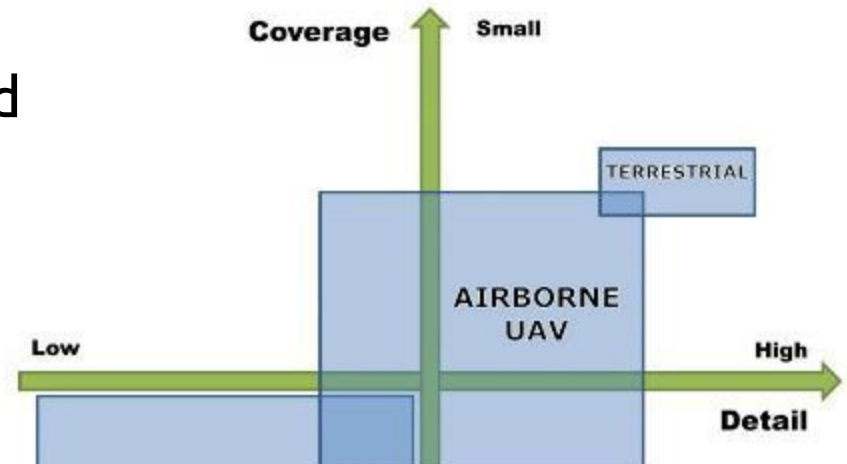


Horizon 2020  
European Union Funding  
for Research & Innovation



# Current GEMINI project status

- ▶ Fusion of satellite, UAV, terrestrial imagery and ground data and measurements
- ▶ Satellite imagery
  - ▶ Sentinel, Landsat, PlanetScope, RapidEye, WorldView 1-4
- ▶ UAV aerial imagery
  - ▶ Multispectral and thermal cameras
- ▶ Terrestrial ground data and measurements
  - ▶ Multispectral and thermal cameras collected from automotive vehicle
  - ▶ Ground measurements (e.g. data from meteorological stations) for acquisition system calibration





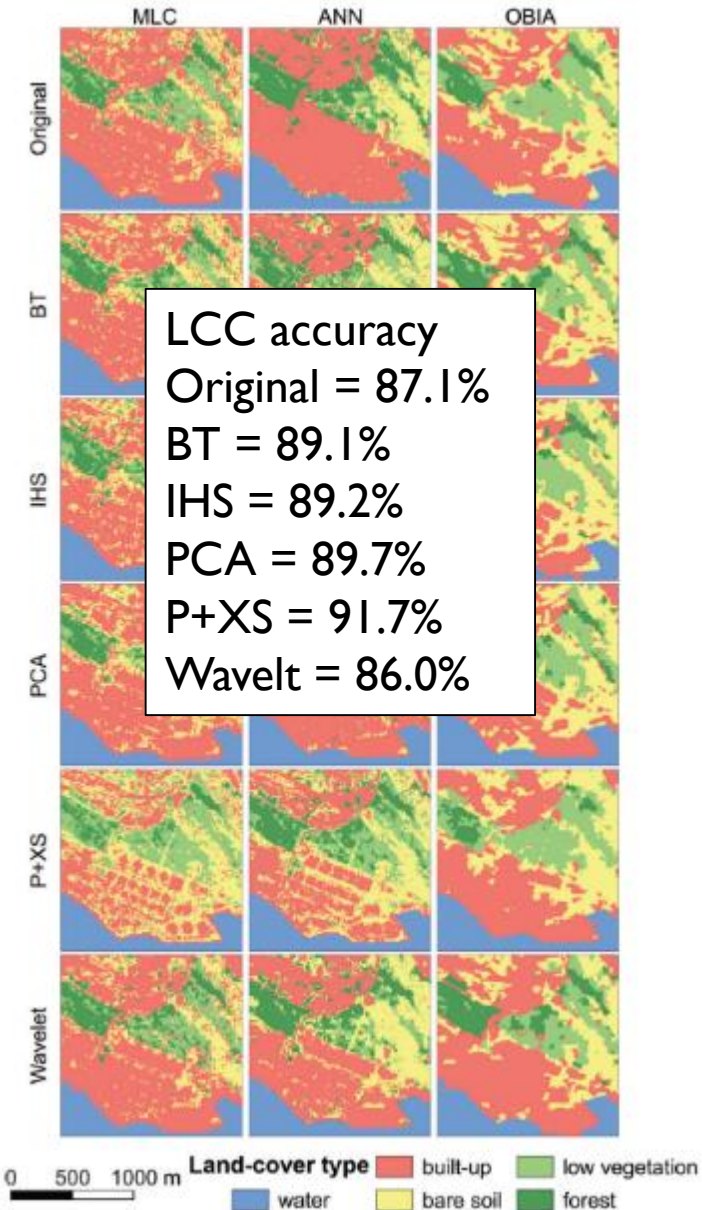
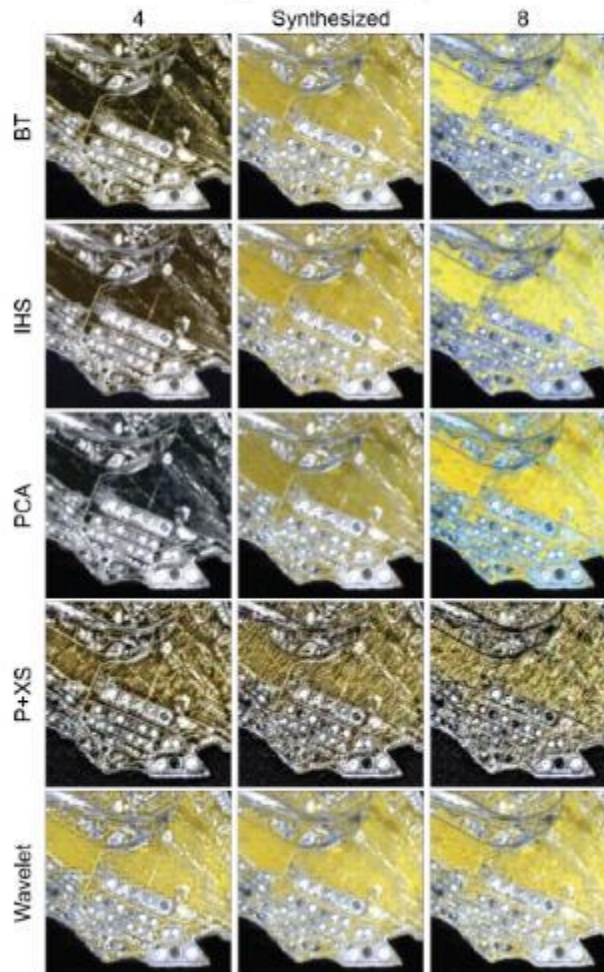
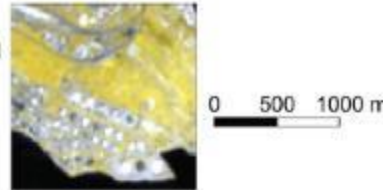
# Can Sentinel-2 improve itself?

## ▶ Improving the synsynthesized

▶ Gašparović, M. and J. classification. *Internac*

## ▶ Study area Rijeka

Composite of original bands 7, 6 and 5 resampled to 10 m by the nearest-neighbour method



▶ Gašparović, M.: Advanced ren



# Can Sentinel-2 improve

## ▶ Sentinel-2 (10 m) & PlanetScope

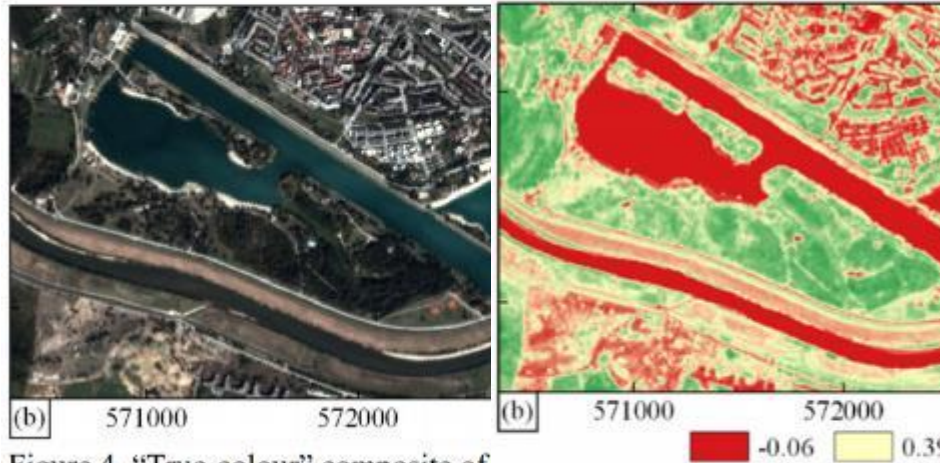
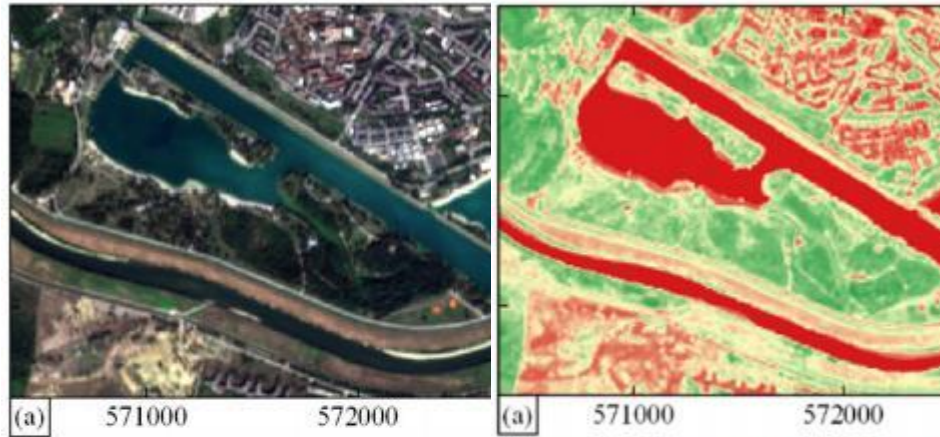


Figure 4. “True-colour” composite of on the: (a) S-2 (4–3–2) and (b) fu

Figure 7. NDVI value of the exampl 2 and (b) fused

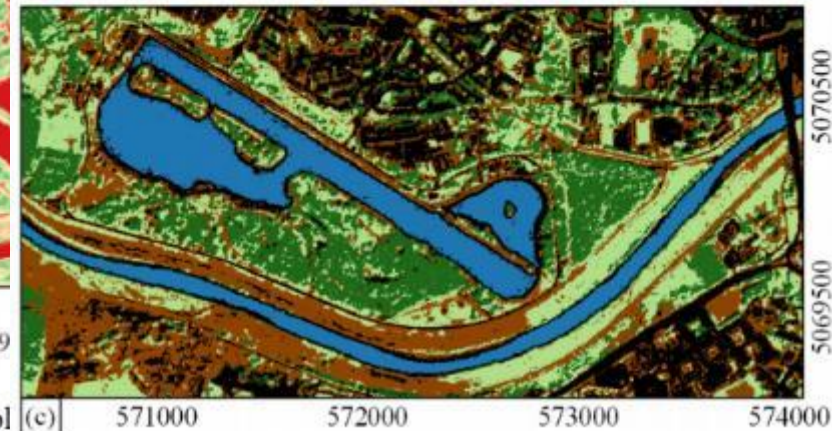
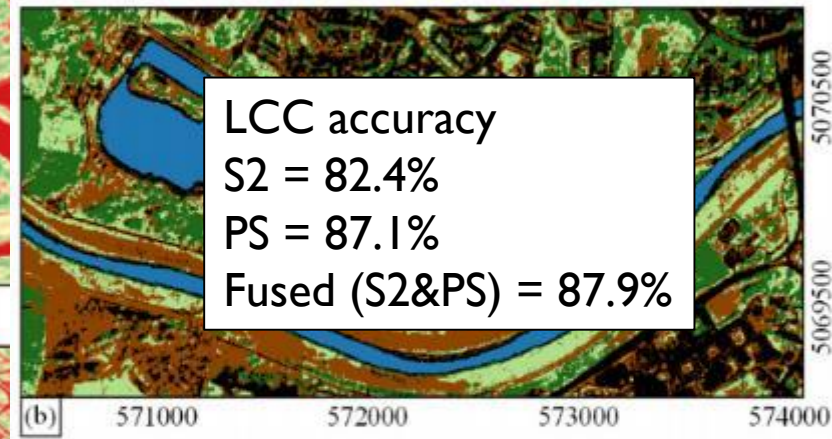
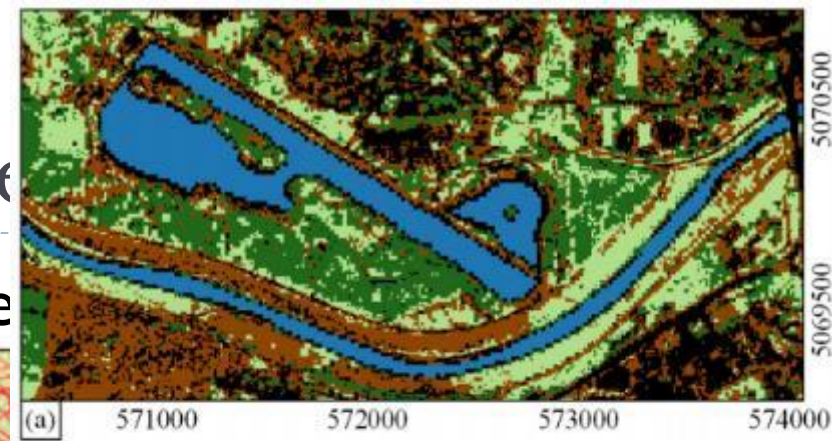


Figure 5. RF classification results of the example subset based on the: (a) S-2, (b) PS and (c) fused imagery

LCC accuracy  
 S2 = 82.4%  
 PS = 87.1%  
 Fused (S2&PS) = 87.9%



# Environmental impact of a fire near Split

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- ▶ Sentinel-2 (17<sup>th</sup> July 2017 – fire; 7<sup>th</sup> July 2017; 6<sup>th</sup> August 2017)





# Automatic burned areas detection

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- ▶ Two Sentinel-2 sets (month before fire, month after fire)



# Wind damage in forests near Vrbovsko

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▶ 11<sup>th</sup>-12<sup>th</sup> December 2017

▶ Sentinel-2

▶ Summer 2017

▶ Summer 2018

▶ Automatic LCC

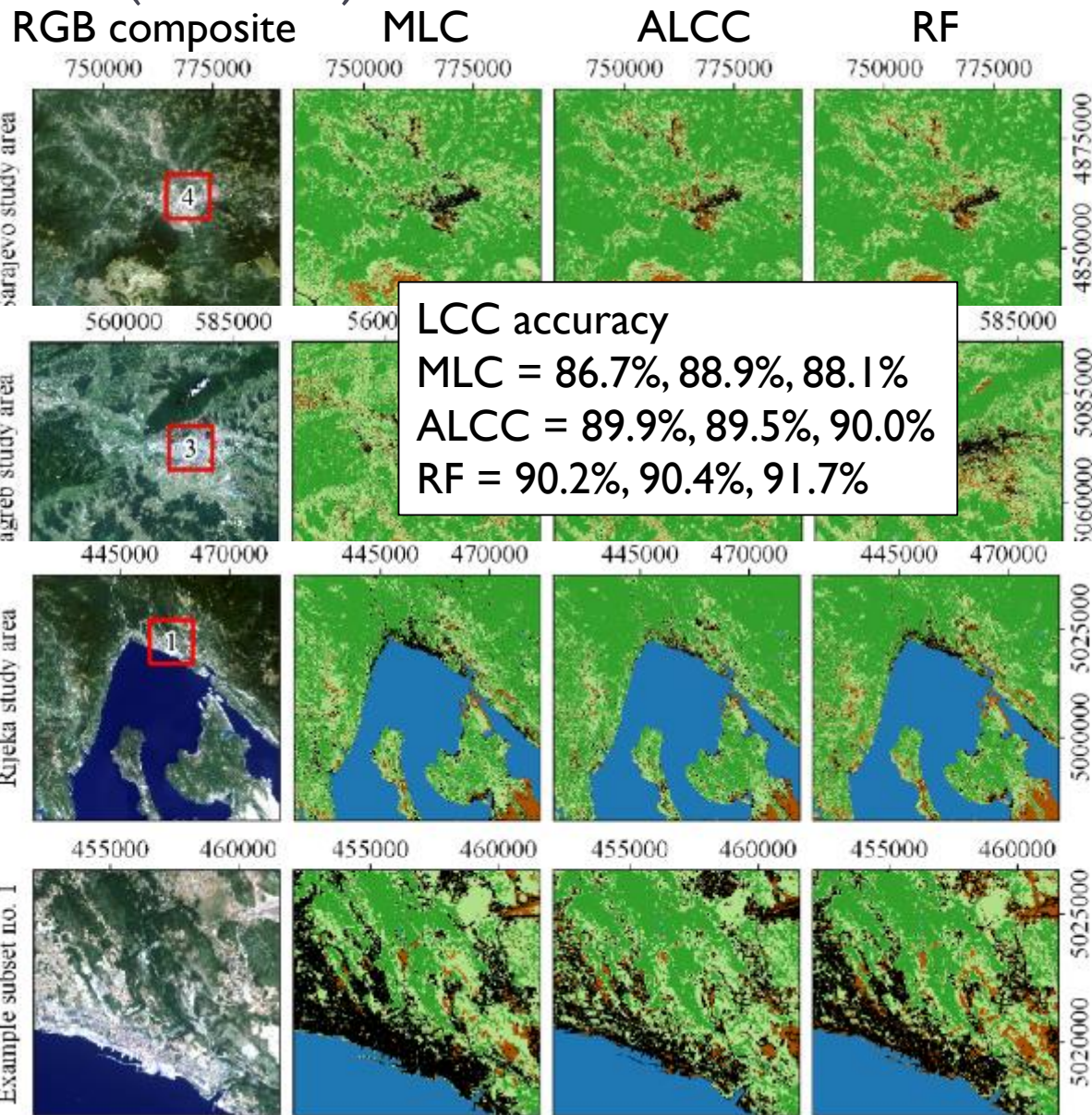




# Automatic cost-effective method for land cover classification (ALCC)

- ▶ ALCC does not require training polygons
- ▶ Various optical satellite data

- ▶ Gašparović, M., Zrinjski, M., (2018) Automatic land cover classification (ALCC) using satellite data



# Conclusions

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- ▶ The importance of protected GI areas is continuously growing
- ▶ To preserve them for future generations is necessary to implement a concept of sustainable development in their management
- ▶ Copernicus Programme allows free data for continuous monitoring of the Earth
- ▶ The GEMINI project enables development of new methods and systems for monitoring the urban GI
- ▶ UAV-based remote sensing offers great possibilities to acquire field data for GI monitoring within the urban areas in a fast and easy way
- ▶ Future analysis will be of great importance in fields such as forestry, arboriculture, urban and geospatial science



## Bundek Lake in City of Zagreb on VHRSI



Thank you for attention

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