



## Fusion of classification algorithms for landfill detection in Ukraine

Andrii Shelestov, Bohdan Yailymov, Hanna Yailymova, Polina Mikava



### Objectives and data

#### National problem

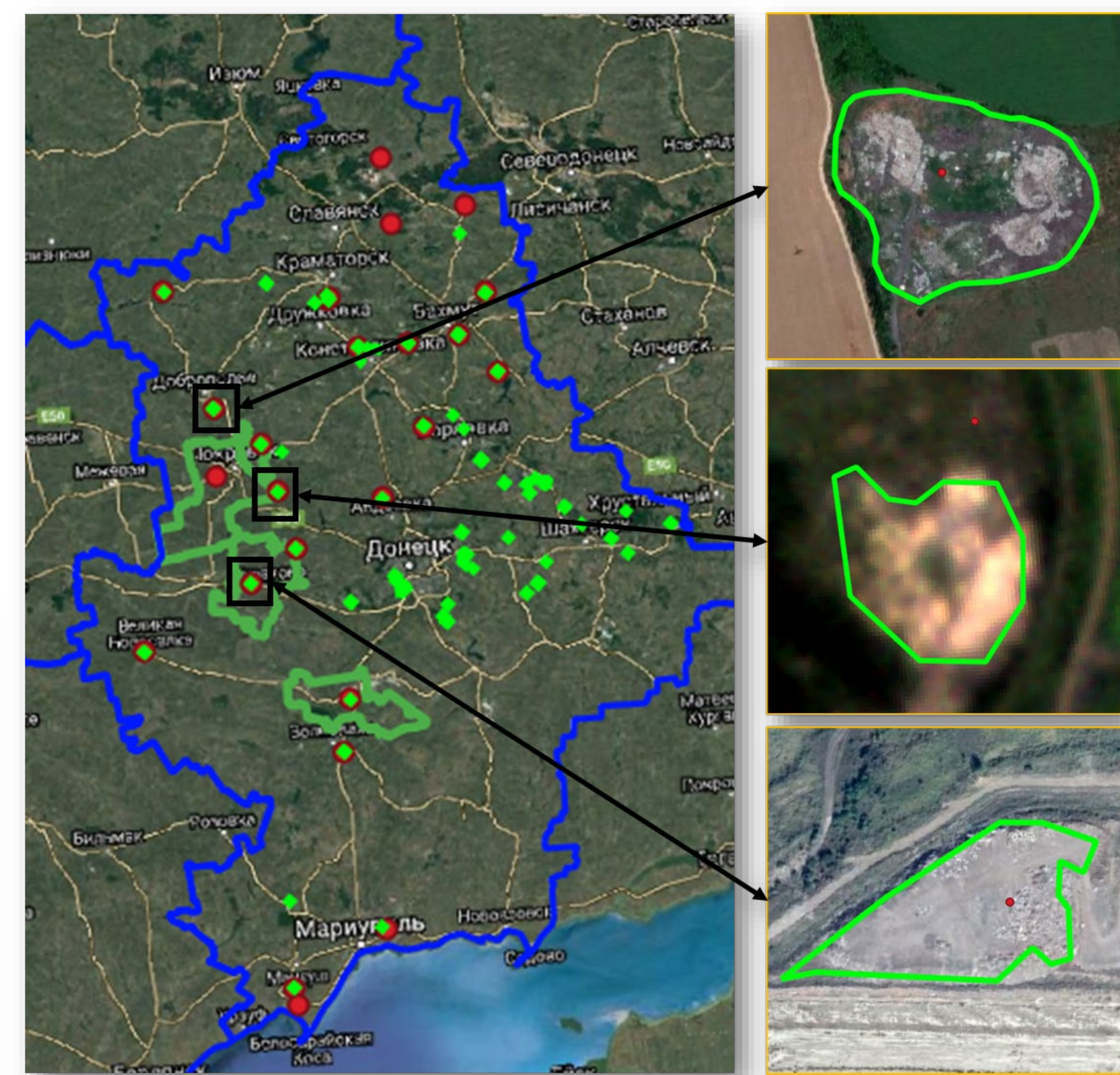
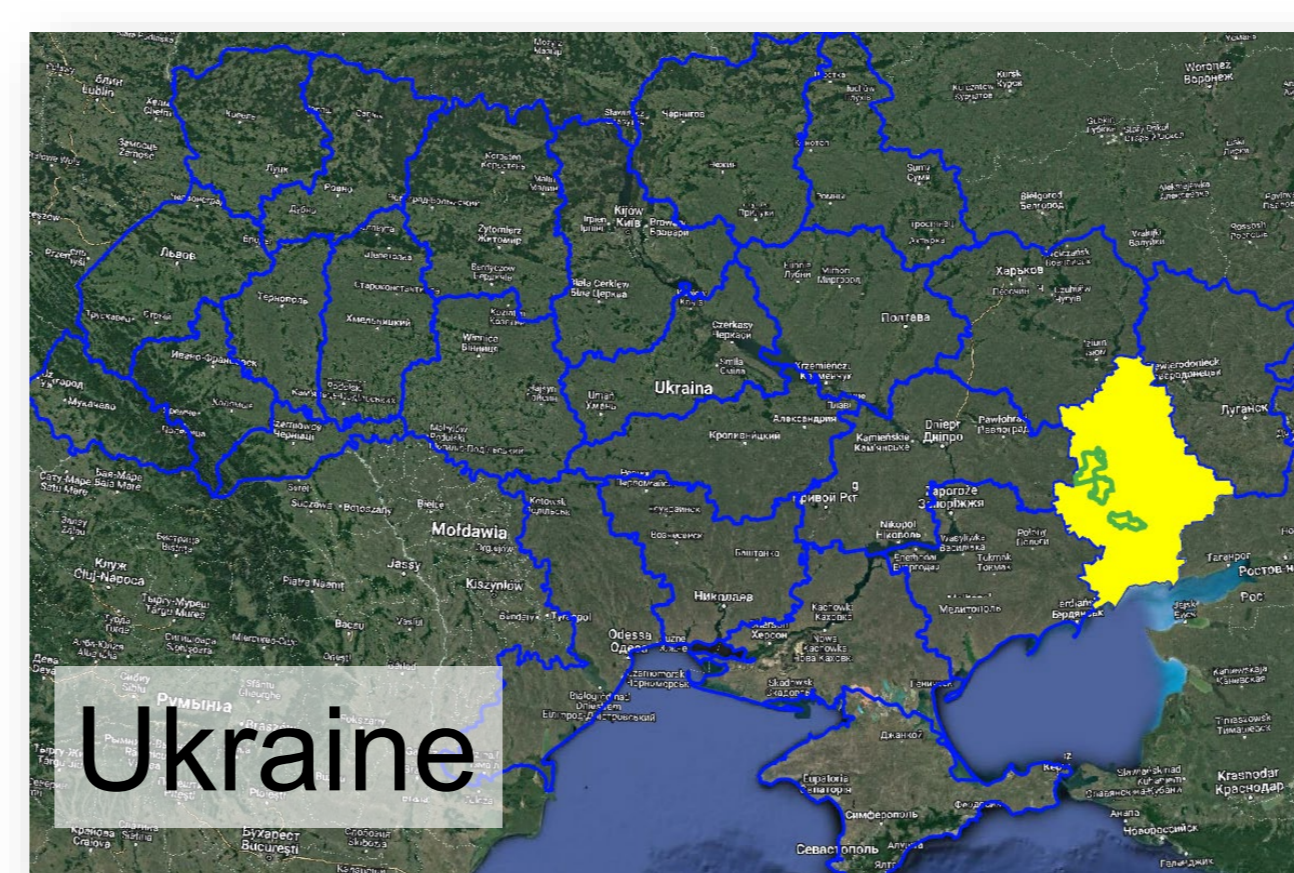
- Landfills occupy 4-7% of the country's area
- During 2021 year:
  - more than 54 million m3 of landfills was generated
  - 6 th. landfills
  - total area ~ 9 th. ha

#### Used data

- Satellite data
  - Sentinel-2 (10 meters)
  - Planet (3 meters)
- Train data
  - Photointerpretation
  - Open [source information](#)

#### Pilot territory

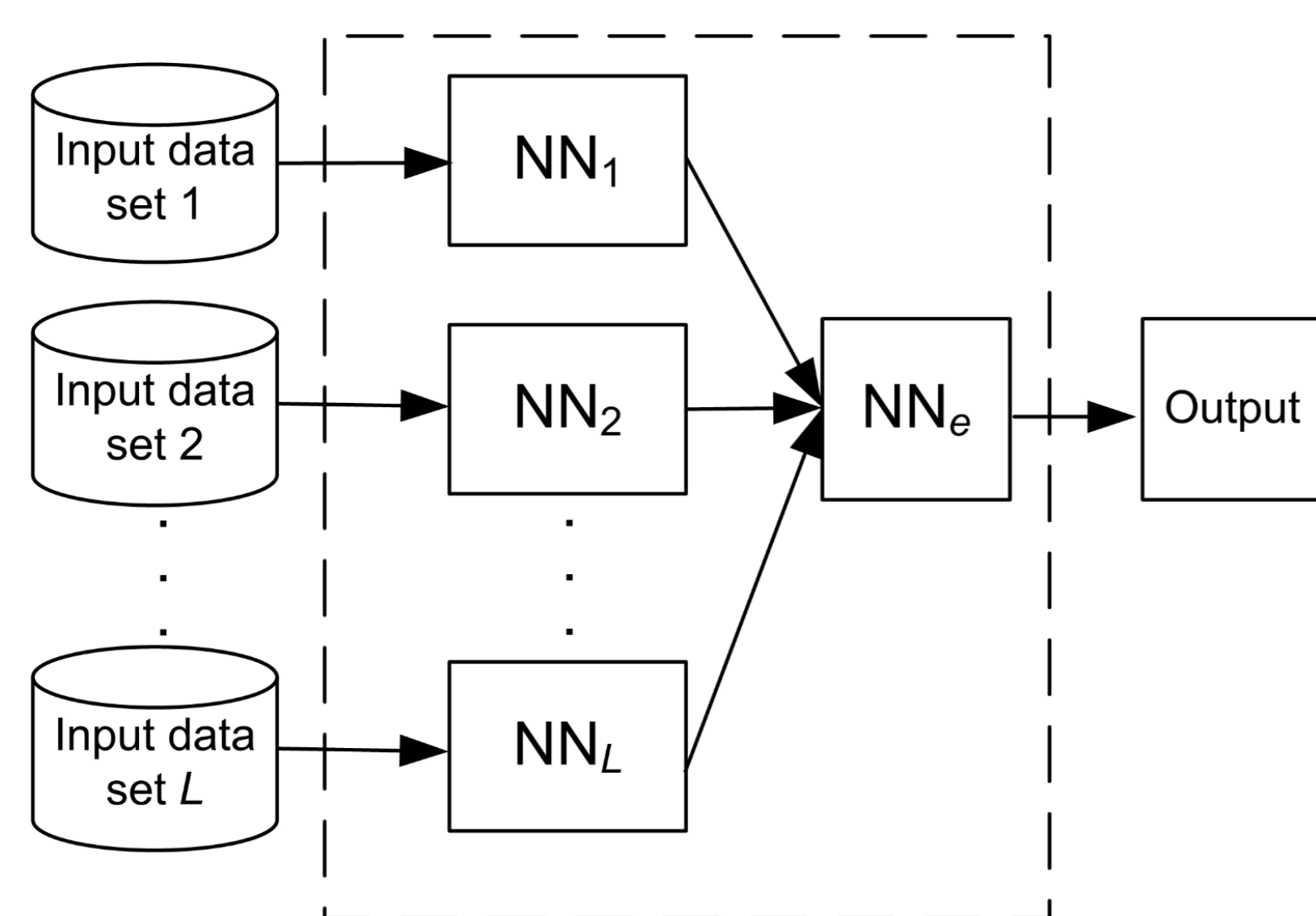
- Ukraine
- Donetska oblast
    - Olhynska
    - Pokrovska,
    - Myrnohradska
    - Kurakhivska regional territorial communities



#### Tasks

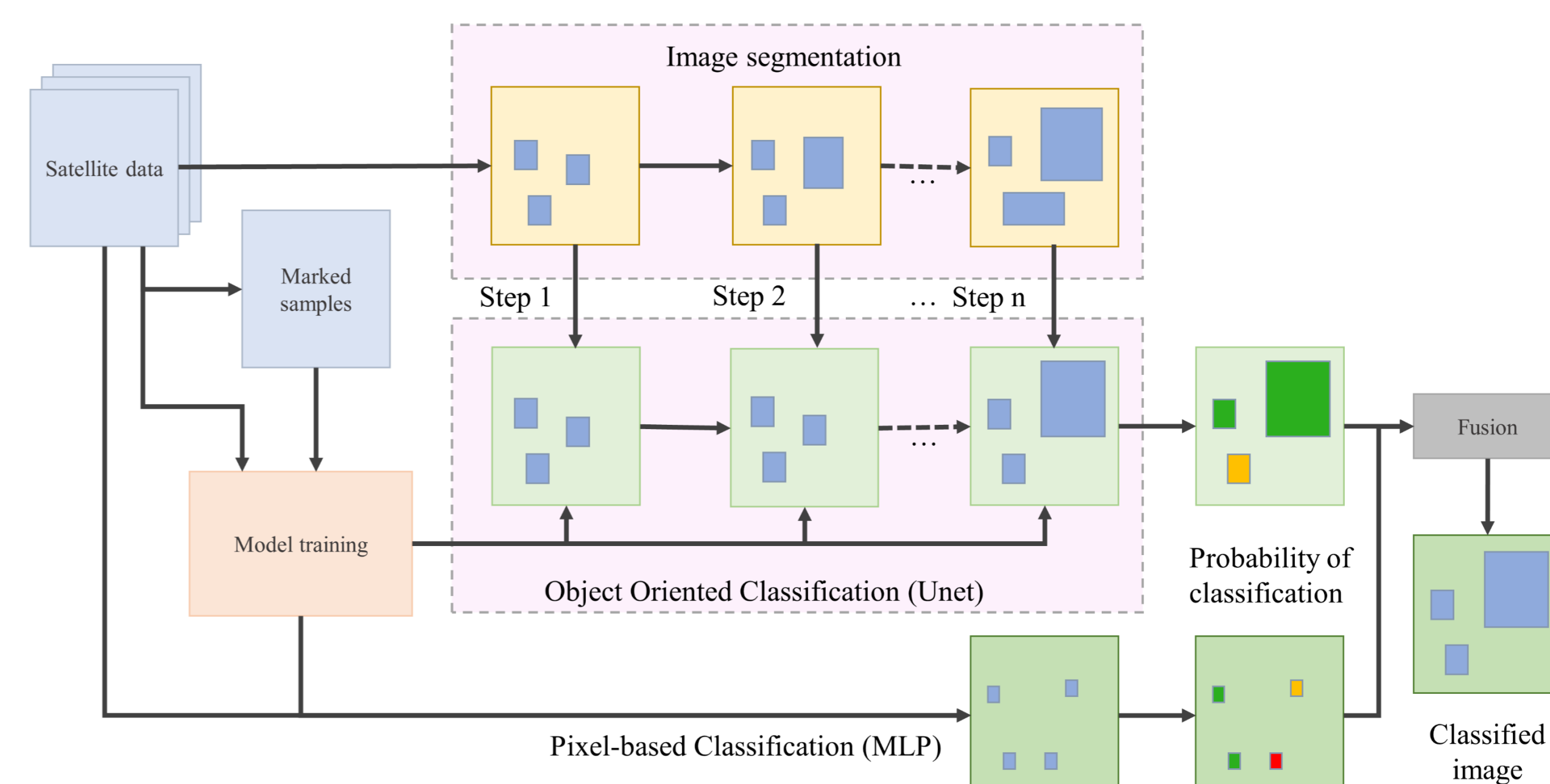
- Develop **neural network technology** to find landfill locations
- The developed technology **can be scaled** for a larger area of the country
- Develop a demo version of the **dashboard** to demonstrate the results
- International collaboration**

### Pixel-based method

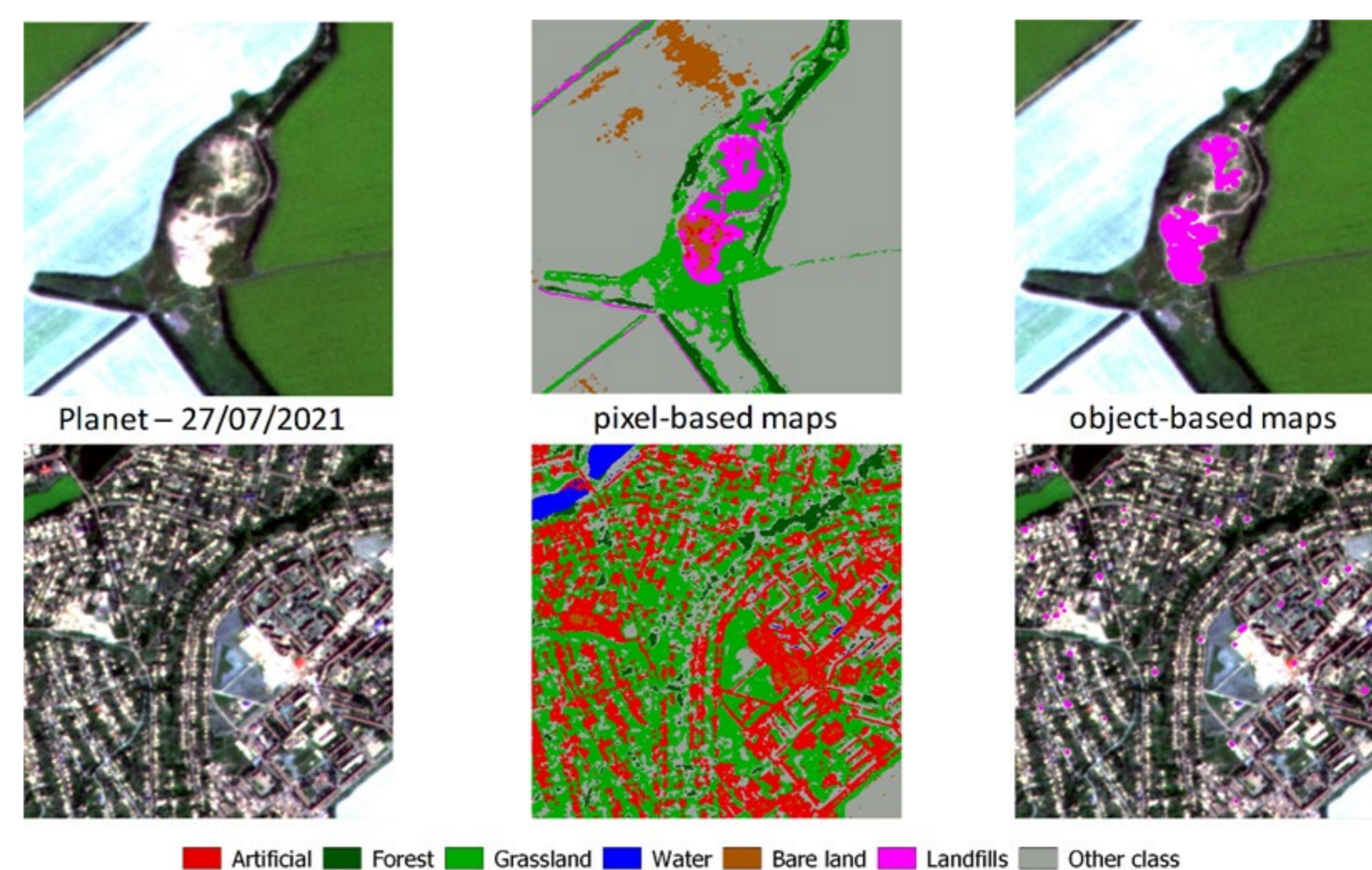
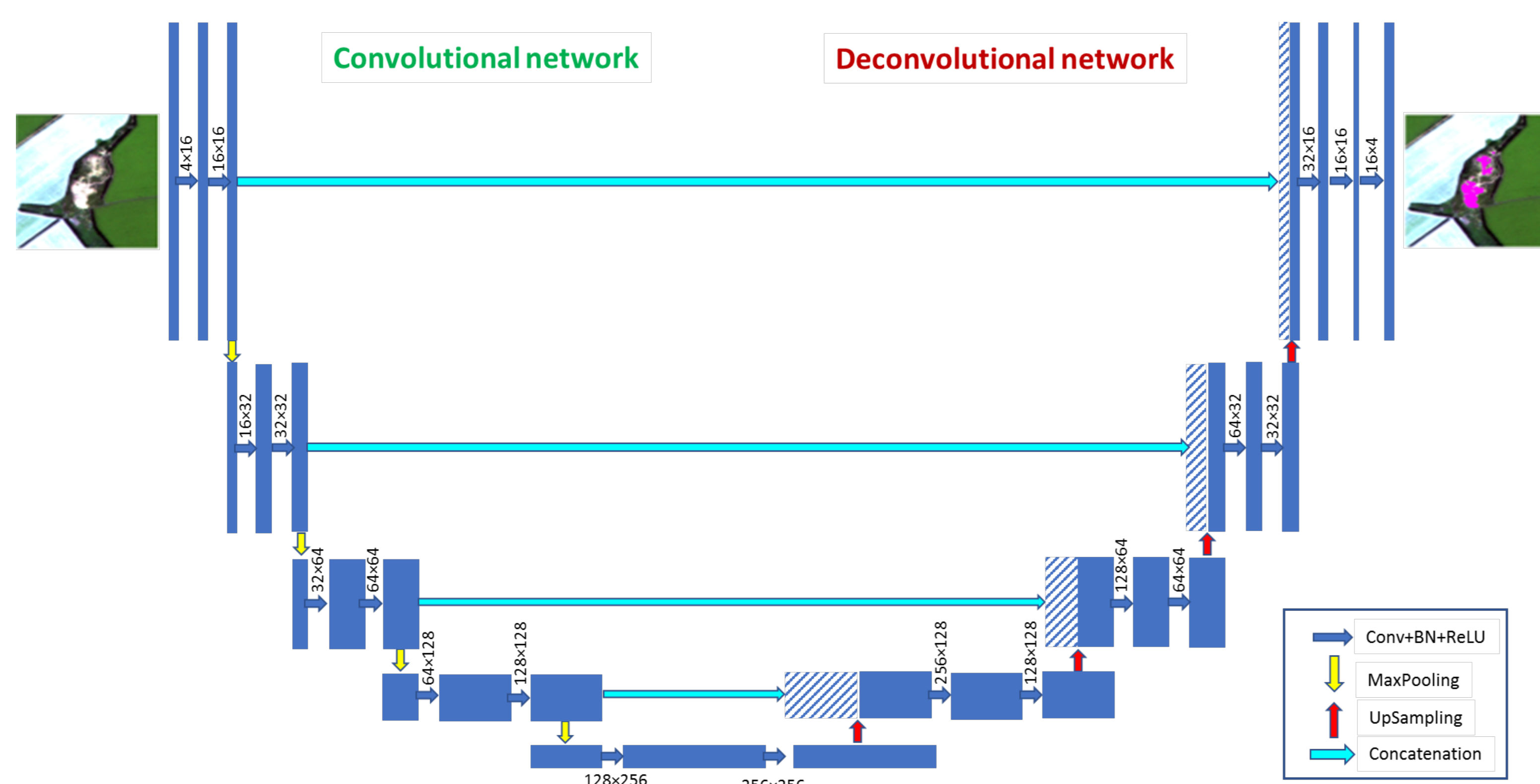


$$\begin{matrix}
 NN_1 & p^1_1 & p^1_2 & \dots & p^1_K \\
 NN_2 & p^2_1 & p^2_2 & \dots & p^2_K \\
 \vdots & \vdots & \vdots & \vdots & \vdots \\
 NN_L & p^L_1 & p^L_2 & \dots & p^L_K \\
 \text{Ансамбль} & p^e_1 & p^e_2 & \dots & p^e_K
 \end{matrix}$$

### Fusion of pixel-based and object-based classification



### Object-based method



### References

- 1.K. Simonyan and A. Zisserman, "Very deep convolutional networks for large-scale image recognition." Iclr, (2015) 1- 14.
- 2.Adedeji, Olugboja, and Zenghui Wang. "Intelligent waste classification system using deep learning convolutional neural network." Procedia Manufacturing 35 (2019): 607-612.
- 3.Kussul, Nataliia, Mykola Lavreniuk, and Leonid Shumilo. "Deep Recurrent Neural Network for Crop Classification Task Based on Sentinel-1 and Sentinel-2 Imagery." IGARSS 2020-2020 IEEE International Geoscience and Remote Sensing Symposium. IEEE, 2020.
- 4.Shumilo, Leonid, Nataliia Kussul, and Mykola Lavreniuk. "U-Net Model for Logging Detection Based on the Sentinel-1 and Sentinel-2 Data." 2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS. IEEE, 2021.

### Project dashboard

