SUNFLOWER YIELD PREDICTION BASED ON HIGH RESOLUTION SATELLITE IMAGERY

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Why use satellite imagery?

"Who stands on a hill, even a small one, sees more than he who stands below the hill."

Petar II Petrović Njegoš

"The Mountain Wreath", 1847

Why is crop yield such an important measure?

t/ha?   t/ha?

t/ha?   t/ha?

t/ha?

t/ha?   t/ha?

Objectives:

- optimise the storage capacity

- optimise logitiscs

- import/export strategy

- help farmers to create appropriate decisions

- market decisions
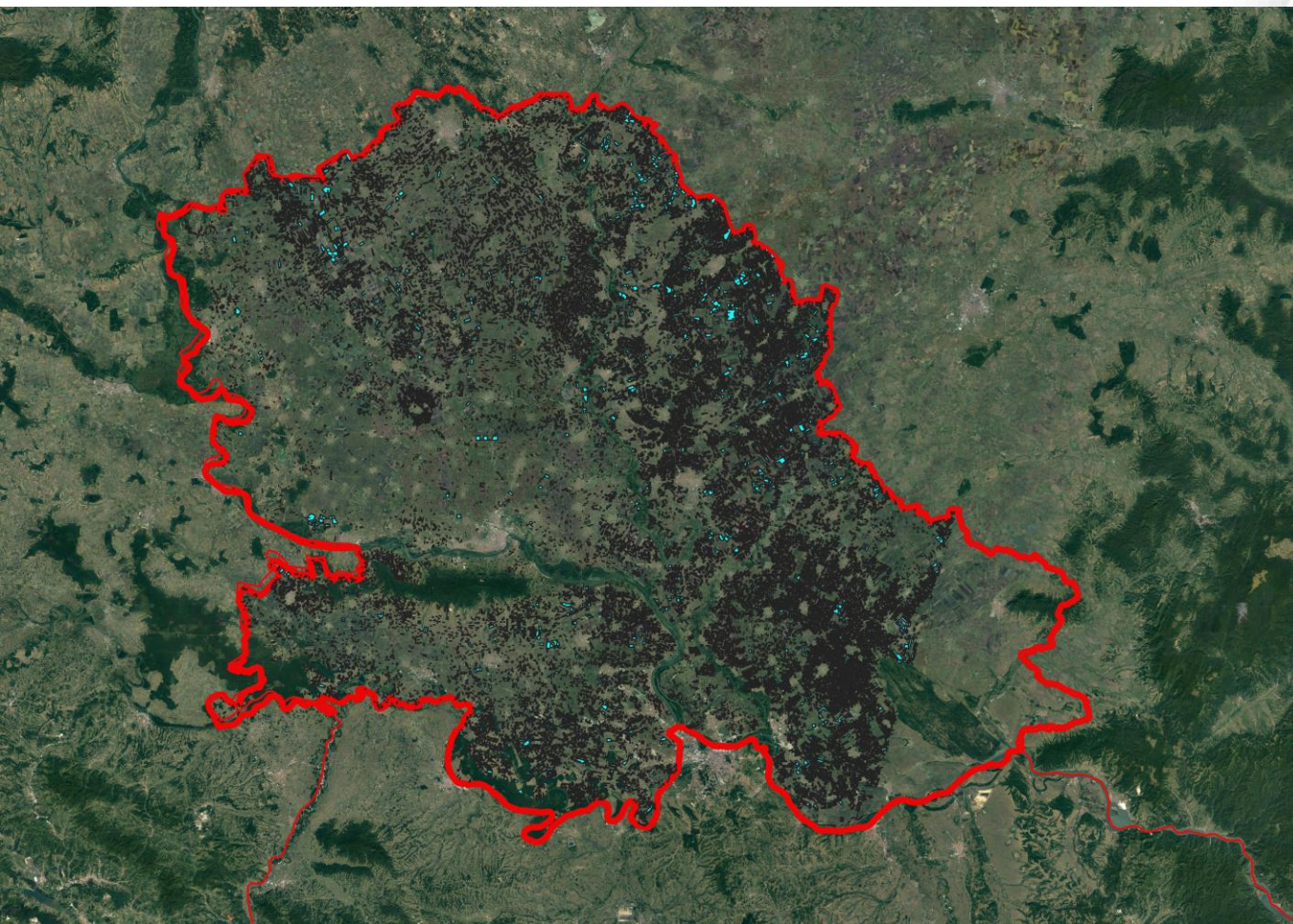

How it's currently done

Is it accurate?

Sometimes maybe yes, sometimes maybe...

First layer: Crop Classification

Sunflower fileds in Vojvodina region

Short oral presentations: Section 8

2. Branislav Pejak: Mapping sunflower areas using high resolution Sentinel-2 images
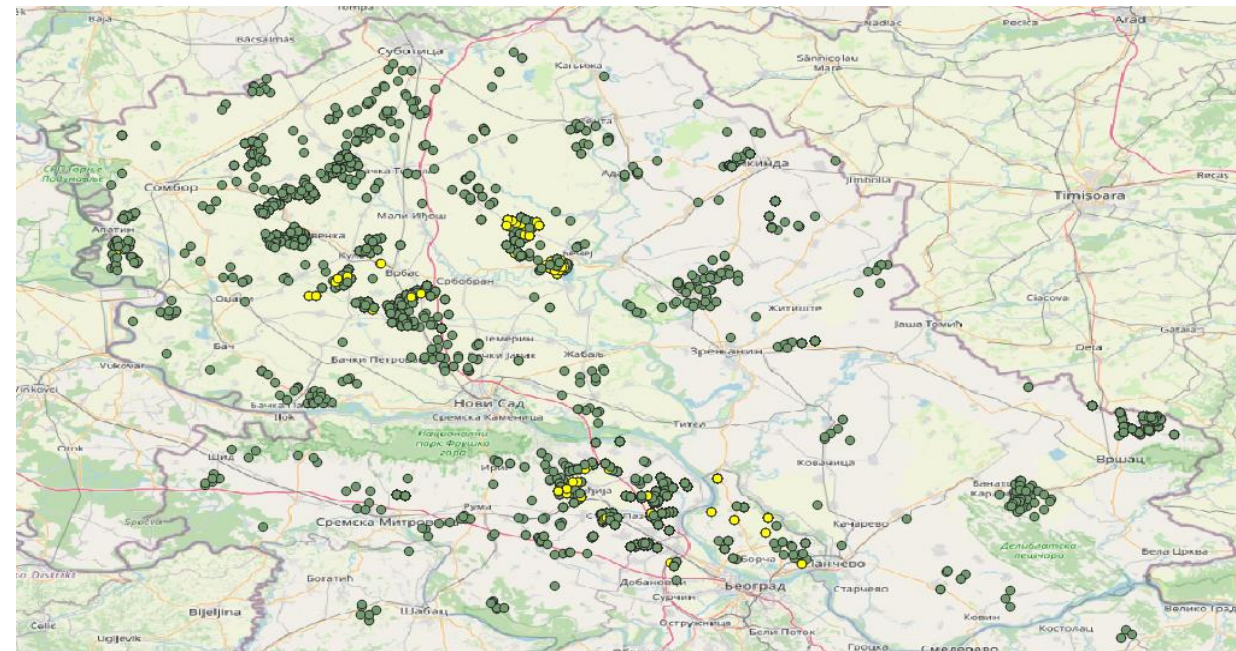
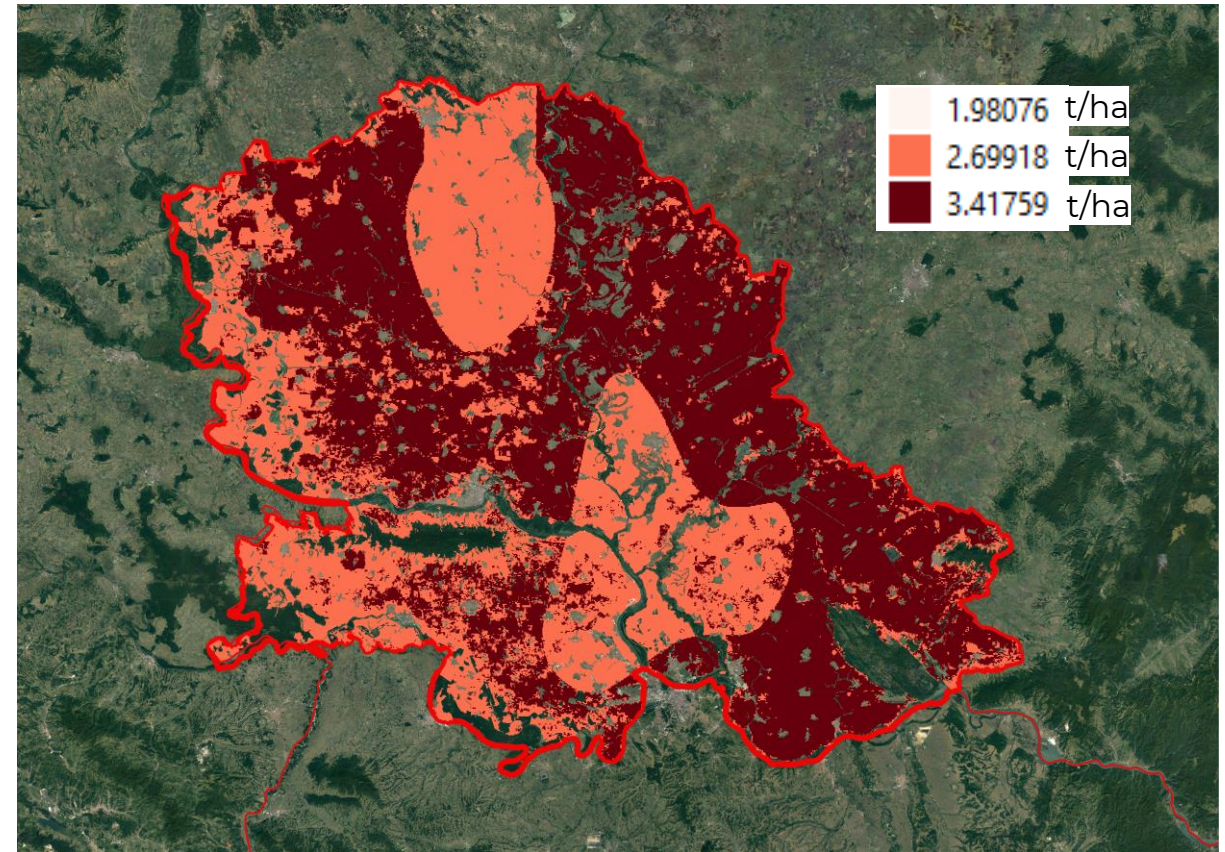# Yield prediction in different scales

3 APPROACHES:

1. **Yield potential mapping**

2. **Yield prediction at the field level**

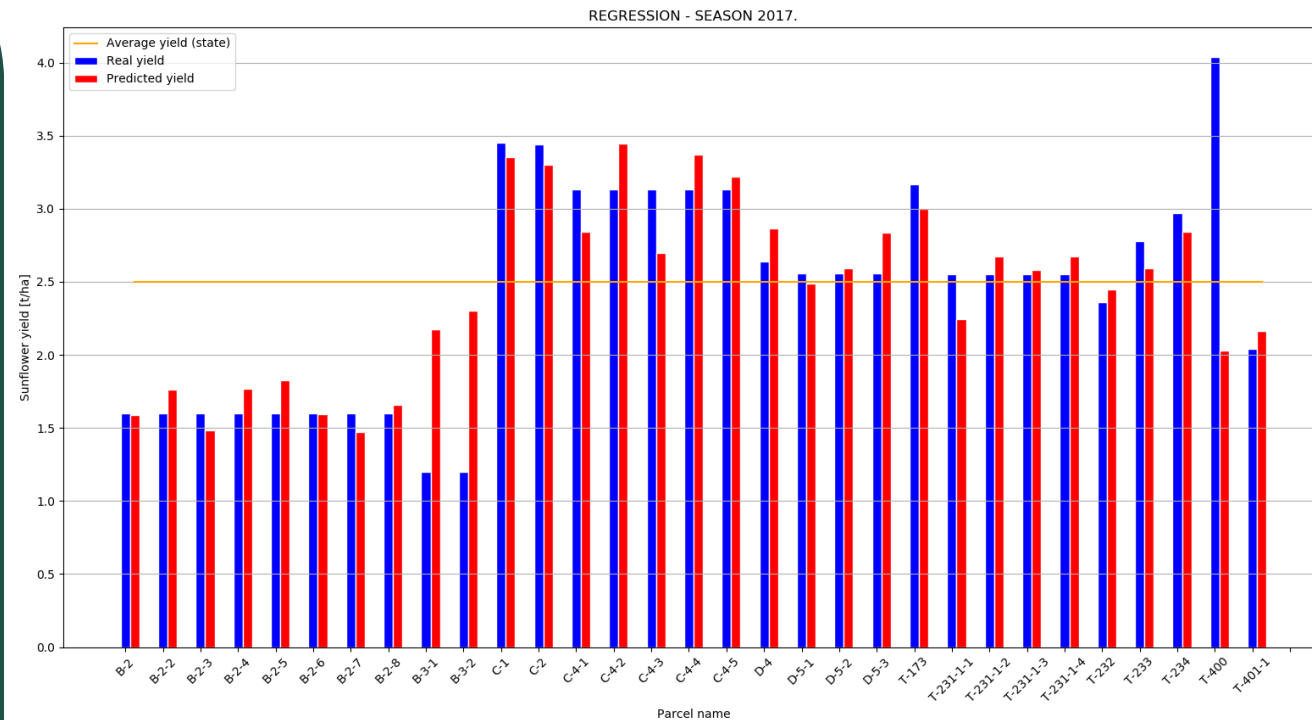3. **Yield prediction on within-field scale**

RESOLUTION

1. Yield potential mapping

- Data:
  - ➤ soil properties data (SoilGrids)
  - ➤ farm survey (3), 2015-2021
  - ➤ Around 1000 ha / year
  - ➤ Around 20 parcel / year

- Machine Learning models:
  - ➤ Random Forest,
  - ➤ SVM,
  - ➤ XGBoost,
  - ➤ Deep Neural Networks

- Resolution of output map: 250 m

1.98076	t/ha
2.69918	t/ha
3.41759	t/ha

Source: https://www.isric.org/sites/default/files/styles/gallery_big_image_900x700/public/SoilGrids_banner_web.png

2. Yield prediction at the field level

- Data:
  - ➢ ground truth (crop type),
  - ➢ satellite images (Copernicus hub),
  - ➢ meteo data,
  - ➢ soil propreties,
  - ➢ farm survey (3), 2015-2021
    - ❖ Around 1000 ha / year
    - ❖ Around 20 parcel / year

- Machine Learning models:
  - ➢ Random Forest,
  - ➢ SVM,
  - ➢ XGBoost,
  - ➢ Deep Neural Networks

- Resolution: field level [t/ha]

- Performance:
  - ➢ PCC = 0.76
  - ➢ MAE = less than 0.3 t/ha

REGRESSION - SEASON 2017.

Legend:
— Average yield (state)
■ Real yield
■ Predicted yield

FULL, FREE AND OPEN ACCESS TO DATA

- ATMOSPHERE MONITORING
- MARINE ENVIRONMENT MONITORING
- LAND MONITORING
- CLIMATE CHANGE
- EMERGENCY MANAGEMENT
- SECURITY

Copernicus
Europe's eyes on Earth

Source: https://i.ytimg.com/vi/bxxMXIDLHp4/maxresdefault.jpg

3. Yield prediciton on within-field scale classfied fields

- Data:
  - yield monitor data (27 fields),
  - satellite images,
  - meteo data,
  - soil propreties.

- Machine Learning models:
  - Random Forest,
  - SVM,
  - XGBoost,
  - SGD,
  - Deep Neural Networks

- Resolution of output maps: 10 m

- Performance:
  - PCC = 0.83
  - MAE = less than 0.25 t/ha

Yield monitor data
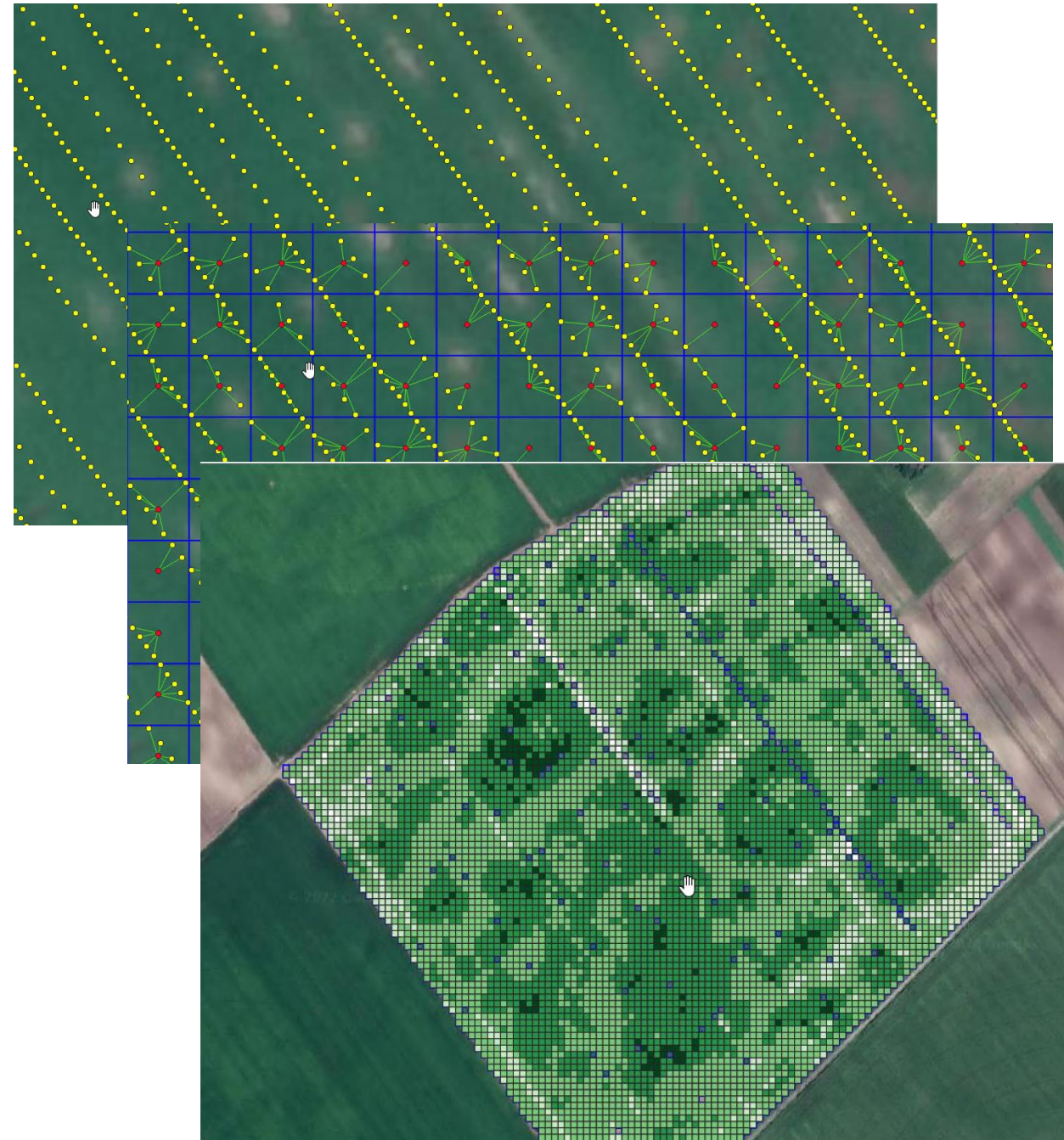
THANK YOU FOR YOUR ATTENTION!

QUESTIONS?