Use of satellite imagery Sentinel-1 and Sentinel-2 for crops classification
Sentinel - 1

Space mission funded by the European Union and carried out by the ESA within the Copernicus Programme, consisting of a constellation of two satellites. The payload of Sentinel-1 is a Synthetic Aperture Radar in C - 5,6 cm (5,405 GHz), band that provides continuous imagery (day, night and all weather, revisit time - 6 days).

Working modes:

- **SM (Stripmap Mode)** - stripmap mode acquires data with an 80 km swath at 5 m by 5 m spatial resolution,
- **IW (Interferometric Wideswath Mode)** - acquires data with a 250 km swath at 5 m by 20 m spatial resolution,
Sentinel - 1

- EW (Extra-wide Swath Mode) - acquires data over a 400 km swath at 20 m by 40 m spatial resolution,
- WV (Wave Mode) - acquires data in 20 km by 20 km area, at 5 m by 5 m under angle 23° and 36.5°.
Sentinel - 1
Comparison of radar reflectance classes values for 3 crops

- **Beans**
  - Series 1
  - Series 2
  - Series 3
  - Series 4
  - Series 5
  - Series 6

- **Spring Barley**
  - Series 1
  - Series 2
  - Series 3
  - Series 4
  - Series 5
  - Series 6
  - Series 7
  - Series 8
  - Series 9

- **Pasture**
  - Series 1
  - Series 2
  - Series 3
  - Series 4
  - Series 5
  - Series 6
  - Series 7
  - Series 8
Sentinel - 2

wide-swath (290 km), high-resolution, multi-spectral imaging mission, supporting Copernicus Land Monitoring studies, including the monitoring of vegetation, soil and water cover, as well as observation of inland waterways and coastal areas (revisit time—6 days),

Sentinel – 2 multispectral instrument samples 13 spectral bands:
• four bands at 10 metres spatial resolution: 490 nm (B2), 560 nm (B3), 665 nm (B4), 842 nm (B8),
• six bands at 20 metres spatial resolution: 705 nm (B5), 740 nm (B6), 783 nm (B7), 865 nm (B8a), 1 610 nm (B11), 2 190 nm (B12),
• three bands at 60 metres spatial resolution: 443 nm (B1), 945 nm (B9) and 1 375 nm (B10).
Sentinel - 2
Spectral reflectance
spring barley

Comparison of spectral reflectance values in 3 training points

3 maj

23 maj

22 czerwiec

2 lipiec

10 wrzesień
Klasyfikacja upraw na podstawie zdjęć radarowych Sentinel-1
klasyfikator: K-Nearest Neighbours; parametry: Wishard

Nazwa klas
- niepola
- bobrek
- buraki cukrowe
- gronie jadalne
- jure
- inne zboża jadalne
- jagnięce jary
- jeżowate ogrody
- koniuszka

Kolory:
- czarny
- pomarańczowy
- żółty
- niebieski
- zielony
- brązowy
- szary
- beżowy
- fioletowy

Legenda:
- czarny: niepola
- pomarańczowy: bobrek
- żółty: buraki cukrowe
- niebieski: gronie jadalne
- beżowy: jure
- fioletowy: inne zboża jadalne
- szary: jagnięce jary
- zielony: jeżowate ogrody
- brązowy: koniuszka

Poziom wykresu:
- 0
- 20
- 40
- 60
- 80
Methodology of selection agricultural plots for in situ testing
Administrative sources were used for plots selection:

- cadastral parcels vector data from Land Parcel Identification System (over 34 mln records, 13GB of data),
- agricultural plots vector data from Land Parcel Identification System (over 33 mln records, 23GB of data),
- General Geographic Database (BDOO).

1. Agency for Restructuring and Modernisation of Agriculture (ARiMR)
2. Head Office of Geodesy and Cartography (GUGiK)
Other sources:

Other sources were used for plots selection:

- SRTM (Shuttle Radar Topography Mission) - areas with slope above 3°,
- vector borders of the SENTINEL-1 at 250 km swath.
Plots selection criteria:
plots of width and length min. 60m
(1 975 876 plots)
Plots selection criteria:
plots located only on areas with slope below 3°
(1 808 337 plots)
Plots selection criteria:
plots located only on agricultural areas
(1 124 595 plots)
Plots selection criteria:
excluded plots at a distance of 2km from the inside border of satellite swath (1 094 806 plots)
Plots selection criteria:

minimum 30 samples for one crop (300 for each voivodeship):

1. winter wheat,
2. spring wheat,
3. rye,
4. winter barley,
5. spring barley,
6. oat,
7. winter triticale,
8. spring triticale,
9. winter cereal mixes,
10. spring cereal mixes,
11. corn,
12. winter rape,
13. spring rape.
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Thank you for your attention.