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Geoinformation Technology of Agricultural Monitoring Using Multi-Temporal Satellite Imagery

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Abstract : Geoinformation technologies of space agromonitoring are a means of operative decision making support in the tasks of managing the agricultural sector of the economy. Existing technologies use satellite images in the optical range of electromagnetic spectrum. Time series of optical images often contain gaps due to the presence of clouds and haze. A geoinformation technology is created. It allows to fill gaps in time series of optical images (Sentinel-2, Landsat-8, PROBA-V, MODIS) with radar survey data (Sentinel-1) and use information about agrometeorological conditions of the growing season for individual monitoring years. The technology allows to perform crop classification and mapping for spring-summer (winter and spring crops) and autumn-winter (winter crops) periods of vegetation, monitoring the dynamics of crop state seasonal changes, crop yield forecasting. Crop classification is based on supervised classification algorithms, takes into account the peculiarities of crop growth at different vegetation stages (dates of sowing, emergence, active vegetation, and harvesting) and agriculture land state characteristics (row spacing, seedling density, etc.). A catalog of samples of the main agricultural crops (Ukraine) is created and crop spectral signatures are calculated with the preliminary removal of row spacing, cloud cover, and cloud shadows in order to construct time series of crop growth characteristics. The obtained data is used in grain crop growth tracking and in timely detection of growth trends deviations from reference samples of a given crop for a selected date. Statistical models of crop yield forecast are created in the forms of linear and nonlinear interconnections between crop yield indicators and crop state characteristics (temperature, precipitation, vegetation indices, etc.). Predicted values of grain crop yield are evaluated with an accuracy up to 95%. The developed technology was used for agricultural areas monitoring in a number of Great Britain and Ukraine regions using EOS Crop Monitoring Platform (https://crop-monitoring.eos.com). The obtained results allow to conclude that joint use of Sentinel-1 and Sentinel-2 images improve separation of winter crops (rapeseed, wheat, barley) in the early stages of vegetation (October-December). It allows to separate successfully the soybean, corn, and sunflower sowing areas that are quite similar in their spectral characteristics.

Keywords : geoinformation technology, crop classification, crop yield prediction, agricultural monitoring, EOS Crop Monitoring Platform
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