Algorithms for processing hyperspectral and multispectral data in monitoring and modeling of environmental changes

Ewa Glowienka 1), Beata Hejmanowska 2), Sławomir Mikrut 1, 2), Krystyna Michalowska 3), Piotr Kramarczyk 1)

1) AGH University of Science and Technology, Poland, eglo@agh.edu.pl, galia@agh.edu.pl, smikrut@agh.edu.pl, gorgany100@o2.pl
2) Hyperlab Solution LTD, Poland smikrut@hyperlabsolution.com
3) Gdansk University of Technology, Poland, krystyna.michalowska@pg.edu.pl

The research included archival and current satellite data, data from conducted aerial campaigns, terrestrial spectrometric measurement, results of field interviews for selected test areas. The data prepared for use were saved in the PostgreSQL database. The contents of the created database are recorded image data: multispectral (Landsat, Sentinel 2, WorldView 2), hyperspectral (over 400 channels) and spectral libraries created on the basis of spectrometric measurement. Due to the huge number of hyperspectral image channels, large recording area and high frequency of satellite scene recording, the created database has a huge capacity, both disk and information.

Imaging remote sensing data have been optimized to remove noise and amplify the signal of the tested objects (soil samples, vegetation, anthropogenic objects) by preparing spectral indicators. For selected channels identified as spectral ranges containing relevant spectral information, analytical methods were used to model e.g. the level of metal content in soil, the condition/state of vegetation, etc. Comparison of the results of accuracy analyzes allowed to indicate classification methods providing thematic information at a specific level of accuracy and to select objects terrain coverage, obtaining the best accuracy with a specific set of channels recording the spectral response for defined electromagnetic spectrum bands. In estimating the level of accuracy, it was necessary to take into account environmental factors characteristic of a given research area.

The research included archival and current satellite data, data from conducted aerial campaigns, terrestrial spectrometric measurement, results of field interviews for selected test areas. Algorithms for remote sensing data processing (hyperspectral and multispectral) have been developed on the basis of all data collected under the project, qualitative and quantitative analysis and verification materials, enabling identification and mapping of selected phenomena (including soil pollution, condition and condition of plant cover).