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THE METHOD OF OPTIMAL HYPERSPECTRAL COLOR SEGMENTATION OF AEROSPACE IMAGES, TO ASSESS THE DYNAMICS OF CHANGES IN THE STATE OF LANDSCAPE ELEMENTS

Abstract

We have developed a method for optimal hyperspectral segmentation of aerospace images. The proposed technique is based on a summary information assessment of the selected color segments of images, which is based on the following assumptions: 1. The signal-to-noise ratio at the output of the hyperspectrometer is a linearly decreasing function of the wavelength. 2. There is a monotonic function of the dependence of the number of pixels on the wavelength of the signal in the selected segment of the image. There is also an inverse function of the dependence of the wavelength of the signal on the number of pixels in this segment. 3. There is a limitation on the range of measured wavelengths. 4. The total informativeness of the selected color segments is determined as according to the classical Shannon formula. Based on the above assumptions, a discrete variational Lagrange optimization problem is compiled. The solution of the continuous analog by the Euler method allowed us to obtain an expression for calculating the optimal function of the dependence of the wavelength of the signal on the number of pixels in this segment.as well as the maximum achievable total amount of information in color segments. If there have been changes in the elements of the studied landscape over a certain period, then the information assessment of such changes can be estimated as the ratio of the increment of the calculated amount of information to the specified time increment. To verify the reliability of the proposed methodology, Azersky satellite images with a resolution of 1.6.-3.0 m were used. The multispectral images presented by JSC Azercosmos were processed on the basis of the ArcGIS 10.8 as a result of which an information assessment of the color segments of the images considered for various stages of the growing season was carried out. Processing procedures made it possible to assess the parameters of the state of individual landscape elements of the studied territory, as well as to trace the dynamics of changes in agricultural crop yields. Further, the results of model calculations and experimental measurement data were compared, which demonstrated the operability of the proposed technique.