A multilevel thresholding method based on multiobjective optimization for non-supervised image segmentation

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Abstract

The aim of this work is to provide a comprehensive review of multiobjective optimization in the image segmentation problem based on image thresholding. The authors show that the inclusion of several criteria in the thresholding segmentation process helps to overcome the weaknesses of these criteria when used separately. In this context, they give a recent literature review, and present a new multi-level image thresholding technique, called Automatic Threshold, based on Multiobjective Optimization (ATMO). That combines the flexibility of multiobjective fitness functions with the power of a Binary Particle Swarm Optimization algorithm (BPSO), for searching the “optimum” number of the thresholds and simultaneously the optimal thresholds of three criteria: the between-class variances criterion, the minimum error criterion and the entropy criterion. Some examples of test images are presented to compare with this segmentation method, based on the multiobjective optimization approach with Otsu’s, Kapur’s, and Kittler’s methods. Experimental results show that the thresholding method based on multiobjective optimization is more efficient than the classical Otsu’s, Kapur’s, and Kittler’s methods.

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