Swarm Intelligence Techniques for Image Segmentation: A Multi-objective Optimization Approach

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Abstract

Image segmentation is an important image analysis component that partitions an image into its constituent parts or objects. Image thresholding is one of the most popular image segmentation techniques which is based on the assumption that objects in an image can be distinguished by their gray levels. This research focuses on thresholding techniques for image segmentation. Thresholding is done by optimizing a segmentation criterion which is a statistical function of the threshold values. But often a single criterion does not give good segmentation results for all sorts of images. Multiple criteria should be optimized simultaneously to obtain good segmentation results which entails the requirement of Multi-Objective Optimization (MOO). We intend to design and implement Multi-objective Particle Swarm Optimization (MOPSO) algorithm to optimize multiple criteria for image segmentation. We will first identify suitable segmentation criteria by surveying the literature. MOO algorithms give a set of equally good solutions called Pareto optimal solutions. We have to devise a heuristic to pick up the best solution among these solutions according to domain specific knowledge. Finally we will assess the performance of the proposed MOPSO algorithm and will evaluate the quality of segmentation using benchmark images.

Since, the state of the art of MOPSO is still in its rudimentary stage, our main focus is on contributing MOPSO body knowledge. We will first try to use existing image segmentation criteria and if necessary we will come up with novel criteria as well.