Multi-Level Thresholding for Image Segmentation With Swarm Optimization Algorithms

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Abstract —**Image segmentation is an important problem for image processing. The image processing applications are generally affectedfromthe segmentation success. There is noany image segmentation method which gives good results for all sorts of images. That's why there are many approaches and methods forimage segmentationin the literature. And one of the most used is the thresholding technique. Thresholding techniques can be categorized into two topics: bi-level and multi-level thresholding. Bi-level thresholding technique has one threshold value which separates the image into two groups. However, multi-level thresholding technique uses *n* threshold values where *n* greater than one. In this paper, two swarm optimization algorithms (Particle Swarm Optimization, PSO and Cat Swarm Optimization, CSO) are applied on finding the optimum threshold values for the multi-level thresholding. In literature, there are some minimization or maximization functions to find the best threshold values for thresholding problem. Some of these methods are: Tsalli's Entropy, Kapur's Entropy, Renyi's Entropy, Otsu's Method (within class variance/between class variance), the Minimum Cross Entropy Thresholding (MCET) etc.In this work, Otsu's (within class variance) method, which is one of these popular functions,is used as the fitness function of algorithms.In the experiments, five real images are segmented by usingParticle Swarm Algorithm and Cat Swarm Optimization Algorithms. The performances of the swarm algorithms on multi-level thresholding problem arecompared with Peak Signal-to-Noise Ratio (PSNR) and fitness function (FS) values. As a result, the PSO yields better performance than CSO.**

Keywords: **image segmentation, thresholding, otsu, within class variance, cat swarm optimization, particle swarm optimization**

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