ON IMAGE SEGMENTATION USING A COMBINATION OF FELZENSZWALB, SLIC AND WATERSHED METHODS

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ABSTRACT

Image segmentation is an essential problem in Computer Vision and it is foundational to the development of next-generation information extraction methods, issued in problems of great interest, such as driving autonomous machines, text analysis, object identification, extracting information from images. Knowing that there are no perfect algorithms for image segmentation, this paper aims to achieve a method that combines the results of different algorithms through various voting schemes in the hope of getting better results.

KEYWORDS

Computer vision, image segmentation, image processing, voting algorithms, SLIC, Watershed, Felzenszwalb

1 INTRODUCTION

Image segmentation is a class of image processing algorithms that identify, and group pixels based on specific criteria. The segmentation process itself entails image processing algorithms that strategically isolate areas of interest within images: for example, image processing could use segmentation to direct self-driving machines in traffic. These algorithms generate certain limitations in terms of image quality. Their tendency to over- or under-segment makes it necessary to devise algorithmic combinations that can help maximize image segmentation results [1].

2 PROPOSED VOTING ALGORITHM

There is a series of approaches for image segmentation. Each one has downsides or upsides corresponding to the input data. Methods such as model-based, central clustering, graph theoretical based, non parametric density estimation based methods, empirical and hybrid approaches, and square-error clustering, present a view on some elements on the input data, by grouping or making clusters based on a set of properties. In the current scenario, no single technique could manage all types of clusters. Studies in the last decade show that fusing classifiers helps to increase the accuracy and the diversity of input data. The combining process of the methods' decisions is reviewed, and this technique is met in studies as the voting technique. The method proposed in this article involves two options for voting using the algorithms Felzenszwalb, SLIC and Watershed. The first voting technique is the use of democratic voting, where each algorithm has an equal weight in the segmentation decision. This method has been proposed as a starting point in exploring voting techniques. Voting is represented as a linear function, and each algorithm has equal weight. This algorithm was tested on several images and has been shown to have weaker results than the independent running of each algorithm separately. Another approach of this method is for each algorithm's vote to come with a weight. The weights are estimated from successive runs, and weights that provided performance were kept for the final vote.

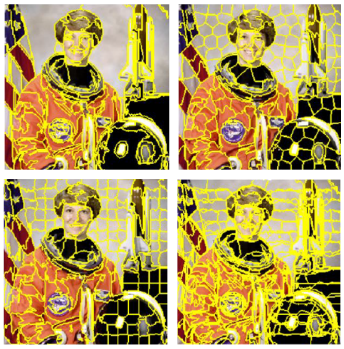

Figure 1: Astronaut image. From the left to right, top to bottom: a) Felzenszwalb segmentation, b) SLIC segmentation, c) Compact watershed, d) Voting method.

3 IMPLEMENTATION AND RESULTS

The results obtained with Felzenszwalb, SLIC Superpixels, Watershed, and the proposed method on image presented in figure 1 are shown in figure 1b,c and d. the corresponding obtained segments after applying these methods.

Image	F	S	Wa	Voting method
Number of segments	194	190	256	198

4 CONCLUSIONS

Different voting techniques have been explored using image segmentation algorithms, and from the obtained results, one can observe the influences of each algorithm on voting. For future work, Deep Learning algorithms can be applied to combine results similarly. Because the algorithms presented in this article are in the class of unsupervised algorithms, they cannot be combined with supervised algorithms, such as Deep Learning.

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