Practice 6: Segmentation

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Abstract

There are many methods to segment images. These methods are based on the characteristics of the image, in this way the pixels corresponding to each group can be clustering. Therefore, in this practice it is proposed to make a function to segment an image. This function has the objective of cluster pixels with similar characteristics. The algorithms that will be used to clustering the pixels are kmeans, gmm, hierachical and watershed. The segmentation database BSDS500 of the University of Berkley will be used.

1. Introduction

The processing of images made by the human being has the ability, just by observing a few seconds an image, to be able to interpret and categorize semantic information. In this way, in the field of computer vision, the segmentation of an image is quite important. The process of segmentation of an image is defined as the process of dividing a digital image into multiple segments, with the aim of simplifying and changing the representation of an image in something that is more meaningful and easier to analyze. In this way the objective of this laboratory practice is to use the BSD500 segmentation database of Berkeley University, to create a function that can segment the different regions within the image. [1]

2. Methodology

For this laboratory the segmentation database was used, this database is composed of 24 images. Each image has the annotation of the segmentation of 5 people. From this, we propose to use the following parameters of the image to apply them in the segmentation function, such as, color space, clustering method and cluster number for each images. The input arguments of the function is a color image, in the rgb channel, and the return argument is an array, the same size as the 2-dimensional image, where pixels belonging to the same group have the same positive response integer.

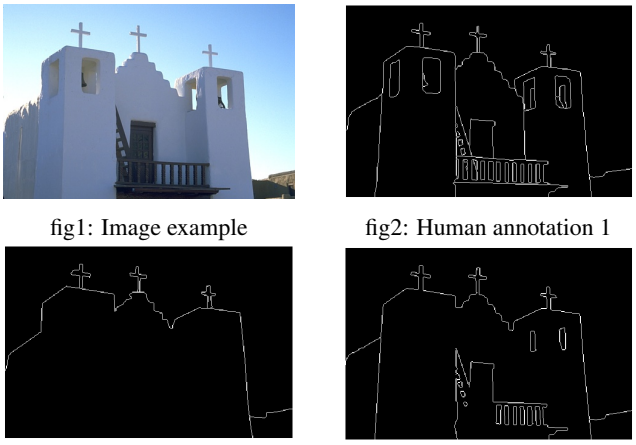

fig1: Image example fig2: Human annotation 1

fig3: Human annotation 2 fig4: Human annotation 3

Figure 1: Example of images segmentation in the database

In this practice, three methods of clustering were used. The first, K-means, is a form of unsupervised grouping where a quantity n of data in this case intensity of pixels, are ordered in number K of groups, where they approach the closest average value, forming groups with the same intensity .

On the other hand, GMM was used, corresponds to the mix of probabilistic distributions that in this case is a Gaussian. Through this method centroids or means of the same distribution are established, the limits between clusters is the variance of them that is calculated empirically, the groups are defined by the maximum probability of belonging to that group.

Finally, a hierarchy segmentation is type of nested segmentations, partitions at higher levels are unions of regions based on low levels. For this reason, the watersheds using the minimum markers produce a hierarchy segmentation, in this extended regional minimum at the contrast obtained by merging together the regional minimum that can be connected by a path of height

For this case, it is necessary to re-scale down the values

of the channels, this in order to reduce the processing scales since they can take very high scales. Therefore, a faster convergence is reached. On the other hand, it was necessary to re-scale the images, this in order to reduce processing times as the main problem and memory uses. Additionally, this allows an easier organization of the obtained information, as it is the case of the application of filters. However, this generates the loss of relevant information as a form and makes comparison with annotations difficult.

To select the cluster number we did not apply any special method, as you know this is random or user's consideration, in our case we apply between 5 and 8 clusters where they resemble the annotations, with the idea of generating the same amount of regions. However, there are methods like the Elbow Method

Generally segmentation problems are evaluated using the Jaccard index, where the intersection of the areas on the junction is compared. However, the segmentation is not a perfect problem and everyone understands the objects in different ways, in this way, the coverage and presicion curves must be generated, the segmentation must be evaluated correctly in the specified region or if this extends. It is evaluated as a detection problem.

To evaluate the function developed, no method was applied, this is because the information was not similar and could not be compared. In addition, the methods were not as accurate as expected.

Finally, for the solution of the problem, a matlab code was developed since it has segmentation tools that are easier to use. However, when using python methods you could see better results. Additionally, the code was run over a group of 20 images with a K = 8.

3. Results

Next, the resulting images and annotations with the expected segmentation are displayed.

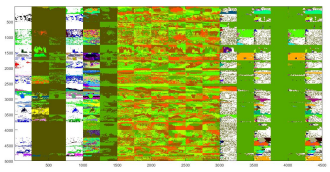

Figure 2: Matrix of image resultant

4. Discussion

By reviewing the method, it can be verified that using different color spaces allows for better results, especially if linear distances can be used. In this case, the one that yields the best results is that of lab + xy, using k-means, the safest thing is that it is due to the use of the Uklidean distance

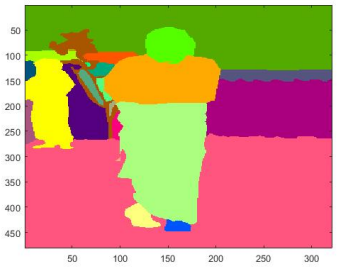

Figure 3: Annotation and expected result in segmentation

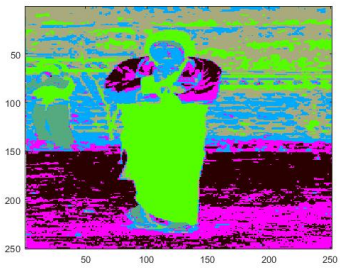

Figure 4: Segmentation obtained

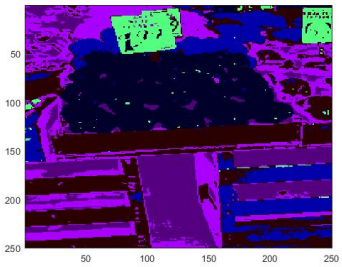

Figure 5: Segmentation obtained

and that the selected color channel is linear, in addition the imposition is not necessary of minimus. The methods are limited mainly in the allocation of clusters, it is an iterative method, that in some images you can get to see better results according to the color channel and the clustering method that is used.

On the other hand, there is no special channel for the operation, everything depends on the information you want to obtain. Since, the methods fail to require a number of specific clusters, they are iterative and the image needs a lot of processing before its proper development. In addition, the evaluation strategy could be improved by applying the purchase on each region, the image and making the coverage and precision curves. Finally, a method could be used to establish the Ks automatically, in the same way better segmentation methods could be applied, as is the case of a

more adequate way to implement minimums in the use of wathersheds.

5. Conclusions

It was observed that the clustering methods are not very effective at the time of segmentation due to lack of labels, processing times and, in addition, they are very difficult to evaluate.

References

[1] D. Martin, C. Fowlkes, D. Tal, and J. Malik. A database of human segmented natural images and its application to evaluating segmentation algorithms and measuring ecological statistics. In *Proc. 8th Int'l Conf. Computer Vision*, volume 2, pages 416–423, July 2001.