International Journal of Electrical and Electronics Research ISSN 2348-6988 (online)
Vol. 4, Issue 2, pp: (182-186), Month: April - June 2016, Available at: www.researchpublish.com

SUPERVISED BASED APPROACH FOR IMAGE SEGMENTATION

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Abstract: **This paper presents image segmentation based on the combination of phase-correlation and region growing algorithm. In image processing image analysis is an integral part. In image processing different processes are done on images to enhance it at different parameters. These processes are not directly applied on images but before that it needs to be divided in smaller parts of interest, so that processing can be done only on the desired part. So segmentation becomes an integral and basic part in image analysis and error at this stage can influence other processing techniques. As in this paper an algorithm is developed for two different dimensions for two class images. Phase correlation is applied to determine spectral similarity. Similar and dissimilar pixels are decided according to the peak value of the phase correlation result to determine pixels that fall into the same segments. Region growing algorithm is used to expand the region from the seed point in which similar or dissimilar pixel blocks are decided by phase correlation algorithm. Experimental results show the effectiveness and efficiency of this method.**

Keywords: **Phase correlation, region growing, image segmentation, seed points.**

I. INTRODUCTION

When texture images are considered there is no formal mathematical definition for texture images. It is considered to be a complex visual patterns, composed of spatially organized entities that have characteristics like brightness, color, shape, size. Simply it is considered to be a regular repetition of an element or pattern on a surface. Data for texture image can be taken from natural texture, material texture etc[9]. Some of the pictorial representation of natural and material texture is shown in figure 1.

(a)Material Texture **(b)Natural Texture**

Fig. 1: Types of textures[11]

Image segmentation is a process of partitioning digital image into multiple segments that is set of pixels also known as superpixels. In image segmentation the goal is to simplify or change representation of image into something that is more meaningful and easier to analyze [3]. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. Image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics[8]. Each of the pixels in a region are similar with respect to some characteristic or computed property, such as colour, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristic [9]. Recently, it is shown that the phase correlation of subsampled images can be effectively used to discriminate similar and dissimilar images and, therefore, provides a competent approach for hard-cut detection in archive film sequences affected by noise and other artifacts, and the subsampling of images improves robustness against noise as well as global and local variations[1].

Phase correlation is applied to determine the similarity between pixels. The phase correlation has a built in whitening effect so that global variations are automatically compensated during this process[5]. Similar and dissimilar pixels are decided according to the peak value of the phase correlation result to determine pixels that fall into the same segments and the number of resulting segments is determined automatically by this process[2].

Along with phase correlation region growing algorithm is also used. The concept is simple. A small numbers of seed point to represent the property which is required, then grow the region. Any seed point can be selected with any criteria or property which helps to distinguish the region [10].

II. IMAGE SEGMENTATION USING PC AND RGA

As mentioned earlier in this paper an algorithm is developed by using the combination of phase correlation and region growing algorithm. In this algorithm the result varies based on the kind of seed points selected. So the results depends on basically two things. First is seed point selection and second is threshold selection for phase correlation value[7]. Along with this the result also depends on the window size. If window size is too small then it will take huge time to scan all the windows and if window size is too large then it will give inappropriate results. In many papers it is observed that mostly window size of 16x16 is taken which is not too big or too small. So all the images are subdivided into 16x16 window size which is considered to be more suitable in such kind of processes. There are two parameters based on which the results of these three algorithms are compared and they are percentage accuracy and time. To check the robustness of these algorithms they are applied on two different dimension of image i.e. 128x128 and 256x256.

Phase correlation is an important aspect in the algorithm. Similar and dissimilar pixels are decided according to the peak value of the phase correlation result to determine pixels that fall into the same segments or not. Phase correlation can be used for template matching [1]. The ratio R between two images img1 and img2 is calculated as follows [4]:

$$R = \frac{\mathrm{F}(\mathrm{img1}) \times \mathrm{conj}(\mathrm{F}(\mathrm{img2}))}{||\mathrm{F}(\mathrm{img1}) \times \mathrm{conj}(\mathrm{F}(\mathrm{img2}))||} \quad (1)$$

where F is the fast fourier transform, and conj is the complex conjugate. The inverse Fourier transform of R is the phase correlation [4]. As selecting the threshold is an important task. So instead of selecting the threshold just by observation there is need to use some other method for phase correlation value. Putting the value by by observation can automatically put some error in the output as the threshold is selected only by observation of the phase correlation value.

So in this algorithm instead of selecting the threshold by observation new concept of taking an average of all that phase correlation values is applied and the resulting average value is considered to be a threshold. As average of some numbers is more accurate than the value taken just by observation, the accuracy in the third algorithm is high compared to first two algorithms. Along with that region growing algorithm is also used. In this initial seed is selected and then the region grows from it and then another seed is selected and process continues till all the windows get scanned.

III. ALGORITHM

1. Read the image from the database.

2. If image in colour then convert into grayscale.

3. Choose initial seed window neighbor window.

4. Apply phase correlation on both the windows and take average of those value.

5. Repeat step 3 and apply phase correlation by taking that average value as a threshold.

6. Stored the result in the database.

7. Find percent accuracy and required time.

IV. EXPERIMENTAL RESULTS

According to the concept of averaging, an average of more number of readings give more accurate and error free output. So concept of averaging is used in the algorithm along with phase correlation and region growing algorithm. In the region growing algorithm after selection of the seed point the region grows by comparing the surrounding pixels or block of pixels with the seed point. But for comparison it needs some criteria which will be taken with the help of phase correlation. First phase correlation applied on the window to find out it's phase correlation value and then similar and dissimilar pixels are decided according to the threshold. And based on that the region should be merged or it should be exlcluded has been decided.

As mentioned earlier the algorithm is applied on different database and on different dimension. Different database has different kinds of textured images. The results are shown for the database with their average accuracy and average time required for each figure. So the pictorial and tabular results are shown below.

(a) 128x128 **(b) RGA with PC**

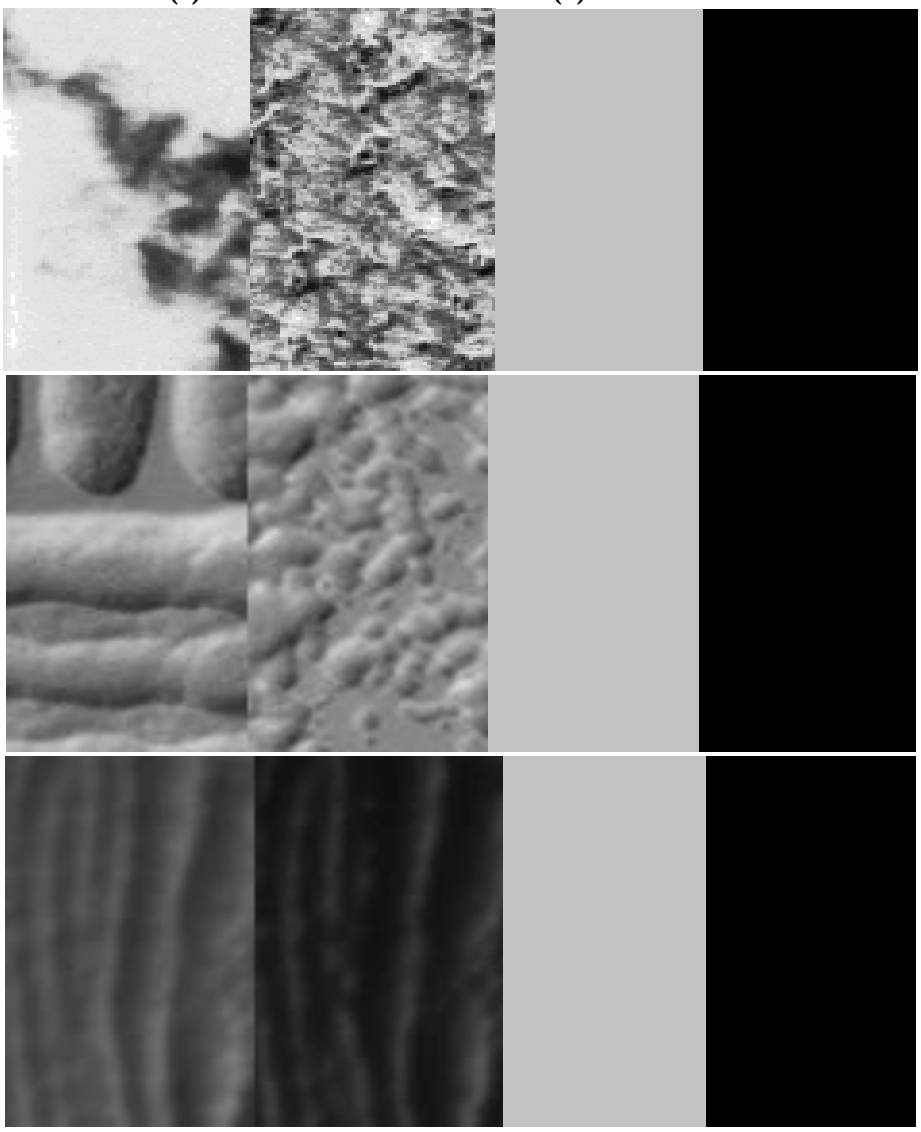

Fig. 2: Segmentation Result of an Algorithm for 128x128 Dimension

Table 1: Segmentation Result for 128x128 Dimension

Database	Average Time	Average Accuracy	Total Time	No. of Images
Database 1	2.2689	99.4594	251.8479	111
Database 2	2.3680	99.6096	1577.088	666
Database 3	1.8692	99.3400	170.0972	91

(a) 128x128 **(b) RGA with PC**

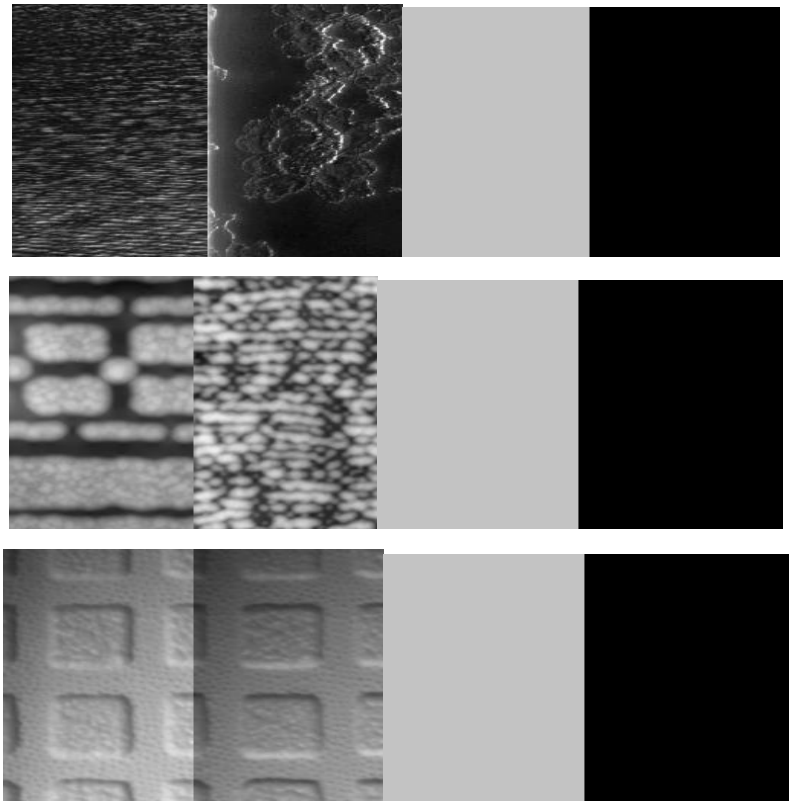

Fig. 3: Segmentation Result of an Algorithm for 256x256 Dimension

Table 2: Segmentation Result for 256x256 Dimension

Database	Average Time	Average Accuracy	Total Time	No. of Images
Database 1	9.6400	99.0090	1070.0400	111
Database 2	9.7401	99.3540	6486.9066	666
Database 3	8.6032	98.6813	782.8912	91

V. CONCLUSION

A supervised image segmentation approach using phase correlation and region growing algorithm is presented in this paper. In region growing algorithm initially seed windows are selected one by one and phase correlation is performed on it along with it's neighboring window to classify similar and dissimilar windows depending on the threshold. As this algorithm is performed on textured images, so it has huge application in real life like in medical imaging, machine vision, natural texture, object detection, etc. This algorithm has a limitation for it's region growing algorithm as it requires to provide initial seed window. So it can be considered as a future work to make the region growing algorithm fully automatic so that it can start automatically by deciding initial window and stops when entire region gets scanned.

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