ISSN: 2278 – 1323
International Journal of Advanced Research in Computer Engineering & Technology
Volume 1, Issue 5, July 2012

A New Approach of Region Descriptor in content based image compression in medical applications

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Abstract:
In this article the goal is to state a new algorithm demarcating regions and definer of regions in image processing applications. The study domain of this algorithm is the images derived from radiology in medical applications, bases of the algorithm is utilizing mechanism of "division" and "domination" and "quad tree".
Advantages of this method is it's ability of scaling, simpleness, accuracy in demarcating and it's shortcoming of calculation in comparison with other methods.

Key words: region discriptor, content based image compression, quad tree, division and domination.Lossy compression.

Introduction

One of the newest methods in image and video compression , is the method of content based image compression. Bases of this method is dividing an image into two ROI regions of less importance ant more importance, in this article an effective and competent way for demarcating these regions is presented. From the prevalent methods "chain codes", "playgon estimations", "indexes", "fouriyer definers"[6] , "topologic definers" and ... . are to be named which mostly have complex algorithms and are not proper for defining regions in medical images.
The method presented in this article has a high flexibility and due to rotation, magnifiying, image ratio change, the regions code won't change also length of code for defining the region is very short.

Since nowadays mankind deals with lots of different images of different applications , one of the most important purposes of saving, preserving and transferring. In fact in this level a "ROI" definer for specifying important and unimportant regions Is needed. In this paper mamography imagery has been studied.

Studying mamography imagery, it has been concluded that geometric definers can't be used because of the cloud like entirely, of these images. On the other hand, definers such as fourier, has extremely complexe calculation, and less flexibility therefore in this paper a method is presented which has, less mathematic calculations and is more flexible to magnification variance.

Mammography imagery[4]

In a digital mammograph different types of masses such as race mose calcium, benign tumors, malignant tumor and etc. can be seen. The newly tested analysis methods for mammography imagery has shown acceptable results which has helped physicians in diagnosing the healthy and concerned tissues of body.
Basically breast tissues consist of lipid and adapter fiber tissues which this sector is divided into 20 other sectors named "LOBE" (figure 3)which images is image compression. There are several methods of compressing which can be classified into two groups named: 1) lossy compression 2) loss less compression. Which the first group has high compression rate and low quality and the second group has an average rate

of low compression including the maintenance of the quality.

Considering the high rate of compression in "lossy compression"[5] methods they can't be applied in some medical applications, since by destruction of image details, medical diagnose will be disrupted and has no validity, therefore a compounded methods of compression are posed which content based image compression can be considered on of them.

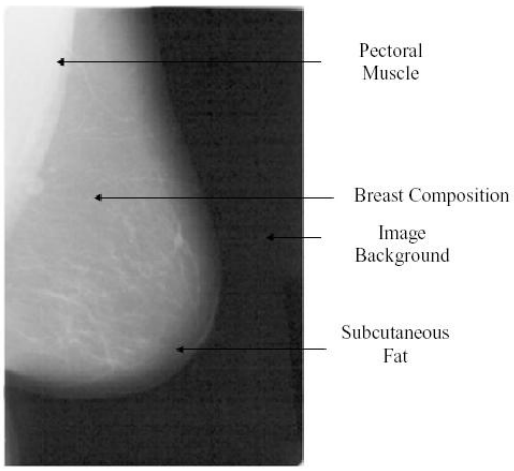


Figure 1-normal mamogram

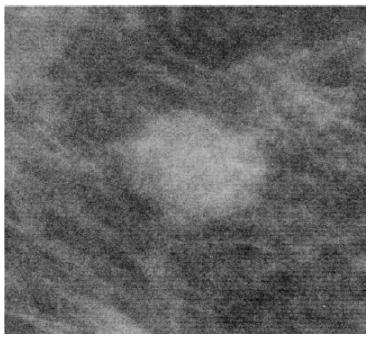


Figure 2- LOBOLE in mamogram image

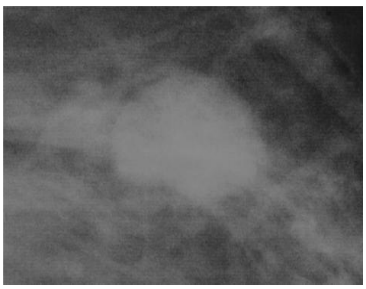


Figure 3- LOBE

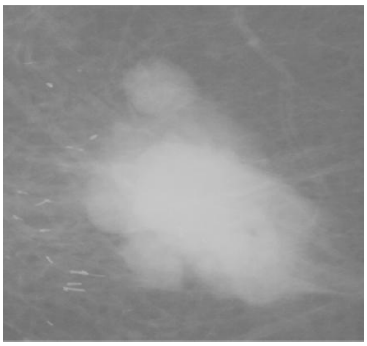


Figure 4 – calsium LOBE

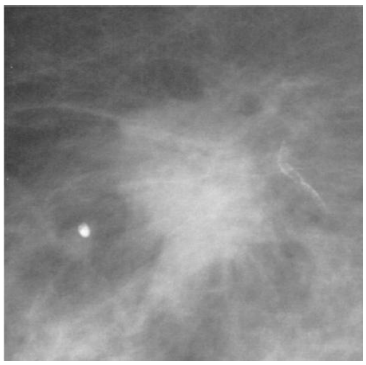


Figure 5 –tumor

In this method after dividing an image, into two regions of interest and regions with less interest . different compression algorithms will be implemented on them and regions of low interest. Will be compressed by lossy compressions methods and regions of interest will be compressed by loss less compression methods. One of the most important factors of this process is preserving and defining those two regions separately, is divided into some sub-sectors named "LOBOLE" , these sectors make the structure of lactation glands. These glands ooz the milk into the air tubule which conveys the milk outside the breast. Therefore any type of disruption in this system can cause de formation in the tissue and be seen in mammography imagery.

In mammography imagery different types of glands can be viewed(figure 1-5), according to their density shape and verges, tumors and masses, can be seen as circle elliptical shapes like earlap, dis ordered and wormless.

Verges in a mass or tumor can include limited, dimed, faded, unclear, gloomy prickled mass.
Some samples of tumors are available in the following figures. These images are the samples of different tissues, in mammography. By studying these masses and tumors, different methods of distinguishing healthy and infected masses or normal tissues can be presented.

Discriptor of a Region

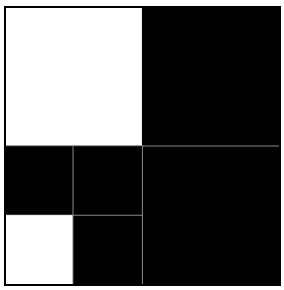
At the beginning some common methods in definers are reviewed and then the main idea of this paper is presented.
One of the common methods is using "shape number methods" which consists of a chain of numbers from 0 to 3, these numbers represent the deformations along the verges, this definer is mostly used for demarcation of closed regions and is not proper for regions with spreaded mass.
"fourier"[3] definer is one of the other common definers in this method by considering points in verges the goal is to find one of the "fourier" series which is closer to the desired verge. In this method loads of calculation is also needed, this method is not suitable for spreaded masses .therefore a method should be selectedin which spreaded masses in the image is also been seen.
An another method is to use "Phi_s" curve definers, in this method a point is selected as the center , "s" and "Phi" represent the distance of the point from the center. And the angle in regards with horizontal action(figure 8-10).

Figure 6-mamogram image in allication before segmentation

Figure 7-application output after segmentation

Considering the dependence of this method to the center pounds. And also complex calculations and the generated code , it doesn't have much efficiency in medical applications. After selecting a proper method for diagnosing the unhealthy tissue from the rest of the image , now a good method for demarcation and specifying these regions should be found a sample of separation in one image in presented below.
It can be seen the "Far" region in figure1-5. doesn't have geometric order and has different pieces and is not bounded. So that definers such as "fourier" and "shape number" can hardly be used. The idea of this paper is utilizing the division, solution and Quad tree method. In this method , at the beginning the the image is divided into 4 regions. Each filled reason, is considered 1. and each blank region is considered code 0 and also a symbol is selected which is in case of viewing the symbol, that region will also be divided into 4 regions.

At the beginning the whole area will be scanned, if all the points are white, it will be code 1 and if all the parts are black the code will be 0(figure 8). now if the region is not single colored, the region will be divided to 4 other regions and a "p" symbol is added to the code of the region. And for each 4 regions in clock wise order, the algorithm will be applied after these levels , a chain of 0s,1s, P's are available which they describe the "Far" region. A sample of applying the algorithm is presented below.



P10P00100

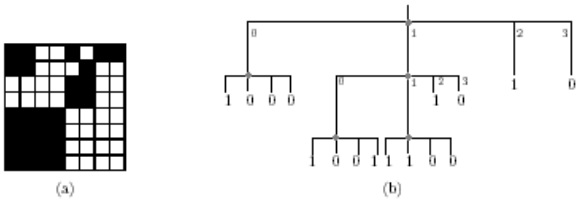


Figure 8-quad tree discriptor

In this algorithm for specifying that a region is filled or not a matrix of "ones" can be masked on the region, there is no need for all the points to be checked and scanned, only one different point in region is enough to divide it into 4 regions. So each of the divided regions don't have to be re checked because they have already been checked, and scanned in previous level. Therefore the complexity of this method is decreased.

One of the important parameters in this algorithm is specifying the blocking factor, this parameter is a number greater or equal to one and specifies the accuracy of the definer. In fact the lower this parameter is the better accuracy of demarcation of region will be. But the length of the code will be longer. The results from the influence of the blocking factor on accuracy and length of code is available on the chart below.
Blocking factor which is one of the worst case will pose a shorter code than the other methods and is less complex in comparison with similar methods.

Algorithm Advantages:

An important point in this method is the independency of the definer from the image size , in fact in case of the scale charge , the code won't be deformed. Also the length of the generated code is shorter than the other methods. Another advantage of this algorithm is the order of the regions code and the regions information.
In fact by generating the region's code, simultaneously the information of the region can be scanned an loaded with the same order.

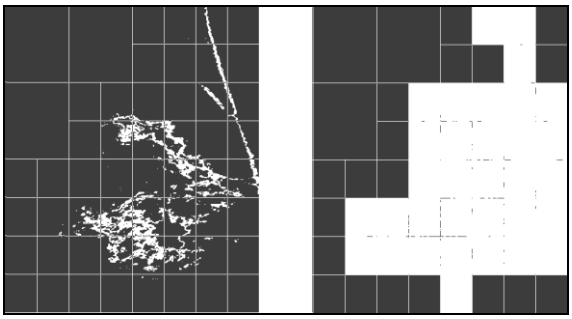


Figure 9-region segmentation in application blocking factor=16

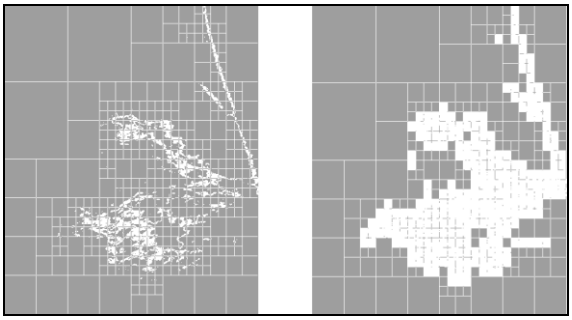


Figure 10- region segmentation in application blocking factor=64

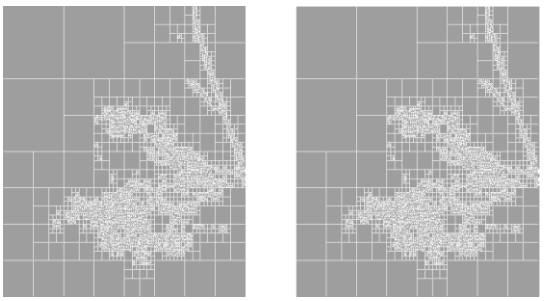


Figure 11- region segmentation in application blocking factor=128

Results from the algorithm:

In this sector some experiments have been applied to a set of 30 images and influence of different parameters have been calculated , and a

comparison with the other methods like "Fourier descriptor" chain code and polar definer has been made.

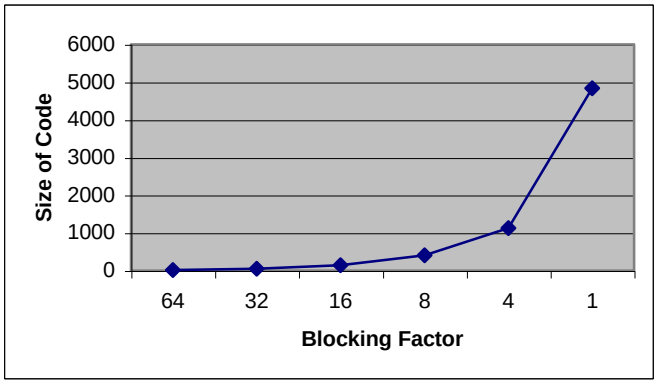


Figure 12- Blocking factor in trade of discriptor code size

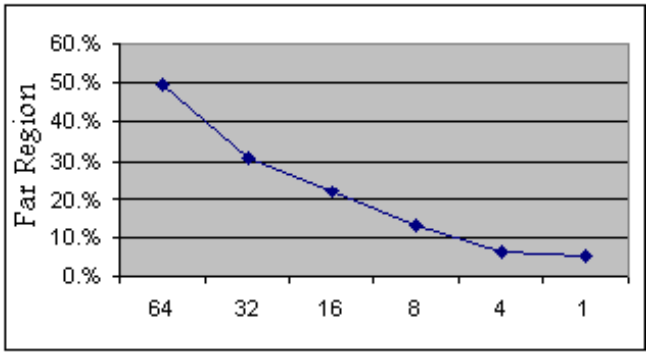


Figure 13 - Blocking factor in trade of Far region area

The mentioned algorithm is written in Delphi 7 . in the diagram results of different definers for code length is posed and compared. As it can be seen the smaller the factor of blocking is, the larger will be the code length of the region, and the "Far" region is more precisely specified and consumes less space of the image.

Conclusion:

In this paper different methods and algorithms for a region definer has been studied and after specifying the properties, advantages and disadvantages of each method, an algorithm for definer of regions in medical applications was posed which in comparison with common methods, does have more flexibility andspeed of process and doesn't have the disadvantages of other methods.

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