

Texture Analysis of Cirrhotic Liver Using Gray-Level Co-Occurrence Matrix

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ABSTRACT: The main purpose of this paper is to present the theory and techniques works behind the gray level co-occurrence matrix and discuss the main function and their values. Gray level co-occurrence matrix is a style of taking out the second order statistical texture features It has proven strongest approach for texture classification and the parameter derived from this method beneficial for analysis the overall content of an image. GLCM operations applied on the preprocessed CT scans images. There are so many preprocessing techniques which we are applied such as change the contrast, increase and decrease the contrast of image these techniques are helpful to extracting the gray level co-occurrence features from the image.

KEYWORDS : CT scans, GLCM, Medical Image Processing, Liver Cirrhosis

I.INTRODUCTION

Liver is located in right upper most quadrant of the abdomen of body .It mainly divided in to three parts which are right lobe ,left lobe, caudate and again right lobe is further divided .Cirrhosis is slowly progressive disease which replace healthy liver tissue and form scar tissue and these scar tissue growing called fibrosis and it happens slowly over by many years and when the whole liver scarred it gets hard and shrinks and reach to cirrhosis which is almost endpoint in patients who suffered from progressively chronic liver diseases, only liver transplantation left the last option. There are various cause of liver cirrhosis with consuming large amount of alcohol specifically in woman's, viruses, chronic viral hepatitis (hepatitis B and C) and fatty liver diseases making up the majority of factors of liver diseases. In this paper we used CT scan images because it is fully automated techniques which is faster and safe , can perform operations without interrupting human presence . Detection of this is really important. Early detection of liver cirrhosis was shown to be improved by regression of collagen tissue. Regression is normally associated with advancement in clinical status but can fluctuate with the degree of advancement. Prognosis and management of chronic liver disease is related to the amount and progression of liver fibrosis.

Gray level co-occurrence matrix applied on these CT scan images to capture texture pattern of cirrhosis followed by preprocessing the CT scan images.

II.RELATED WORK

1.Image acquisition : In this paper we used CT scans of Liver Cirrhosis, we have used secondary images for our purpose.

2.Image preprocessing : We have applied various image preprocessing techniques such as change in contrast, increases and decreases in contrast according to our need before applying the GLCM operations. By applying preprocessing operation we enhance the quality of the image for work.

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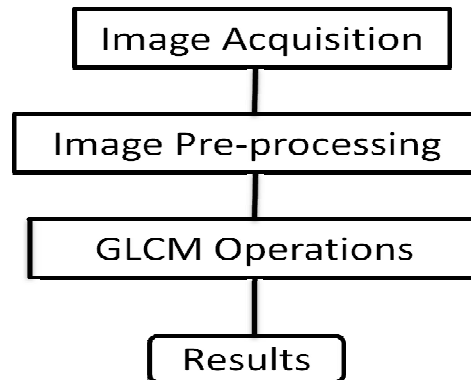


Fig.1) Flow Chart of the Methodology Used

3.Gray level co-occurrence matrix(GLCM) : It is a method which extracting the second order statistical texture features .The GLCM function specify the texture of image by computing the how often pair of pixel with particular value $GLCM(i,j)$ is a two dimensional function and composed of 'm' pixels in vertical direction and 'n' in horizontal direction. Total pixels are $m*n=N, 0<=1<=m, 0<=j<=n$ of GLCM image after creating the GLCM extracting the statistical parameter from the matrix.

After creating the GLCM we derived the several measures from matrix. These measures provide the meaningful information about the texture of image. The following measures are

A.Contrast: firstly determined the intensity contrast between the pixel and its neighbor of GLCM image . Contrast reflects the sharpness of images and the depth of texture grooves. Deeper texture grooves associate with high contrast and better visual sharpness; on the contrary, low contrast led to shallow grooves and blurred images. Higher number of pixels with high difference in grayscale is associated with higher values of contrast .It is calculated by the contrast equation

$$\text{Contrast} = \sum_{i=1}^m \sum_{j=1}^n (i - j)^2 GLCM(i, j)$$

B.Correlation:Correlation that brings out how correlated a reference pixel to its neighbor over an image, is uncorrelated to energy, contrast and homogeneity. The equation for correlation measurement considers the mean and standard deviation for row and column in the matrix. Correlation measures the linear dependency of grey levels of neighboring pixels.

$$\text{Correlation} = \sum_{i=1}^m \sum_{j=1}^n \frac{\{i*j\} * GLCM(i, j) - \{u_x * u_y\}}{\sigma_x * \sigma_y}$$

C.Energy: Energy, the square sum of each matrix element, reflects the grayscale distribution homogeneity of images and texture crudeness. Same values of all co-occurrence matrix resulted in small energy profiles; on the contrary, high energy might be expected in case of unequal values among co-occurrence matrix values. The highest contrast value or periodic uniformity in a gray level distribution form the maximum energy of texture.

$$\text{Energy} = \sum_{i=1}^m \sum_{j=1}^n (GLCM(i, j))^2$$

D.Homogeneity: Reflects the homogeneity of image textures and scaled the local changes of image texture. High values of homogeneity denote the absence of intra-regional changes and locally homogenous distribution in image textures. Homogeneous textured image is comprised of limited range of gray levels and hence, the GLCM image exhibits a few values with relatively high probability

$$\text{Homogeneity} = \sum_{i=1}^m \sum_{j=1}^n \frac{GLCM(i, j)}{1 + (i, j)}$$

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4.Results :

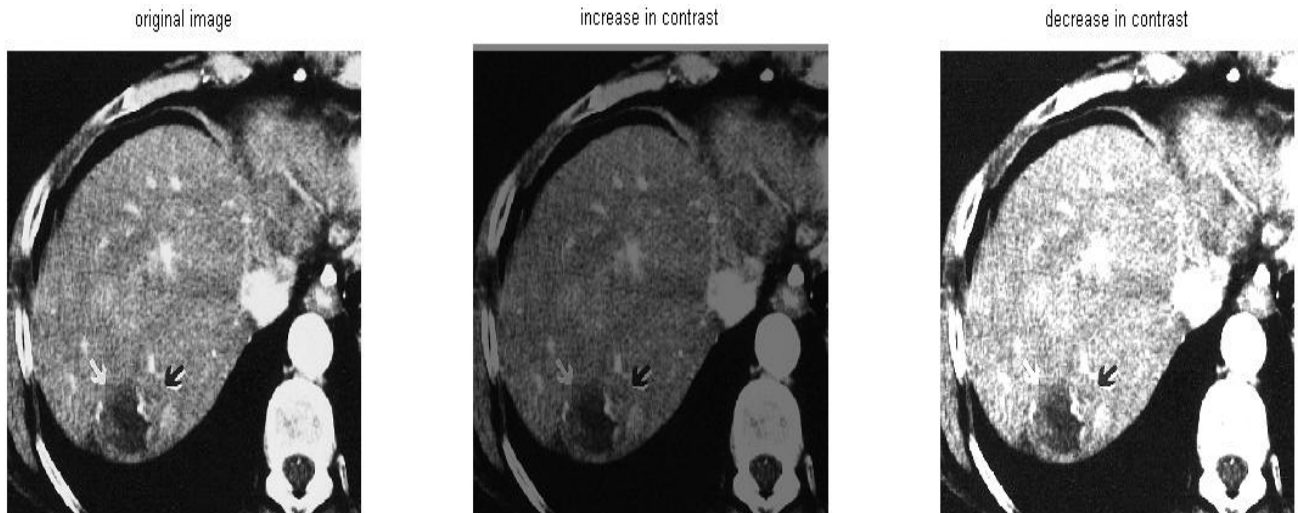


Fig.2) Change in Contrast (a).Original Image, (b).Image after increasing the contrast, (c).Image after decreasing the contrast

Corresponding Graphs of GLCM properties of Original image:

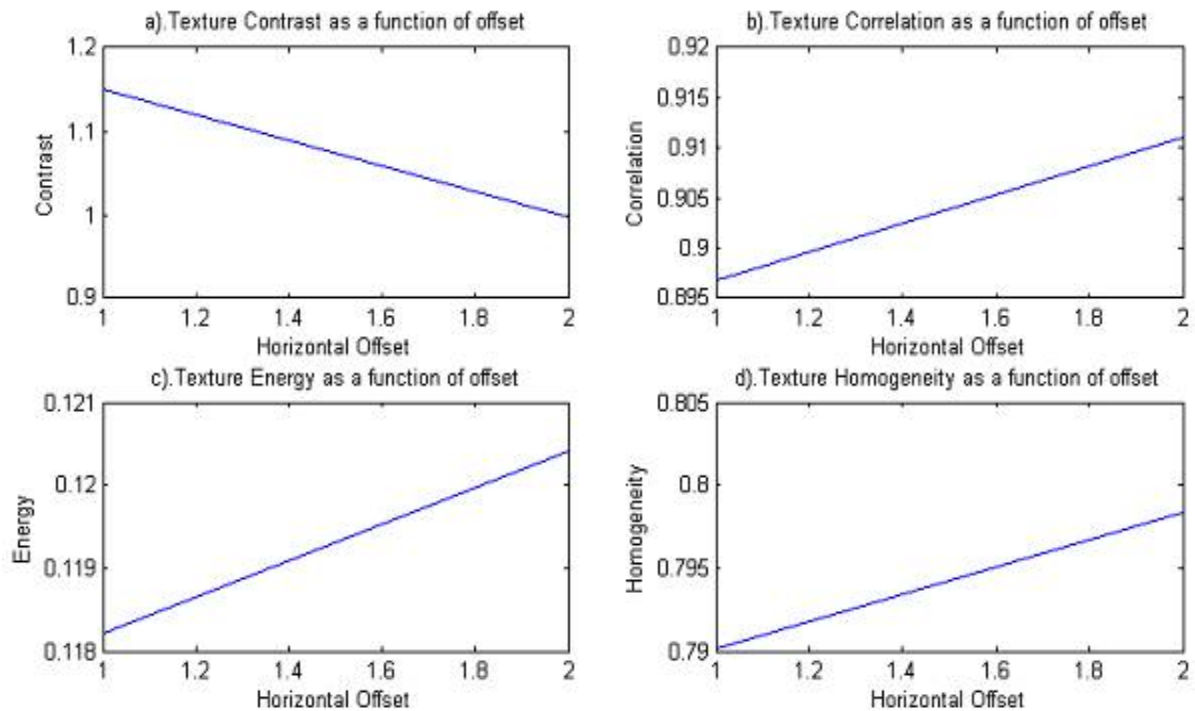


Fig 3). Graphs of GLCM Properties: Contrast returns a measure of intensity contrast between a pixel and its neighbor; Correlation returns how correlated a pixel is to its neighbor; Energy returns sum of squared elements in GLCM; Homogeneity measures the closeness of the distribution of elements in GLCM to GLCM diagonal.

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Corresponding Values of GLCM Properties:

Table 1. Values of different GLCM Properties along with the time taken.

Sr. No.	Statistics	Range	Time Taken(in sec)
1	Contrast	1.1501 - 0.9964	0.001643
2	Correlation	0.8968 - 0.9110	0.002202
3	Energy	0.1182 - 0.1204	0.001375
4	Homogeneity	0.7902 - 0.7984	0.00136

III. CONCLUSION

In this paper, we have extracted several GLCM features. Texture feature is appropriated for characterization and identification of cirrhosis by GLCM operations followed by image preprocessing on CT scan images and further increased the recognition performance. We get some of the properties of the image through which we can detect or conclude whether a particular image have liver cirrhosis or not.

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