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# ANALYSIS OF DIABETIC NEPHROPATHY USING CONTOUR BASED SEGMENTATION OF IMAGE PROCESSING ON RENAL BIOPSIES IMAGES

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***Abstract*—**This Diabetic nephropathy is a significant cause of chronic kidney disease and end-stage renal failure globally. Much research has been conducted in both basic science and clinical therapeutics, which has enhanced understanding of the path physiology of diabetic nephropathy and expanded the potential therapies available. The computational technology enhanced towards medical research, substantial research work has been done towards analysis of Diabetic nephropathy. It is a challenging task as 100% detection of Nephropathy disease with regular pathological procedure is not possible [1]. We propose a solution to the problem of segmentation of the renal Biopsies images for the analysis.

This research work examined the analysis of diabetic nephropathy in the context of computational contour based image segmentation approach. Proposed method used chan vese algorithm with different parameter than original model. The quality of proposed image segmentation is evaluated using SNR and PSNR statistical measure. The performance of segmented image analysis was calculated on the basis of distance matrix method. SNR is 90%. The PSNR based quality of segmentation is 100%.The rate of recognition can be further improved by increasing the size of the database and by considering better statistical measure.

**Keywords—** Diabetic Nephropathy,Chan-Vese model, PSNR

## I INTRODUCTION

Segmentation plays a vital role in medical image processing. Image Segmentation is the partition or separation of the image into dissimilar regions of related attributes. Medical Image processing is one of the most active research topics from the past few decades. Accuracy of Medical image segmentation remains a challenging task even though a lot of work has been done on this topic. As there is no universal solution for this problem here we have proposed method which is the modification of the original Chan-Vese algorithm [2].The proposed method is applied to provide a solution for the medical background diabetic nephropathy, which is considered to be the leading cause of end-stages renal disease. Diabetic nephropathy includes gradually increasing proteinuria (excretion of excess proteins in the urine) accompanied by blood pressure, with a progressive turn down in GFR [1]. There is also a significantly increased risk of cardiovascular disease. Traditionally, these changes had been accredited to possessions on mesangial cells and endothelial cells, the cells that sustain the capillary loops. Nevertheless, more modern investigation advises that the podocytes may be major significant factor in causing diabetic glomerulosclerosis. The most important consequence of glomerulosclerosis is that it causes a leaky filtration membrane consequently there is unusually increased filtration of protein. Important factors are the loss of podocytes and the disruption of their cytoskeleton, which consequences in a change in podocyte shape known as podocyte effacement. Proteinuria thus results in damage to the renal tubules with further loss of nephrons. This paper is structured as follows: section II depicts the review on related work. Section III is explaining methodology and data source used in this paper. Section IV illustrates performance evaluation.

Section V describes experimental analysis with observation. Section VI is highlighting conclusion followed by references.

## II RELATED WORK

In the current era of research the medical image processing is very broad field, which covers image analysis techniques and clinical imaging devices such as radiological imaging which includes radiography, ultrasound, thermograph, nuclear medicine and functional imaging [6].

Large efforts have been taken for automation of Diabetic nephropathy. But work need to be done in performance improvement using the different computational techniques.

Diabetic nephropathy is a micro vascular disease of the glomerular that affects patients with type 1 and 2 diabetes. Pathological changes in the glomerular include diffuse thickening of the GBM accompanied by steady decline of the glomerular filtration rate. The pathogenesis of this alteration is poorly understood. It correlates with proteinuria and may be related to abnormal podocyte function [1]. The renal corpuscle includes Bowman's capsule and glomerulus where the filtering of selected blood components occurs [7]. The filtering action within glomerular is performed by endothelial cells, the glomerular basement (GBM). Researcher of medical science has done much more research effort but there is still need the computational algorithm for automated detection of Diabetic nephropathy.

## III METHODOLOGY

For this research database plays an important role. In this experiment we used the standard dataset which has already preprocessed by medical community.

### 1 DATABASE COLLECTION

For the research of Diabetic Nephropathy database play an important role. The database needs standard preprocessing operation. Renal histological images are used for this experiment which contains microscopic structure of the kidney. In this work images are used from National Center for Biotechnology Information (NCBI) .It is part of the United States National Library of Medicine (NLM), a branch of the National Institutes of Health. The NCBI is located in Bethesda, Maryland and was founded in 1988 through one of legislation .The NCBI houses a series of databases relevant to biotechnology and biomedicine and an important resource for bioinformatics tools and services. Major databases include GenBank for DNA sequences and PubMed, a bibliographic database for the biomedical literature. Other databases include the NCBI Epigenomics database PubMed is one of it .It is a database developed by NCBI National Library of Medicine (NLM), it works as a part of the NCBI Entrez retrieval system. It was primarily designed to provide the access to references and abstracts from biomedical and life sciences journals. PubMed provides links that allow access to the full-text journal articles of participating publishers. MEDLINE database is the primary data source for PubMed which includes the fields of medicine, dentistry, nursing, health care system, veterinary and the preclinical sciences .PubMed Central(PMC) was launched in February 2000, it is a free archive and serves as a digital counterpart to NLM's extensive print journal collection. PMC provides permanent access to all of its content and is managed by NLM [9, 10].

### 2 IMAGE SEGMENTATION

Image segmentation means division of an image into meaningful structures. It is process of extracting and representing information from the image to group pixels together with region of similarity [3].The goal of segmentation as to divide an image into parts that have a strong correlation with objects or areas of the real world contained in the image [5]. Computation complexity is one of the important criteria for image segmentation which should be considered carefully when real time image segmentation is required.

a) CONTOUR BASED IMAGE SEGMENTATION

Contour-based approaches usually start with a first stage of edge detection, followed by a linking process that seeks to exploit curvilinear continuity. Boundaries of regions can be defined to be contours. If one enforces closure in a contour-based framework then one can get regions from a contour-based approach [13,14]. The difference is more one of emphasis and what grouping factor is coded more naturally in a given framework. In contour-based approaches, often the first step of edge detection is done locally. Subsequently efforts are made to improve results by a global linking process that seeks to exploit curvilinear continuity. A criticism of this approach is that the edge/no edge decision is made prematurely. To detect extended contours of very low contrast, a very low threshold has to be set for the edge detector. This will cause random edge segments to be found everywhere in the image, making the task of the curvilinear linking process unnecessarily harder than if the raw contrast information was used. Contour analysis (e.g. edge detection) may be adequate for untextured images, but in a textured region it results in a meaningless tangled web of contours.

## IV PERFORMANCE EVALUATION

After For the performance evaluation of segmented images, we used SNR and PSNR statistical measure**.** The noise performance and hence the signal to noise ratio is a key parameter for any radio receiver. The signal to noise ratio (SNR) as it is often termed is a measure of the sensitivity performance of a receiver.

PSNR is used to measure the quality of reconstructed image from segmentation technique. The signal in this case is the original data, and the noise is the error introduced by compression. When comparing compression code, PSNR is an approximation to human perception of reconstruction quality. Although a higher PSNR generally indicates that the reconstruction is of higher quality, in some cases it may not. PSNR is most easily defined via the mean squared error [12].

- Mean Square Error

$$MSE = \frac{1}{m\,n}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j) - K(i,j)]^2$$

- Signal to Noise Ratio (SNR)

**SNR=20*log10((input-seg)./MSE);**

- Peak signal-to-noise ratio(PSNR)

$$PSNR = 10 \cdot \log_{10}\left(\frac{MAX_I^2}{MSE}\right)$$

Here, MAXI is the maximum possible pixel value of the image. When the pixels are represented

Using 8 bits per sample, this is 255. More generally, when samples are represented using linear PCM with B bits per sample, MAXI is 2B−1 for color images with three RGB values per pixel The definition of PSNR is the same except the MSE is the sum over all squared value differences divided by image size and by three.

On the basis of PSNR and SNR statistical measure we analyze the quality of segmentation using the active contour method.

## V EXPERIMENTAL ANALYSIS

Counter based method was effectively applied, on the set of dataset of 10 sample images. A sample of two original images is shown in figure 1.

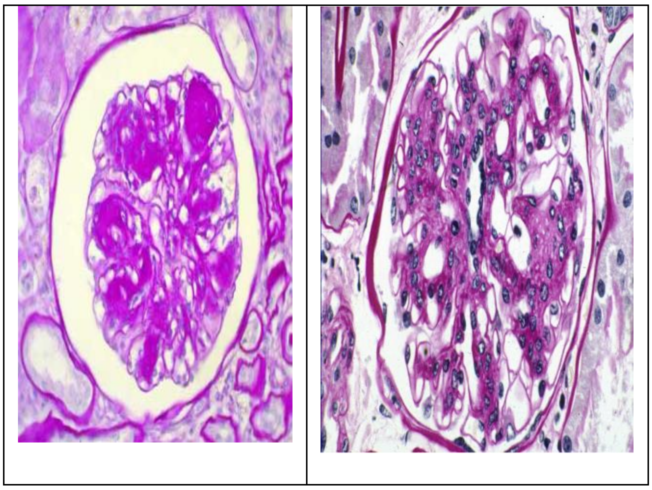

Fig. 1: sample of two original database images

The graphical representation of active contour segmentation of sample 1 and sample 2 images is described in figure 2, figure 3 respectively.

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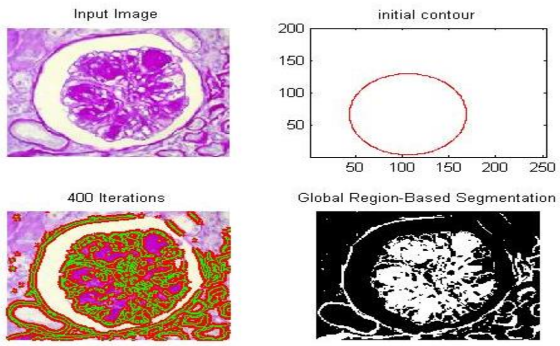


Fig. 2: Active Contour segmentation steps for sample 1 image

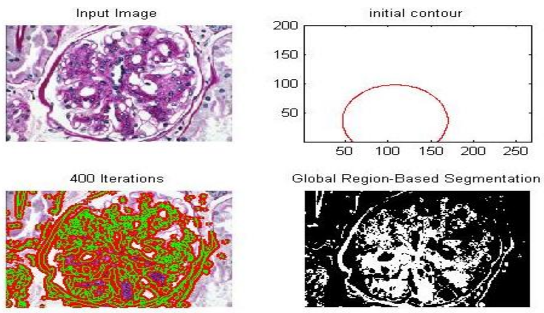


Fig. 3: Active Contour segmentation steps for sample 2 image.

The extracted and final segmented graphical results of image 1 and image 2 are shown in figure 4.

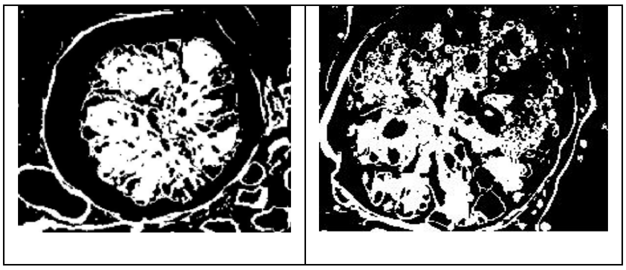

Fig. 4: Graphical representation of segmented image of sample 1 and sample 2.

The quality of segmentation is evaluated using Signal to noise ratio and Peak-signal to noise ratio statistical measure. For the quality measure we calculated the SNR and PSNR of 10 sample set images. On the basis of evaluation we calculated the accuracy of segmentation performance.

The statistical results of SNR and PSNR are described in table 1.

Table 1: The statistical results of SNR and PSNR of original image

| *Input Image* | *PSNR of input image* | *PSNR of Enhanced image* | *SNR of input image* | *SNR of Enhanced image* |
|---|---|---|---|---|
| Image 1 | 11.42 | 28.03 | 30.80 | 7.85 |
| Image 2 | 28.66 | 28.02 | 8.73 | 7.84 |
| Image3 | 31.48 | 27.44 | 13.91 | 6.58 |
| Image4 | 33.48 | 27.49 | 12.90 | 7.58 |
| Image 5 | 31.56 | 27.42 | 14.10 | 6.63 |
| Image 6 | 32.39 | 27.35 | 15.45 | 6.50 |
| Image 7 | 31.42 | 27.88 | 13.92 | 7.56 |
| Image 8 | 30.93 | 27.28 | 12.18 | 6.37 |
| Image9 | 31.01 | 27.37 | 11.83 | 6.54 |
| Image10 | 30.27 | 27.47 | 11.96 | 6.74 |

From table 1 it is observed that the SNR and PSNR of the original and successive segmented image. In the column 1 the input images are shown and column 2 and 3 PSNR of input images and segmented images are shown respectively. Similarly in column 4 and 5 SNR of input images of column 1 and SNR of segmented images are shown respectively. From this table it is observed that all images are successfully segmented.

The experimental results as mentioned in Table 2 were obtained from SNR and PSNR statistical measure. From the table 2 it is observed that the accuracy of quality segmentation of SNR is 90% whereas the PSNR is 100%.

Table 2: Performance of quality of image segmentation using SNR and PSNR

| *Parameter Names* | *Statistical Segmentation Quality Measure* | |
|---|---|---|
| | ***SNR*** | ***PSNR*** |
| Number of images | 10 | 10 |
| Successfully segmented | 09 | 10 |
| Unsuccessfully | 01 | 00 |
| Accuracy (%) | 90 | 100 |

## VI CONCLUSION

In the current era of digital medical Imaging image segmentation play an important role. For this our research work we have used the Active Contour Method for image segmentation. The quality of image segmentation is evaluated by Signal to Noise Ratio (SNR) and Peak Signal to Noise Ratio (PSNR) statistical measure. The Average accuracy of active contour image segmentation calculated using SNR is 90%. The performance of PSNR towards active contour image segmentation is 100%. The all of this statistical measure are good for quality measure of image segmentation. The quality of image segmentation is directly affects the performance of image recognition system.

The experimental result was found to be encouraging. The Active Contour Method scheme is robust and effective for medical image segmentation. This would be of befit to the patients for early and effective diagnosis. The quality of segmentation can be further improved by increasing the size of the database and by considering better classifier.

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