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Big Data Analytics for Health on Kidney Disease

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ABSTRACT

Predicting kidney based disease is a composite task it needs more experience and knowledge. This kind of disease is a slow process killer in well grown countries and a major donor to disease burden in developing countries. Chronic Kidney Disease (CKD) is a restrained slow in renal function for a period of long time. Diabetes and high blood pressure are the very common causes of chronic kidney disease. This paper involves in providing A Detailed Study of segmenting and detection of tumor based on computed tomography images. Many CT image segmentation algorithms are available; it can be divided into edge, texture, and thresholding. The main thing in this work is to determine the kidney tumor by applying the algorithm on the test result acquired from the patient medical report and segmentation of the tumor location.

KEY WORDS: Chronic Kidney Disease, Image segmentation, Segmentation Algorithm, Classification Algorithm, Otsu Thresholding.

1. INTRODUCTION

The main functions of kidneys are to filter the blood. Bloods in our bodies passes through kidney several times a day. It cleans dirt and controls the body's fluid balance, also it regulates the electrolytes balance. Urine is created as it filters blood, it is segmented in the pelvis a funnel shaped structure that exhibits the tube named ureters in the bladder. Kidney contains over a million units called nephrons, each of which is a microscopic filter for blood. It's possible to lose as much as 90% of liver function without experiencing any symptoms or problems. It is a silent killer.

There are lots of factors it increases the major threat of Kindly disease: Diabetes, Hypertension, Smoking, Obesity, Heart disease, Family history of kidney symptoms, Alcohol intake, Drug abuse/drug overdose, Age, Race/Ethnicity and Male sex.

Symptoms of kidney disease: a) there will be a change in urine function, b) Difficulty or pain during voiding, c) Blood comes in urine, d) Swelling & Pain in the back or sides, e) Extreme fatigue and generalized weakness, f) Lack of concentration and drizzliest, g) Cold & cough, h) Skin rashes and itching, i) Ammonia breath and metallic taste, j) Nausea and vomiting, k) Shortness of breath.

Also there are different kinds of kidney diseases:

a) Pyelonephritis (infection of kidney pelvis): Bacteria affect kidneys, mainly it leads to back pain and fever. Spreading of bacteria in a non treated infected bladder is the main cause of pyelonephritis.

b) Glomerulonephritis: A super active immune system it attacks the kidney and causes swelling and more damage. When Blood contains protein in urine are common basic problems that occur with glomerulonephritis. It also turned out to be kidney failure.

c) Kidney stones (nephrolithiasis): Minerals in urine form stones it grows large and blocks the urine flow. It is heavily pathetic and painful situation. Mostly kidney stones pass by very easily on their own but some may be too large and need to be treated.

d) Nephrotic syndrome: if the kidney gets damaged then it pours more protein into the urine, it may also leads to edema disease (it's a leg swelling symptom.)

2. PROPOSED WORK

In the above said proposed method, the obtained images move on to a pre processing stage which is of four folds namely: Image enhancement; Filtering; Classification and Segmentation.

Thresholding is a basic and simple image segmentation technique. It separated all the grey segmented pixels in different types of classes also in different levels. A thresholding method exhibits an intensity value, known as threshold, it splits the desired classes. Fuzzy C refers to an overlapping clustering technique. One pixel value depending on two or more clusters centers. It is also known as soft clustering method. For feature extraction GLCM is used and for classification of normal images and tumor images SVM algorithm is used; FCM (Fuzzy C means), GLCM, Otsu method, SVM.

Preprocessing: Image pre-processing also gradually increase the scalability of an inspection (Also known as Optical Inspection). Users can improve and optimize the cameras during their clicks.

Preprocessing leads to improve the image quality while getting the original image information. Preprocessing also does blurred space removing, noise distraction, and it also increases the image brightness and contrast to get the image information. In preprocessing phase the taken image is filtered using median filter and the image is resized.

Image acquisition and transmission are the important phase of image processing where noise mixed in the image. According to the environmental condition noise added in the image, also it happens during image acquisition, inadequate light levels and dust particles if presents in the screen.

Median Filter: It is a sliding window filter it replaces the center value in the window with the median of all pixel values in the window.

Mainly, it checks the neighbors comes under 5X5 window keeping pixel (7, 6) in the centre. Sort the intensity values of 5X5 window. 12, 06, 12, 19, 21, 23, 27, 29, 31, 34, 35, 36, 42, 45, 45, 59, 61, 62, 63, 64, 71, 93, 103, 196, 208. This window contains 25 intensity values i.e pixels and the median intensity is 13th intensity value i.e. 42. So, the pixel (7, 6) contains intensity value 42 instead of 45. This is the how the median filter works. Matlab function for median filter is: B = medfilt2 (A, [m n]).

Let A[i], i=0:::(n-1) be a stack of n array based real numbers. The median of all numbers in A is A [(n-1)/2].

Sometimes, the cases of n being odd versus even are differentiated. For odd n, the array has a unique middle as defined above. If n is even, then we can finalize that there are two medians, at A [n/2] and A[n-1/2], or one median, which is the average of these two values. However sorted order was used to define the median, the n values do not have to be fully sorted in practice to determine the median. The well-known quicksort algorithm can easily be modified so that it only recurses on the subarray of A that contains the (n + 1)/2-th element; as soon as a sort pivot is placed in that array position and the median of entire set is known.

Feature extraction:

- Basic thing is to identify co- occurrence matrix.
- There are fourteen statistical measures are given by Haralick. These things can be separated from matrix to a feature vector through measures of texture. Out of all four are considered here: - Energy, Entropy, Homogeneity and Contrast. All these values are manipulated.
- Then the vector is stored.
- Matching processed with the stored database similar images with queried image.

GLCM: The method of examining through statistical way in texture is considered as spatial relationship of pixels in the grey level co-occurrence matrix (GLCM), also known as the gray-level spatial dependence matrix.

Features: Contrast, Correlation, Homogeneity, Energy, Entropy, Mean, Standard deviation.

Classification: Taken image through query is matched with training database to differentiate the normal and different image.

SVM: Support Vector Machine (SVM) is a supervised machine learning algorithm which can be used for both differentiation and regression challenges. Though, it is mostly used in classification problems. In image retrieval it is used to classify the images which are in the same group.

Algorithm: Input: Image Classes set: $\Phi = \{C1, C2, \cdots, CN\}$; SVM parameters
for $i = 1 \rightarrow N$.
do Take all k images from class i and label them as 1.
Random sampling $(2k)/(N-1)$ images from the other classes and label them as -1
Generate training set S
Compute SVM machine i
end

Segmentation algorithms: If the given image is abnormal then it will send to the segmentation process.

Otsu Thresholding: Automatic thresholding method automatically picks "best" threshold t given an image histogram Assumes 2 groups are present in the image:

- Those that are <= t.
- Those that are > t.

For every possible t:

- Calculate within group variances:
  - probability of being in group 1; probability of being in group 2
  - determine mean of group 1; determine mean of group 2
  - calculate variance for group 1; calculate variance for group 2
  - calculate all the weighted sum of group variances
- Remember which t gave rise to minimum.

Probability of being in each group

$$q_1(t) = \sum_{i=0}^{t} p(i)$$

$$q_2(t) = \sum_{i=t+1}^{\max} p(i)$$

mean of individual groups

$$\mu_1(t) = \sum_{i=0}^{t} i\ p(i)/q_1(t)$$

$$\mu_2(t) = \sum_{i=t+1}^{\max} i\ p(i)/q_2(t)$$

Variance of individual groups

$$\sigma_1^2(t) = \sum_{i=0}^{t} [i-\mu_1(t)]^2\ p(i)/q_1(t)$$

$$\sigma_2^2(t) = \sum_{i=t+1}^{\max} [i-\mu_2(t)]^2\ p(i)/q_2(t)$$

FCM: Initialize U=[u_{ij}] matrix, $U^{(0)}$

At k-step: it manipulates the middle vectors $C^{(k)}=[c_j]$ with $U^{(k)}$

$$c_j = \frac{\sum_{i=1}^{N} u_{ij}^{m} \cdot x_i}{\sum_{i=1}^{N} u_{ij}^{m}}$$

Update U (k), U(k+1)

$$u_{ij} = \frac{1}{\sum_{k=1}^{c} \left(\frac{\|x_i - c_j\|}{\|x_i - c_k\|} \right)^{\frac{2}{m-1}}}$$

If $\| U^{(k+1)} - U^{(k)} \| < \varepsilon$ then STOP; otherwise return to step 2.

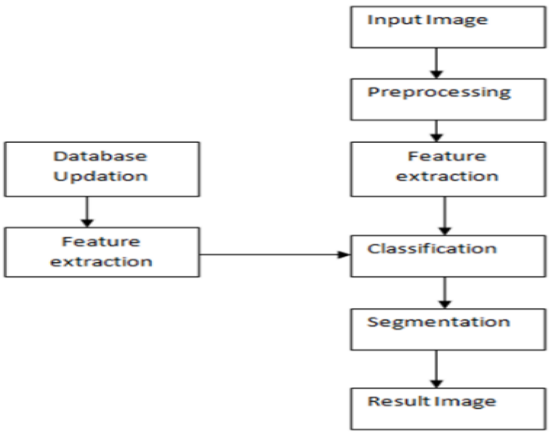

Figure.1. Block diagram

Related work: In our proposed paper it approaches for the classification of multiple kinds of Kidney stones using gray level co-occurrence matrix (GLCM) features mainly contrast, co-relation, energy and homogeneity.

The main base of this work is to ensure and detect the kidney function failure by applying the classification algorithm on the test result came from the patient medical report. Our work reduces the diagnosis time and to improve the diagnosis accuracy using classification algorithms. In this work we propose an algorithm to detect the renal calculi and to detect the level of the calculi. It shows or explicit the human diet condition. In this paper, we have proposed a method for ultrasound kidney image diagnosis for calculi and to find the size of the calculi using Advanced seeded region growing based segmentation. Because of the segmented portion the threshold values proves to differentiate the level of calculi as early calculi, medium calculi and large calculi. Advancement of Seeded Region based image segmentation process homogeneous region depends on the image features. Mainly, the regions of interest (ROIs) extracted from the pre-processed image. Next, the initial seed is selected based on ROIs removed from the image. The size of growing regions depends on this look up table entries.

Previously the processing means like registration, segmentation are separately applied for extraction of sequential proprieties of DCE-MRI images of kidney. For simultaneous registration and segmentation of the kidney,

a 4D model is described. In the duration of kidney abnormal functioning and disease detection, the glomerular filtration rate (GFR) is a significant factor. Dynamic contrast enhancement magnetic resonance imaging (DCE-MRI) is the imaging proficiency, used to stabilize different parameters homologous to suffuse, capillary leakage, and convey rate in tissues of various organs and diseases detection. The described technique's approach permits us to automatically accomplishing a statistical analysis of various parameters from alive cells. Conclusion of detecting is emphasized by average gray level intensity inside the kidney region.

In this review article we show how 3D ultrasound imaging comes through these limitations. Specifically, we also exhibit the developments of a many number of 3D ultrasound imaging systems using mechanical, free-hand and 2D array scanning techniques. In the initial, specialist clinicians engage in training the system by approximately defining the kidneys and "3-D golden standard model" is used to compare the results.

This research paper mentioning and portraying automatic kidney segmentation and finding its abnormalities from abdominal CT images. It is the fundamental step for the study of kidney pathology like stones, tumors, cysts etc. Kidney segmentation from CT images is usually performed manually or semi-automatically because of grey levels similarities of adjacent organs, and variation in shapes and positions of organs. The method is tested by using images and very promising results were obtained.

In existing system, it was take more time (in minute) to detect and the output was less accurate. The medical technicians laboratory adjust rules and parameters (stored as "templates") for the included "automatic recognition framework" to achieve results which are closest to those of the clinicians. These parameters can later be used by non experts to achieve increased automation in the identification process. The system's performance was tested on MRI datasets, while the "automatic 3-D models" created were this research exhibits a multifunctional platform mainly proposes on the clinical diagnosis of kidneys and their using a "genetic algorithm". This research presents the automatic tumor detection (ATD) platform: a new system to support a method for increased automation of kidney detection as well as their abnormalities (tumors, stones and cysts. In this paper, the proposed design will define the "genetic algorithm" which will generate the output within a second and more accurate than the existing system.

3. CONCLUSION

Image processing plays an important role in today's world. Nowadays the image processing application can be found in some of the areas like electronics, remote sensing, biomedical and many more. If we focus biomedical applications, image processing is widely used for diagnosis of different tissues purpose. In this paper Prediction of kidney tumor is considered. In general, segmenting tumor without manual intervention is a complex task. Besides several methods, FCM with OTSU thresholding is an efficient way of kidney tumor analysis so that experts make use of it for diagnosis process.

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