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Review on Classifications of Medical Ultrasound Images of Kidney

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Abstract— Ultrasound is the first priority in kidney image processing. Many medical experts use this for initial screening of kidneys' condition as it does not require any inflammation of body parts or instruments to be inserted into the body. High frequency sound waves are applied to produce recognized images. Ultrasound can be used to calculate the size and appearance of the kidneys, stones present in them, detect congenital abnormalities, swelling and blockage of urine flow. The completely automated and systematic algorithm is given to calibrate the kidney stones by proper analysis. The main theme of the detection is to find renal stones, mark the renal regions and to measure the space occupied by kidney stones. Sometimes the user usually finds difficulty in knowing the boundary of the kidney in the US image even though done by an expertise sonographer. In addition to this human error might also occur during acquisition of ultrasound image by untrained sonographer. So to reduce this distortion and noise, image processing techniques can be used. These techniques also detect the area of the human kidney and stones. US imaging can also be used to scan soft tissues and classify them accordingly find to possible diseases. This paper focuses on the literature review of classification of kidney images using ultrasound.

Keywords— Medical Ultrasound, Medical Sonography, Morphological-Image Processing, Image Texture Analysis

I. INTRODUCTION

The ultrasound (US) imaging is the technique that uses quick and exact methods to produce clear and clarified images. The very common problem seen in human urinary system is renal calculi which is called kidney stones or urinary stones. Two important functions of the kidney those are removing harmful substances from the blood keeping useful substances in the proper balance. To get the high quality imaging the system should be under the control of radiologist. Kidney stones and its symmetric analysis using texture (KSST) segmentation method to segment the stone from renal calculi images is given. This procedure was implemented and certain kidney calculi images are used to assess the KSST segmentation method. The method detected the calculi as it is and gave the exact accuracy. Kidney is one of the most sensitive organs in the human body which not only helps in the production of the urine but also removes toxic substances present in the blood. We usually get into our mind that kidney disorders are hereditary, congenital or acquired. The study in the calcification is very broad area field with several potent researches. In this process texture classification involves high order local patterns i.e., Local Derivative Patterns (LDP). The texture classification is very useful as the size of the calculi differ from one individual to other and gives the appropriate size and shape of the stones. The usage of electronics in the field of medicine has become a trend in this modern world. By using US imaging the difference between normal kidney and diseased kidney can be detected. In spite, of several advantages of US imaging speckle is a specific noise that affects all imaging systems and US images too. However, US imaging contains more speckle noise. Filtering techniques are usually preferred to reduce this speckle. Section 2 discusses literature review. Final conclusion is discussed in section 3.

II. RELATED WORK

In [1], authors have proposed a fully systematic and clear algorithm to detect classification of renal calculi with the help of proper analysis. Here recognition of renal calculi, portion the kidney locale is done. The zone of the kidney which is possessed by renal calculi is computed. The calibrate examination of renal stones are helpful in knowing the progression in the illness. The calculi discovery has been regular basic preparatory stage to take care of the division issue effectively. In [2], authors have proposed Kappa statistics, Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), Receiver Operating Characteristics (ROC) Area, Ranking Algorithm to extract kidney stone region from the kidney calculi images. The implementation result shows the effectiveness of the method. Five significant advances are taken after to choose the correct calculi area from the renal ultrasound pictures. The pixel coordinating and succession of

thresholding process are performed to discover the calculi. Likewise, the utilization of Adaptive Neuro-Fuzzy interface System (ANFIS) directed learning has made the strategy more effective than the past strategies. Here, the usage of relative mistake in the middle of the master radiologist and the portioned calculi, which are obtained from the proposed calculation. The usage result demonstrates the adequacy of the proposed Region Indicator with Contour Segmentation (RICS) division technique in dividing the renal calculi in terms of affectability and specificity. The proposed strategy enhances the calculi zone identification exactness with lesion in computational time.

In [3], authors have discussed on classification of kidney US images as cystic and polycystic types. Gradient vector force (GVF) snakes are used for segmentation, despeckling is done by Gaussian filters. In [4], authors have proposed a method of the texture classification of CT images and diagnosis of the kidney stones. Early detection of kidney stones and textural classification using high order pattern descriptor is proposed. The neighbourhood of local derivative parameter (LDP) is utilized in the technique. The n^{th} request LDP is proposed to encode the $(n-1)^{th}$ arranged neighbourhood subordinate course varieties, it can take more points of interest data. The nearby surface data for a given pixel and its neighborhood is portrayed through the surface units which ascertained in various strategies. In [5], authors have proposed naïve Bayes, SVM classifier and multilayer perception method. These methods are used for diagnosis of chronic kidney disease. In information mining a stage of learning disclosure process has assembled on measurable database. Machine learning for computerized reasoning examinations is also used when exploring a lot of information. Measurable systems are used for the assuring models to be utilized for information forecasts.

In [6], authors have presented a paper to depict the utilization of an expensive memory stockpiling and recovery (LAMSTAR) neural system to medicinal analysis and therapeutic data recovery issues. The system depends on learning lines hypothesis of stockpiling and recovery of the focal sensory process. It utilizes varieties of sorted out guide materials. The system utilizes highlights of overlooking, insertion and extrapolation. In this manner it deals with inadequate informational collections. It can bargain similarly well with correct and fluffy data. Hence being particularly material to medicinal determination where the finding depends on correct information, fluffy tolerant meeting data, understanding history, watched pictures, test records. Moreover, the system can be worked in shut circle with web indexes to shrewdly utilize information. Uses of the system to three particular therapeutic determination issues are portrayed: two from nephrology and one identified with a crisis room sedate distinguishing proof issue. It has been demonstrated that the LAMSTAR arrangement is one thousand times speeder in the preparation than the back-spread based systems when utilized for a similar issue and with the very similar data.

In [7], authors have presented a paper on ultrasonic separation of ordinary kidney and sick kidney utilizing image surface parameters. The arrangement of surface parameters were acquired from the clinical B-check images and used as contribution to neural system classifier which is a delegated typical and ailing in non-intrusive way. Surface properties of images convey valuable data for segregating purposes. Capability of fast advanced systems encouraged these computational techniques prompting better separation of illnesses. By building up an online symptomatic classifier utilizing web encouraged. Availability has been stretched out to all individuals and even to the provincial segment through telemedicine in their work areas utilizing any sort of web network.

In [8], authors have identified the disorders of the kidney by using US images. The US images are of less contrast and contain particular speckle noise. Ultrasound helps in detecting the kidney diseases. Initial stage is image restoration, which helps in reducing speckle noise and applies smoothening. Next step is using histogram equalization. After that segment the pre-processing images using level set segmentation process and finally get produced better result.

In [9], authors have proposed automated method for ultrasound image and classification of kidney images .The pre-processed kidney images defined the shape of kidney images possibilities of kidney diseases. Each feature is determined by the mean value for all kidney classes. This Computer-Aided Diagnosis (CAD) system also find the kidney characteristic .An arrangement of most noteworthy substance elucidating highlight areas to recognize and characterize the renal issue with US examine.

In [10], improved region growing algorithm for image segmentation is mentioned. They have specified a growth rule by using the result of automatic scan. A seed point is selected in the kidney region based on growth rule. Different features like contrast, energy, correlation and homogeneity are extracted from segmented ROI of kidney. SVM classifier is used for effective classification of normal and diseased kidneys in ultrasound images.

In [11], author has discussed different types of filter techniques and multi-scale. Digital image acquisition and processing techniques is important in medical diagnosis. Medical diagnosis is used to find the types of disease like kidney infection, kidney stones, cyst etc. Frequency filters process by transforming the image in to frequency domain. First stage is take image as input; apply Fourier transform and inverse the process of Fourier transform produce output of noiseless image.

In [12], authors have proposed a PC assisted device to process and examine US renal images for the grouping of

renal images. The US renal images are grouped into four divisions: Ordinary, Blister, Stones and Tumour. Information relating to basic pathologies from an urologist point of view is used as contributions to do the order. Ideal thresholding division calculation is utilized to get the area of Intrigue. Arrangements of first request factual highlights are separated. A grouping rate of 93.5% is obtained. The outcomes accomplished, depend on execution measurements computations, and are exceptionally attractive.

In [13], authors has identified with size and position of kidneys. For example, nearness of cysts and stones can be estimated with the assistance of kidney ultrasound visual introduction. It has four major processes; pre-processing, determining outer region indicator, determining inner region indicators, and enhanced watershed segmentation. Initial stage is to segment the input image and analyze the image after extraction of the information, represented in the form of data from image segmentation for final fast processing.
In[14], authors have presented a processing system to input as two forms one for sample images and other for query image, selecting the sample images is first stage second stage is pre-processing or removing the noise using fuzzy c means algorithm. Next, perform the Gabor wavelet transform for query image followed by same sample image procedure. Finally images are stored in database to apply different classifiers. Finally result is displayed as normal if image is normal, otherwise abnormal.

In [15], authors have used data mining technique for predicting the chronic kidney disease. In healthy individuals also, asymptomatic chronic kidney disease can be identified by using these classifiers like SVM, KNN, and ANN. Distance between test tuple and training tuple in n dimensional space is found.

An automated algorithm for prostate boundary extraction for ultrasound images by applying segmentation processes is presented in [16].

III . CONCLUSION

Image segmentation is a one of important step in image processing. Segmentation partitions an image in to sub parts. This paper discusses about different techniques useful for identification of kidney diseases in medical US images. The survey is carried out on existing methods of classification of medical ultrasound images of kidney. Different classifiers like multilayer ANN, Naive Bayes, KNN and SVM etc. are discussed for finding kidney stones and chronic kidney disease. Segmentation methods such as region growing, active contours, gradient vector force, level set are most suitable for medical ultrasound images. Each method is unique in its own way and different method is suitable for different applications. Finding exactly segmented ROI and classifying correctly is more essential.

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