Kidney Stone Prediction

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ABSTRACT:

A detailed analysis of stone identification in kidneys utilizing image processing techniques employing CT scans was studied in this study. Nowadays, kidney stones are a serious concern that, if not found early, can lead to difficulties and, in some cases, surgery to remove the stone. As a consequence, accurately detecting the stone opens the door to image processing since image processing has a potential to produce exact results and is an efficient technique of detecting the stone. Because kidney stones have poor contrast and include noise, detecting them using ultrasound imaging is a difficult process. This obstacle is solved by utilizing appropriate image processing techniques.

INTRODUCTION:

Digital image processing refers to the use of a digital computer to process digital images. It is also possible to define it as the use of computer algorithms to enhance a picture or extract vital information. Digital image processing is the editing of digital pictures using a computer. DIP is concerned with creating a computer system capable of image processing. The system's input is a digital picture, which the system processes using efficient algorithms and outputs as an image.

Early diagnosis of kidney stones is critical, and image processing tools can help with this. One way for identifying stones is to use ultrasound scans as input. The diagnosis of kidney stones utilizing ultrasound images with random noise and poor contrast. As a consequence, we smooth the image with a filter.

Image processing consists mostly of the following steps:

1. Importing the picture using image acquisition tools.

2. Image analysis and manipulation

3. Output, which might be a transformed image or a report based on the image analysis.

ADVANTAGES:

1. It eliminates sounds.

2. Adjust the image density and contrast.

3. Facilitates computer storage and retrieval.

4. Images can be made available in whatever format required, such as black and white or negative images.

DISADVANTAGES:

1. Depending on the system employed, the initial cost is substantial.

2. If the system is destroyed, the image is gone.

PROBLEM STATEMENT:

Kidney dysfunction can be life intimidating. Hence early detection of kidney stones is essential and this can be done by image processing techniques. One of the methods to identify stones is by taking X-Ray images as input, preprocessing the image and applying image processing techniques to detect whether the stone is present in the kidney or not.

LITERATURE SURVEY:

In a recent study, Rahman et al. [1] proposed reducing speckle noise and segmenting ultrasonic kidney images to not only improve stone detection but also to improve image quality. An improved kidney stone detection procedure was developed in 2015 by Viswanath and Gunasundari. To reduce speckle noise, an ultrasound picture was pre-processed and recovered. The authors of [2] examined kidney stones in the human body and developed a technique that uses pre-processing segmentation and morphological analysis to help identify them. As shown in [3], bilateral filter, adaptive histogram equalization, and watershed algorithm have been used to remove noise, enhance contrast, and segment images to efficiently detect kidney stones. An image processing technique for detecting kidney stones without human involvement has been presented in [4]. The technique has been segmented and morphologically studied.

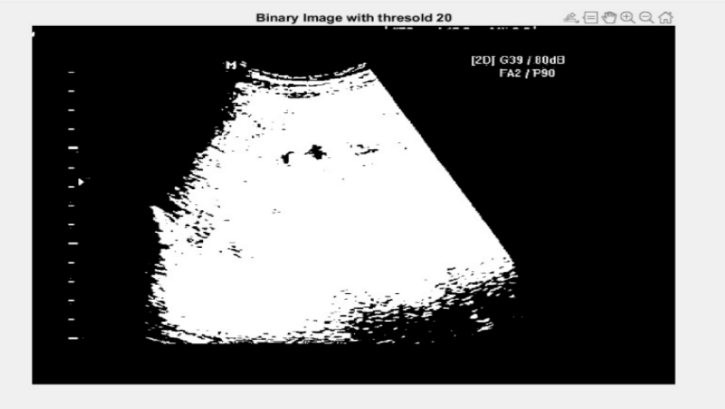
This project aims to discover kidney stones with their correct locations from ultrasound images. The literature review points out that the method is based on manual data calculations that are time-consuming. In this proposed method there are 5 steps. These include preprocessing images, enhancing images, morphological segmentation, and the analysis of kidney stones, if present. As a result of this, the method is reliable and reduces data processing time.

IMPLEMENTATION:

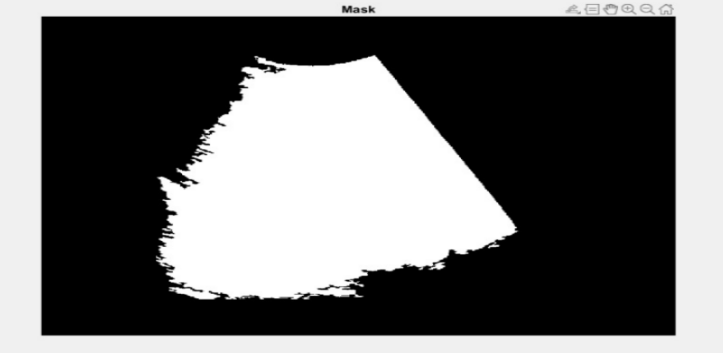
First we read the image that we have chosen to process though imread function

Then we convert the image to gray scale image using rgb2gray function

Then we convert the gray scale image to binary image with threshold value 20/255

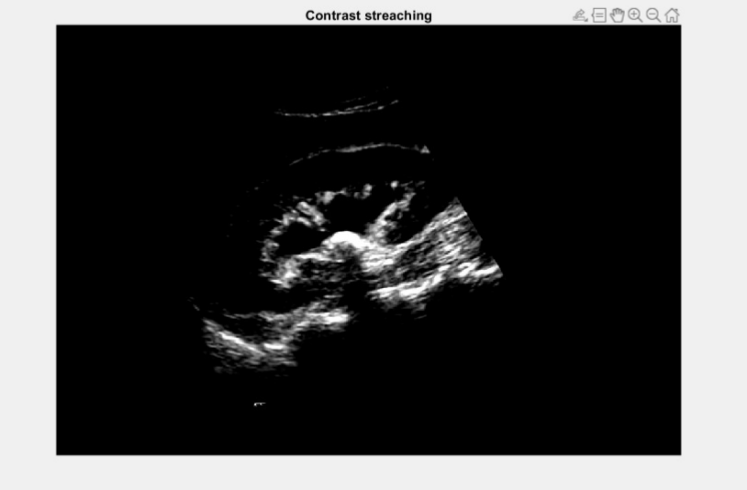


Then we create mask to fill the holes and remove the unwanted areas.

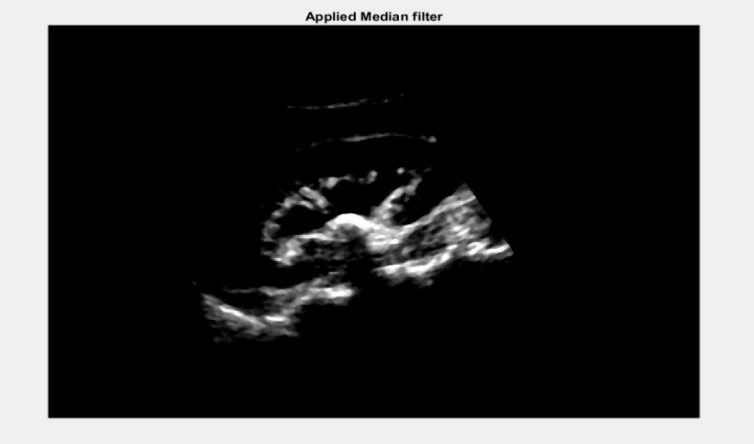


We apply the mask to above grayscale image we get the preprocessed image

Then for clarity we make the darker parts in the image darker and the brighter parts of the image brighter for this purpose we use contrast stretching .

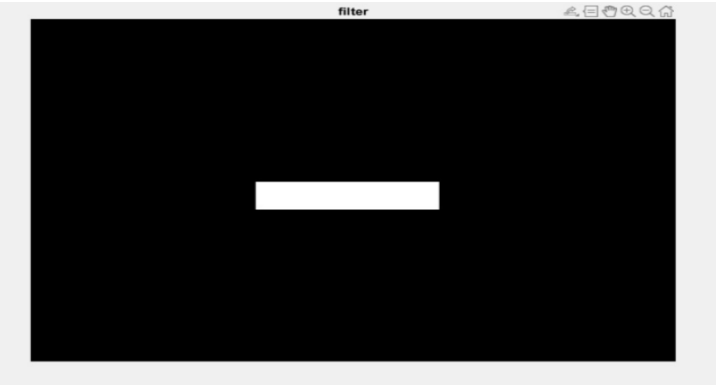


To the above image we apply median filter for normalization through which we get more clarity of the pre processed image



Then we fix threshold values: the pixels values greater than 250 are considered 1(bright) and less than 250 are considered 0 (dark).

Then we create a filter to detect the stones in the kidney
After analyzing X rays we can say that the probability of finding stone in the kidney is mostly at the center part of the kidney .
Then we create this filter to find whether the stone is to be found in the center of the kidney or not .



RESULTS :

Then we multiply the above filter to the original image. After multiplying we get the pre processed image in which the brighter part is the area where the stone is present .

This is the final pre processed image :

We have pre pre processed the image four times that is from original to gray from gray to binary from binary to contrast stretching image from contrast stretching image to median image
We have used two filters for removing the unwanted areas or parts from the pre-processed images: one mask to fill the empty holes in the binary image and the second is the final filter which when multiplied with the original image shows the area where the stone can be found .

CODE:

```
clc
clear all
close all
warning off
originalimg = imread('Kidney with stone/1.jpg');
figure;
subplot(3,3,1);
imshow(originalimg);
title("Original Image");
grayimg = rgb2gray(originalimg);
subplot(3,3,2);
imshow(grayimg);impixelinfo;
title("Gray Scale Image");
%Thresolding, pixel value greater than 20 is equal to 1 and less than 20 is
%equal to 0
binaryimg = imbinarize(grayimg,20/255);
subplot(3,3,3);
imshow(binaryimg);
title("Binary Image with thresold 20");
%Creating the mask
mask = imfill(binaryimg,'holes'); %filling the holes in area of kidney
%removing the unwanted area
mask = bwareaopen(mask,1000);
subplot(3,3,4);
imshow(mask);
title("Mask");
%applying mask to the gray scale image
img =
uint8(double(grayimg).*double(mask));%uint8(double(originalimg).*repmat(mask,[1
1 3]));
subplot(3,3,5);
imshow(img);
title("Preprocessed Image");
%contrast streaching
img = imadjust(img,[0.3 0.7],[]);
subplot(3,3,6);imshow(img);title("Contrast streaching");
%applying median filter
img = medfilt2(img,[5 5]);
subplot(3,3,7);imshow(img);title("Applied Median filter");
```

```
%Thresolding, pixel value greater than 250 is equal to 1 and less than 250
%is equal to 0
img = img>250;
subplot(3,3,8);imshow(img);title("Thresolding with value 250")
%creating filter to detect the stone in kidney
%The stone lies mostly in center part of the kidney
[r, c, m] = size(img);
x = r/2;
y = c/3;
row = [x x+200 x+200 x];
col = [y y y+40 y+40];
filter = roipoly(img,row,col);
subplot(3,3,9);imshow(filter);title("filter");
finalimg = img.*double(filter);
figure;imshow(finalimg);title("Final Image")
output = bwareaopen(finalimg,4);
[ya, number] = bwlabel(output);
if(number>=1)
   disp('stone is detected');
else
   disp('No stone is detected');
end
```

CONCLUSION :

Finally we want to say that through image processing we have detected the kidney stone with utmost accuracy which will be very useful for the medical surgerys and will help in the detection of stones in the kidney. The doctors by looking at the pre processed image can get a accurate idea of where the stone is present and can save the patients life as we can see we have pre processed the image so clear that only the parts where the kidney is present will be brighter rest of the parts will appear darker and not only that we have created filter to remove all the unwanted ares or can be called the disturbances from the final image .

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3. Borges T, Rai A, Raj D, Ather D and Gupta K 2022 Kidney stone detection using ultrasound images 310–7. Reference link

4. Rajput S, Singh A and Gupta R 2021 Automated kidney stone detection using image processing techniquesIn: International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO) 1–5.Reference link