

Kidney Stone Detection Using Image Processing On CT Images

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ABSTRACT

This paper presents a technique for detection of kidney stones through different steps of image processing. The first step is the image pre-processing using filters in which image gets smoothed as well as the noise is removed from the image. Image enhancement is a part of preprocessing which is used to enhance the image which is achieved with power law transformation. Next, the image segmentation is performed on the preprocessed image using thresholding technique. The imaging modality used is CT because it has low noise compared to other modalities such as x-ray and ultrasound.

KEYWORDS

Computed Tomography, stone, median filter, power law transformation, thresholding.

1. INTRODUCTION

Nowadays, kidney stone has become a major problem and if not detected at an early stage then it may cause complications and sometimes surgery is also needed to remove the stone. So, to detect the stone and that too precisely paves the way to image processing because through image processing there is a tendency to get the precise results and it is an automatic method of detecting the stone. Doctor generally uses the manual method to detect the stone from the Computed Tomography image but our technique is fully automated so it is advantageous as the time is reduced and with that the chances of error also reduces.

2. METHODOLOGY

The basic fundamental steps of image processing are:

2.1 IMAGE ACQUISITION

The image that we get from the hospital is in the form of DICOM so to perform the image processing it needs to be converted to jpg. This can be done through MicroDicom converter. The image is acquired in Matlab using 'imread' command.

Syntax: imread ('filename.jpg')

The image can be converted to grayscale image. To perform this 'rgb2gray' function is used.



Fig1: Original image of KUB-CT

2.2 IMAGE PREPROCESSING

The image preprocessing is performed using these two basic steps:

1. Filtering

It is used to remove the noise. There are various filters such as average filter, weighted average filter, Gaussian filter but the median filter is the best to remove the impulse noise or the salt and pepper noise. It is a low pass non linear filter. After filtering the image gets smoothed hence, filtering is also done to smooth the image.

Syntax: `immedfilt2(x)`

Where, x is the image.

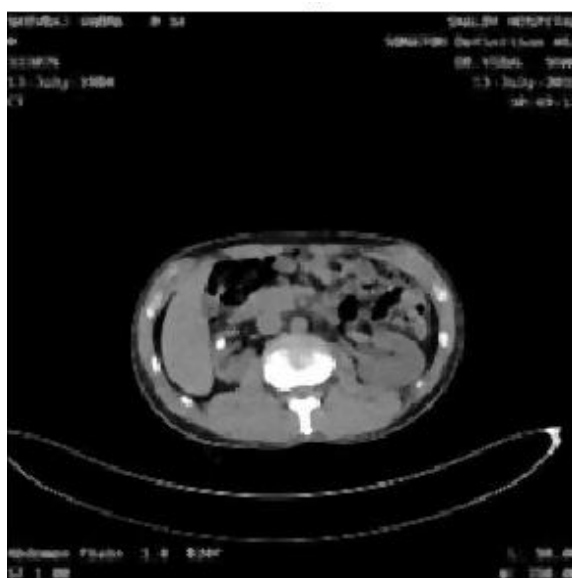


Fig2: Median Filtered Image

2. Enhancement

Image enhancement is a technique to modify the intensities of the image. The image that we get is of lower quality therefore the image enhancing is done to improve the quality of the image. The best way to do is through histogram equalization. In this, each pixel intensity is modified so if the image is towards the darker side then it gets stretched towards more white side and hence, we can say that the image is enhanced.

Syntax: imhisteq(y)

Where, y is the filtered image.

There, are other enhancement techniques like contrast stretching but in this the image is only stretched and not modified.

Power law transformation is a better option to do image enhancement. Here, the value of constant should be assumed on the basis of trial and error method. By taking $\gamma=2.5$, the results are very much desirable.

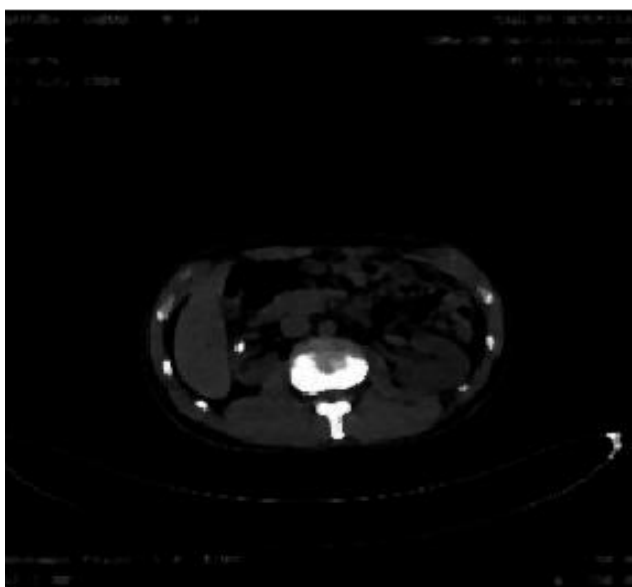


Fig 3: Power law transformation ($\gamma=2.5$)

2.3 IMAGE SEGMENTATION

The image segmentation means to partition the image into different regions to extract the desired features. There are different ways of doing segmentation through different algorithms,

Here, thresholding technique is used to segment the image. In this technique, threshold value based on the intensity of the pixel is selected and intensities below this value will become zero. Thresholding is done on the preprocessed image. Here, the threshold value is taken as 120.

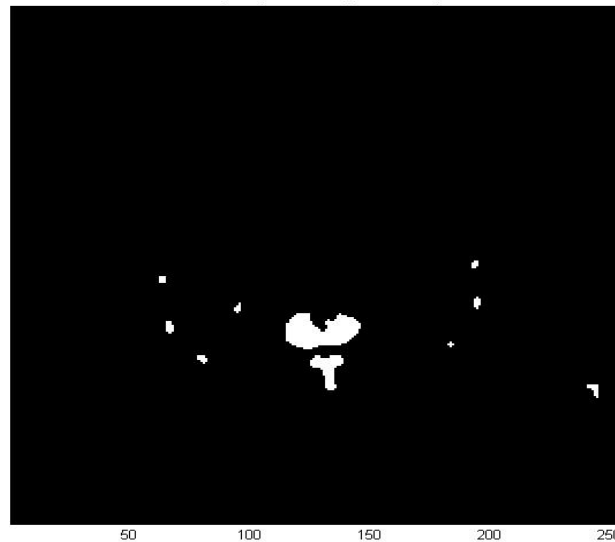


Fig 4: Threshold image

3. CONCLUSION

To sum up, through power law transformation kidney area is enhanced properly. In the original image the gray level of thoracic cage, vertebral column and lesion part is same. Hence, to separate the anatomical part, preprocessing and segmentation is done. Also, thresholding technique is very simple and accurate to do segmentation.

REFERENCES

- [1] Saman Ebrahimi and Vladimir Y. Mariano, "Image Quality Improvement in Kidney Stone Detection on Computed Tomography", Journal of image and graphics, Vol.3, No. 1, June 2015.
- [2] Prema T. Akkasaligar, Sunanda Biradar and Veena Kumbar, "Kidney stone detection in computed tomography images", IEEE, 2017.
- [3] Aniket Gaikwad1, Azharuddin Inamdar2, Vikas Behera, "Lung cancer detection using digital Image processing On CT scan Images", International research journal of engineering and technology, 2016.
- [4] Wayne Brisbane, Michael R. Bailey and Mathew D. Sorensen, "An overview of kidney stone imaging techniques", Nat Rev Urol, November 2016.
- [5] S. Asadi, H. Hassanpour, and A. Pouyan, "Texture based image enhancement using gamma correction", Middle-East Journal of Scientific Research, vol. 6, no. 6, pp. 569-574, 2010.
- [6] R. C. Gonzalez and R. E. Woods, "Digital Image Processing", 2nd ed., 1992, ch. 2, pp. 47-51 and ch. 10, pp. 568-611.
- [7] D. Y. Kim and J. W. Park, "Computer-Aided detection of kidney tumor on abdominal computed tomography scans", Acta Radiologica, vol. 45, no. 7, pp. 791-795, 2004.
- [8] D. T. Lin, C. C. Lei, and S. W. Hung, "Computer-Aided kidney segmentation on abdominal CT images", IEEE Trans. on Information Technology in Biomedicine, vol. 10, no. 1, pp. 59-65, Jan. 2006.
- [9] F. L. Coe, A. Evan, and E. Worcester, "Kidney stone disease", Journal of Clinical Investigation, vol. 115, no. 10, pp. 2598-2608, 2005.
- [10] F. Grases, A. Costa-Bauza, and R. M. Prieto, "Renal lithiasis and nutrition", Nutrition Journal, vol. 5, no. 23, pp. 1-7, 2006.