

Noise Removal In Medical Images Using Filters

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Abstract

Image processing is one of the most promising and vast research area in which medical imaging is most significant. Medical imaging is most important as in this the various medical images are used for diagnose at various stages of recovery. During diagnose the images may get corrupted by noise or the X-ray images can have noise in them. Filters are basically used to remove noise that may arise due to certain types of errors generated in image acquisition. Various filtering techniques are used for image enhancement. In the paper the linear filter and median filters were used to remove noise and the results of both are compared. From the results it is concluded that for removing noise the median filter is best to use.

Keywords: Medical imaging, Image acquisition, filters.

1. Introduction

Medical imaging is very significant in image processing. During diagnose a large database of medical images is used. There may be various types of noise in medical images that may be due to some errors in image acquisition [1]. To remove such types of errors from the images different types of filters are used. Filtering is a technique for enhancing an image. Filtering can implement various operations like smoothing, sharpening and edge enhancement [2]. There may be linear filters and nonlinear filters. Linear filters basically use an explicit mask. Mask is a sub image which is used in filters. The non linear filters do not explicitly uses coefficients. Their operation is directly on the values of the pixels in the neighbourhood under consideration. Some of the linear filters are low pass filter, high pass filter, high boost filter and derivative filters. The nonlinear filters are maximum filters, minimum filters and median filter [3].

2. Linear filtering Linear filtering is used to remove certain types of noise. In linear filtering explicit mask is used there are various linear filters like low pass filters, high pass filters and derivative filters and averaging filter which can be used to remove noise. In this each pixel is replaced by a weighted average of its neighbourhood pixels [2]. That is each pixel is replaced by its average with the average of its nearest four pixels. Basically image is enhanced by removing the noise by performing the spatial operations performed on local neighbourhood of input pixels. The image is convolved with a finite impulse response filter called spatial mask [4].

3. Median filter The nonlinear filters don't use explicitly the coefficients. Their operation is based on the values of the pixels in the neighbourhood under the consideration. An averaging filter can be used for removing grain noise from an image. In this each pixel is set to the average of the pixels in its neighbourhood, local variations caused by grain are reduced. While median filter can be used to suppress the noise without blurring the sharp edges of the image. It replaces a pixel by the median of all the pixels in the neighbourhood. Median filters are best suitable for removing the noise patterns which may have high spike like components. In order to perform the median filtering the mask of size 3*3, 5*5 etc. can be considered. The coefficients of the mask are equal to 1. Then this mask is placed in the top left corner and the pixel values are read below this mask [3].

4. Work done

In the work done the database of medical images were collected and the noise usually the salt n pepper noise was introduced in these medical images[5] .Then the linear filtering and nonlinear filtering was used to remove that noise from the images .The results of both were compared and recorded.



Brain.jpg



Lung.jpg



Noisy image of Brain.jpg



Noisy image of Lung.jpg

5. Results

The linear filtering was used to remove the noise from the images and the results were obtained as shown:

Similarly the Median filtering was applied on the noisy image and the result were as shown:



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6. References

- [1] R.C.Gonzalez “Digital Image Processing” second edition Addison-Wesley pp 70-71.
- [2] S.Annadurai ‘fundamentals of digital image processing’.Pearson Education pp102-113
- [3] Sanjay Sharma”Digital image processing” pp57-157.
- [4] A.K Jain “fundamentals of digital image processing” pp244-249
- [5] “Noise removal” A study by Uri Tal.

From the results it is clear that the non linear filters are more useful to apply on the image which is having noise as they remove the noise in the image with less blurring of the edges. The averaging filter removes the noise by blurring it and while doing so it also blurred the edges. Hence the resulting image will have the blurred edges. But in comparison the median filter will not blurred the edges and will remove the noise from the image resulting in a clear image.