Similarity Identification of an Image using Various Filtering Techniques

K. Sheidkavood, M. Ponni Bala

Abstract: ***In the field of medical imaging, application of image processing plays a vital role to assist the doctors to achieve the highest success rate of saving time and easy way of diagnostic the problem. Recent days, Women's health is a remarkable issue. Most of them are suffered by the Ovary disorder (PCOS). Appropriate solution for this disorder to is early detection. Based on the doctor's suggestion at early stage, we can avoid the infertility, cancer, and heart disease. Ultrasound Images are mostly used by doctors to identify the PCOS. Since, it's a safer way of scanning method and low cost. But it has a main drawback of multiplicative noise (Speckle noise). In this paper, we like to provide easy and fast method of normalize the multiplicative noise and improving the noise measuring factors like SNR, PSNR, MSE and Similarity indexing of an noisy image. So that, early stage itself we can realize PCOS.***

Index Terms: PCOS, PSNR, SSIM and speckle noise.

1. INTRODUCTION

Ultrasound imaging is a clinical examination strategy and that employ sound waves of very high incidence and their sound coming back. The advantage of being compact, flexible, and never again requiring ionizing radiations [1]. This methodology directed towards to find the invisible body information's need to be resolved and diagnostic radiology, providing the clinician with new information that has not at all been available in naked eye. The ultrasound imaging which is an acclaimed non-disturbing and periodic charge strategy to watch the dynamical conduct of organs [4]. During the image acquisition this method is suffered by the multiplicative noise i.e. speckle noise. This will modify the quality of the image because it has characteristics of abrupt changes in the image intensity value in unexpected way. Even we lose the information and able to visible the noise content in a scanned image.This will lead the clinician or radiologist or a gynecologist leads to fail sometime for exact diagnostic method towards the patients.

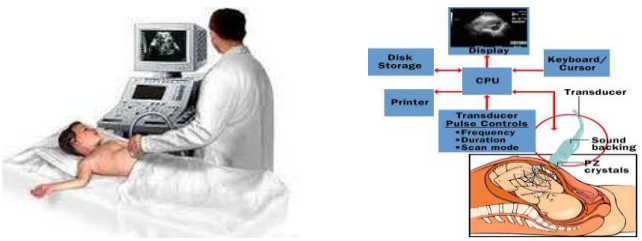

Fig 1: Ultrasound imaging system

A. Multiplicative noise

Noise is high frequency information and it's an unwanted measure during analysis. It consists of spurious and extraneous information. This is by chance to occur in the image, when image was captured or during the transmission of captured image. Basically multiplicative noise and shot noise occurs only during acquisition process. Speckle noise reduction is a challenging task to view and diagnostic the patient. We have more number of filtering techniques evolved day by day but yet to be choosing exact speckle noise reduction filtering is biggest challenge for researcher. It causes any distribution to be multiplied by each pixel in the image and it corrupts the image like ultrasound image, laser and sonar images etc. Recent days a researcher follows to combine the many filters to remove noise and proving the best among others.

B. Polycystic ovary syndrome: (PCOS)

PCOS is not a disease but it's a disorder commonly occurring in a female reproducing ages. PCOS can be cured when proper treatment by the clinicians not immediately but somehow it will take time to come out of this issue. A basic reason said by clinician is that due to segregation of androgen in females. This disorder leads a female to suffer by infertility, heart disease, etc. Infertility causes not only with PCOS. Due ovarian twist also possible reason for infertility. Clinicians analyze these infertility sign based on the blood flow in the ovary. When normal ovary it consists of actual blood flow but when cyst formed in the ovary, blood form clots in and around the ovary and clinicians will identify that suffered by PCOS. Sign for ovarian twist is that, like a turbine structure or whirlpool structure.

Based on the size of the cyst, clinicians diagnosing the patients. Variety of cysts will be present in the ovary but not all the cysts are the root cause for infertility. Some cysts exhibiting the egg for fertilizing. If cysts are very small in size, it's a big challenge for the clinicians to diagnostics. Lot of automated follicle identification methods have been submitted by the researcher but not yet implemented with any radiologist or gynecologist in real life.

C. Filtering techniques

Based on the noise in the image variety of filtering methods have been used to remove the noise in the image. In radar image, the same multiplicative noise have been evolved and combination of filtering techniques been used to remove the noise. Some most common filtering techniques used for ultrasound imaging is by us:

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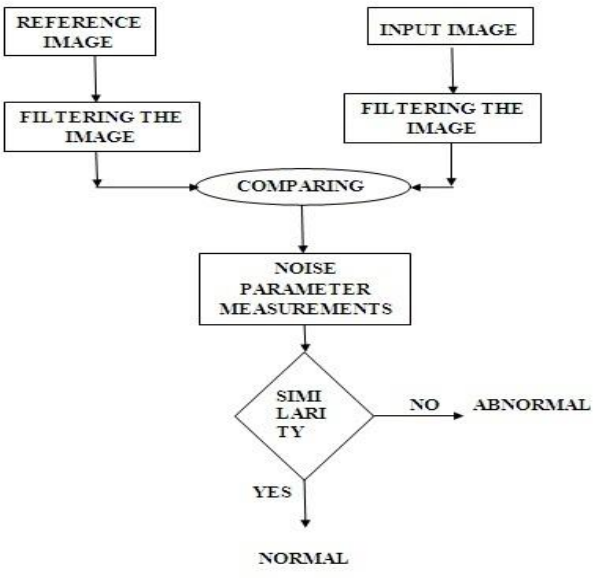
1. Average filter
2. Disk filter
3. Gaussian filter
4. Laplacian filter
5. Log filter

2. PROPOSED METHOD

We have the image database obtained from the clinician, PKS Hospital. Just we have taken a reference image from Google dataset. While applying all the above filtering techniques to the image and comparing the noise parameter, we can come to a solution that suffered by PCOS. Once we identified ourselves as a patient of PCOS, we can consult a doctor and get diagnostic from the doctors treatment.



3. EXPERIMENTAL RESULTS

As per the flow chart, consider to US images, one is normal ovary and other one is affected ovary by cyst. In second stage, apply all the filtering techniques to the reference image so that, multiplicative noise present in the image will be reduced. Among the above mentioned filters, Gaussian filter alone producing a comparative less noise content in the reference image. Base on the filtering results, we can calculate the noise parameters like, SNR, PSNR, MSE and Similarity index of both the image.

Based on the comparison of above parameters, it's possible to realize that our ovary is normal or abnormal. We can add the speckle noise randomly into any images and can detect the normal or abnormal category of image. This process has been processed with the database obtained from PKS hospital as input image and goggle data base image as reference image without PCOS. Initially reference image also suffered by speckle noise, so that it was processed with five types of the filters and obtaining noise free image without losing image information. Then processed image has been compare with the input image to get the input image characteristics and the comparison result consists of Similarity indexing, SNR, PSNR and Mean square error. If the similarity index of the input image with reference image is greater than 99%, we realize it's a normal ovary. But this value less than 99% we can realize it as abnormal ovary and we can consult doctor for further treatment effectively.

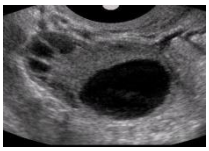


Fig 2:Reference image

Fig 3: Input image

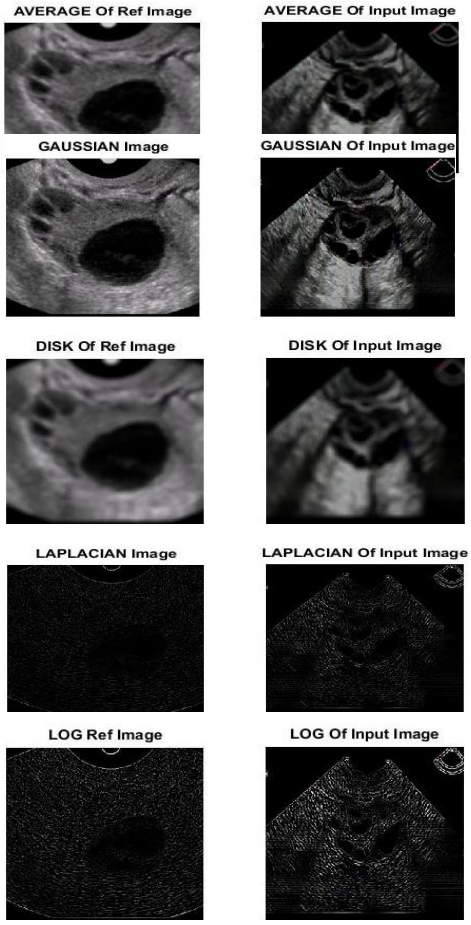


Fig 4: Filtered Images

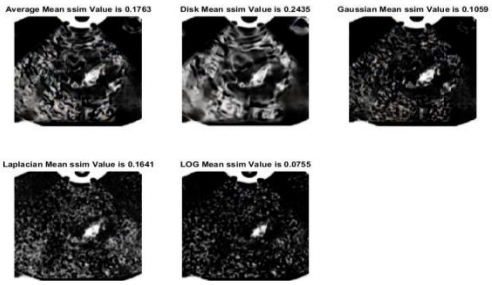


Fig 5: Similarity indexing Image

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Fig 6: Output results image

Table: 1 Normal Case

PARAMETER	AVERAGE	DISK	GAUSSIAN	LAPLACIAN	LOG
PSNR	*Infinite*	*Infinite*	*Infinite*	*Infinite*	*Infinite*
SNR	*Infinite*	*Infinite*	*Infinite*	*Infinite*	*Infinite*
SSIM	*1.0000*	*1.0000*	*1.0000*	*1.0000*	*1.0000*
MSE	*108.7302*	*204.4394*	*5.6880*	*7426.3311*	*7051.9497*
Time	*9.8859 s*	*9.8859 s*	*9.8859 s*	*9.8859 s*	*9.8859 s*

Table: 2 Abnormal Case

PARAMETER	AVERAGE	DISK	GAUSSIAN	LAPLACIAN	LOG
PSNR	10.9818	11.1567	10.7899	24.9097	19.5054
SNR	-6.3928	-6.3641	-6.3728	-6.1281	-6.2662
SSIM	0.2191	0.2787.	0.1331.	0.1835	0.0808.
MSE	5263.7291	5100.5748	5438.7985	1068.3261	1192.8838
Time	9.884842s.	9.884842 s	9.884842 s	9.884842 s	9.884842 s

4. CONCLUSION

The proposed system shows similarity index value as 1.0000 for normal case and each filter will have the same elapsed time as 9.8859 seconds whereas in abnormal case the similarity index values are different for each filters as 0.2191, 0.2787, 0.3585, 0.1835 and 0.0808 for average, disk, Gaussian, Laplacian and log filters respectively, whereas the elapsed time of the abnormal case is 9.884842 seconds for all the filters. By analyzing the values for similarity index it is evident that the Gaussian filter is highly efficient when compared to other filters. Most suitable for similarity identification is Gaussian filter and it is preferred over the other filters for real-time applications. In future, when applying this system for severe cases the system can be used efficiently by modifying the system to an extent. The notable fields that are to be considered for deploying the system are cybercrime, medicine, medical imaging, etc..,

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