International Journal of Current Engineering and Technology
E-ISSN 2277 – 4106, P-ISSN 2347 – 5161

Available at http://inpressco.com/category/ijcet

Review Article

Review of Enhancement of Diagnostic Images for Pelvic Region of Human (Female) Body

Sadanand L. Shelgaonkar†*, Anil B. Nandgaonkar† and Prashant Deshpande#

†Pacific Academic of Higher Education and Research University, Udaipur, Rajasthan, India

Accepted 10 Aug 2016, Available online 15 Aug 2016, **Vol.6, No.4 (Aug 2016)**

Abstract

Diagnosis of the pelvic disease is challenging problem for the doctors. Correct diagnosis require different techniques, different methods for investigation of lesions of pelvis, we are having scope to carry out the diagnosis of related organs i.e. Uterus, Ovaries, Adnexa. Appearance of the lesion in the form of either solid/cystic/mixed. In case of similar appearing lesion on ultrasonography, due to subjective error or instrumental error, in many cases doctor suggest for CT scan or MRI.

Keywords: *Diagnostic images, Ultrasound, Pelvic lessons, Color Doppler, Special Domain.*

1. Introduction

Rapid advancements in the instrumentation and technology in ultrasound imaging has enabled two major approaches to the study of the uterine circulation. Trans-abdominal ultrasound of the female pelvis has been the conventional approach in imaging of the female pelvis. With this approach a full urinary bladder is required to provide a window for imaging and to displace bowel gas. Therefore required deeper penetration and a lower frequency transducer, usually 3 - 5 MHz, must be used. The resolution of images is limited by the relatively lower frequency transducer that is required, and it also has great limitations in the obese lady, especially in the elderly who often cannot hold a full bladder. In the study of uterine hemodynamics in patients who are pregnant, these disadvantages may not be very significant, because the uterine arterial signal from these patients are usually strong. However, in the non-pregnant state, especially in pos (menopausal ladies, studies of uterine hemodynamics with TAS could be very difficult. In transvaginal imaging, the transducer can be placed closer to the structures to be evaluated. Therefore, less penetration is required. Higher frequency transvagjnal probes, up to 7.5 MHz can be used, and higher resolution images can be obtained. These advantages of transvaginal ultrasound (TVS) are well recognized, and studies comparing TVS to TAS have shown that TVS provided as much diagnostic information, or even more information than TAS in 96-99% of cases. A transvaginal ultrasound is usually performed to view the endometrium, the lining of the uterus, and the ovaries. Transvaginal ultrasound also provides a good way to evaluate the muscular walls of the uterus, called the myometrium. Sonohysterography allows for a more in-depth investigation of the uterine cavity.

Threedimensional (3D) ultrasound permits evaluation of the uterus and ovaries in planes that cannot be imaged directly. Pelvic tumours are common in women. Detection of benign and malignant tumours of the cervix, uterus and ovaries by full bladder trans abdominal sonography has been used for many years.

The recent development of high resoluction transvaginal probe has increased the diagnostic specificity of sonography in this domain. Colour Doppler transvaginal sonography has been recently introduced to evaluate pelvic masses. It is used to characterize the blood flow in pelvic lesions, so transvaginal sonography with the addition of colour Doppler, is being investigated as a method of non invasive tissue characterization. Transvaginal colour Doppler sonogrphy has been proposed as a diagnostic tool when malignancy is suspected. It plays a useful role in early detection and better tissue characterization of pelvic tumours and masses.

2. Literature Review

In past few decade there was no definite clinical or laboratory test by which female internal genital system i.e. Uterus, Ovaries could be examined. Kelling (1902) was first to utilize air injection in to an Abdominal cavity (Ted Dubinskys *et al*, 1999). Jacobeus (1910) pierced abdominal wall of 20 cadavers and

*Corresponding author **Sadanand L. Shelgaonkar** is a Research Scholar; **Dr. Anil B. Nandgaonkar** is his guide and **Dr.Prashant Deshpande** is M.B.B.S, MRD, DNB

demonstrated that no damage done to viscera by needle.

Rectal examination, bimanual examination was carried out but accuracy of diagnosis was limited. Pelvic pneumo gynecography, a radiological aid in the diagnosis of the gynecological disorder (Christina Pahl *et al*, 2012). To avoid complicated procedure simple and reliable techniques came in radiological fields.

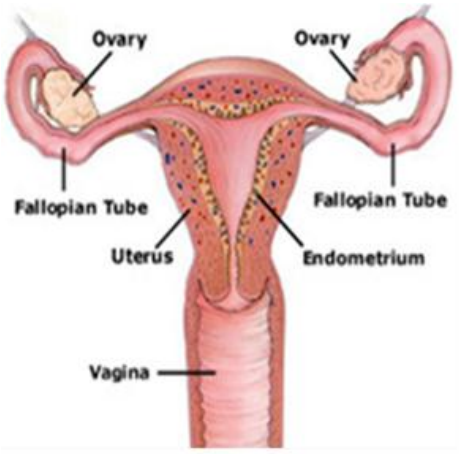

Fig.1 Gynecological

It is essential aspect of scientific research. it provides basis for further investigation. In literature review we have focused on pelvic exercise and urinary tract symptoms. In conceptual frame work, perspective regarding inter- related phenomena of the interest (Patel MD,1996). Work done For diagnosis of endometrial carcinoma cervical carcinoma, fibroid (leiomyoma),bulky uterus, pelvic congestion. to test ovaries and adnexa for be-nign and malignant. Also to carry out diagnosis of fallopian tube. pelvic inflammatory diseases, pelvic floor with stress urinary continence. Diagnosis of the ectopic pregnancy (Israel Thaler *et al* 1992). It influences health of women and social pressure. Diagnosis of lesions of pelvic for obese patient Trans vaginal use is doubtful (Christina Pahl *et al*, 2012). Ultrasonography in similar appearing lesion difficult for correct diagnosis .To diagnosis the patients (already surgery in pelvic region carried out) due to adhesion and scars, not getting clear images. We are having scope to process images to get clarity in picture for better characterization of pelvic regions (Siim Kurjak *et al*, 1992 ; Christina Pahl *et al*, 2012).

3. Objectives of the Proposed Study

To Analyze the data ,images collected by using ultra sound and color Doppler and process the same by Image enhancement spatial domain techniques, provide correct path for exact diagnosis of lesions in pelvic region. Even after availability of modern medical equipments and technology, up to certain extent problem remain unidentified for exact diagnosis genetical (female) organs.

4. Research Methodology

Different Researchers uses different techniques or tools for investigate or diagnostic diseases with certain assumptions.

A. Hypotheses to be tested

For the characterization of lesions in pelvic region, organs to be tested are uterus, ovaries, adnexa. Sometime if surgery is carried out on pelvic region of patient then adhesion, scars may appear so during diagnosis it is difficult to get clear picture, appearing of similar lesions, in all cases doctors may have different opinion. Even if they are having same diagnostic equipments. We shall do the study of cases in which diagnosis of patients with Trans abdominal and Trans vaginal ultra sound and color Doppler will be carried out and Image enhancement is carried out for analysis by spatial domain techniques thus by implementing same, we will get clarity in image and able to get exact diagnosis of the disease.

The aim of an Image enhancement is to Improve the Visual appearance of an image. Many images in medical imaging suffer from poor contrast and noise. It is necessary to enhance the contrast and remove the blurring, noise to increase the image quality.

Types of image Enhancement: There are two basic types of image enhancement

A) Spatial domain
B) Frequency domain

Based on direct manipulation of pixels in image again image can be enhanced by

- Point processing
- Mask processing

A. spatial domain technique

In spatial domain technique. In case of frequency domain Based on Modifying Fourier Transform of image

- Combination of two domain method
- Color image enhancement.

In spatial domain method

- Contrast and Dynamic range modification
- Noise reduction
- Edge enhancement and detection is carried out.

Due to low contrast we cannot clearly extract objects from the dark background. Image processing such as Analysis, Detection, Segmentation and Recognition carried out during enhancement (Sheila Sheth *et al*, 1993). For Medical imaging Spatial domain technique

is preferred as it operates directly on pixels. This is advantageous as it is conceptually simple to understand but these techniques lacks in providing adequate robustness.

Frequency domain image enhancement is used to describe analysis of mathematical functions or signal with respect to frequency and operate directly on transform coefficient of image such as Discrete wavelet transform(DWT), Discrete cosine transform(DCT).This is having low complexity of computation also manipulating frequency composition of image. Limitation is that it cannot simultaneously enhance all parts of image very well.

Spatial domain works in Point processing operation and Spatial filter operation. Frequency domain can again classified in to three categories, Image smoothing, Image sharpening, and periodic noise reduction by frequency domain filtering (V. K. Shandilya *et al*, Nov.2012).

Image enhancement techniques can be divided into two broad categories:

A. Spatial Domain Techniques

Spatial domain techniques directly deal with the image pixels. The pixel values are manipulated to achieve desired enhancement. Spatial domain techniques like the logarithmic transforms, power law transforms, histogram equalization, are based on the direct manipulation of the pixels in the image. Spatial techniques are particularly useful for directly altering the gray level values of individual pixels and hence the overall contrast of the entire image. But they usually enhance the whole image in a uniform manner which in many cases produces undesirable results (Sheila sheth *et al*, 1993).

It is not possible to selectively enhance edges or other required information effectively. Now we see two techniques of spatial domain techniques.

1) Log Transformation Technique : Log transformation is one of the elementary image enhancement techniques of the spatial domain that can be effectively used for contrast enhancements of dark images. The log transform is essentially a grey level transform which means that the grey levels of image pixels are altered. This transformation maps a narrow range of low grey level values in the input image to a wider range of output levels (V. K. Shandilya *et al*, Nov.2012). The general form of the log transformation can be mathematically represented as Where, s is the output grey level, r is the input grey level and c is a constant. It is assumed that r 0.

2) Power Law Transformation Technique: Power law transformation is another commonly used gray level transformation in the spatial domain. It is conceptually similar to alpha rooting in the frequency domain as this is done by raising the input grey level by some power. It is similar in operation to the log transforms in that power law transforms with fractional values of map a narrow range of dark input values into a wider range of output values thereby increasing the contrast.

The transformation can represented as where s is the output grey level, r is the input grey level, b is a scaling constant and is the power to which the input grey level is raised. One significant advantage of the transformation is that it is possible to control the transformation function by varying the parameter . The frequency domain of images is clearly depicted in the mathematical form as Where X (p, s) is the orthogonal transform of the image, X (p,s) is the magnitude of the transform and (p,s) is the phase angle of the transform.

B. Frequency domain techniques

Transformation or frequency domain techniques are based on the manipulation of the orthogonal transform of the image rather than the image itself. Transformation domain techniques are suited for processing the image according to the frequency content. The principle behind the frequency domain methods of image enhancement consists of computing a 2-D discrete unitary transform of the image, for instance the 2-D DFT, manipulating the transform coefficients by an operator M, and then performing the inverse transform. The orthogonal transform of the image has two components magnitude and phase. The magnitude consists of the frequency content of the image. The phase is used to restore the image back to the spatial domain. The usual orthogonal transforms are discrete cosine transform, discrete Fourier transform, Hartley Transform etc. The transform domain enables operation on the frequency content of the image, and therefore high frequency content such as edges and other subtle information can easily be enhanced. We see one technique of transformation domain i.e Alpha rooting technique.

1) Alpha rooting Technique: Alpha rooting is a simple but effective technique of image enhancement in the transform or frequency domain. The technique is applied on the orthogonal transforms of images. It is used to augment the high frequency content in the image. The method is based upon the fact that after applying an orthogonal transform, high frequency coefficients of an image, will have smaller magnitudes than low frequency coefficients. By raising the magnitude of an image to some value, , where 0 ¡ ¡ 1, the higher valued lower frequency components of an image can be reduced more in proportion to the lower valued high frequency components. The mathematical form of the operation is X = where X(p,s) is the magnitude of the image transform, (p, s) is the phase of the transform and is the value by which the magnitude is raised (0 ¡ ¡ 1).The effect is observable in most of the images on which alpha rooting is applied and becomes more pronounced in case of darker original images. Thus many a time, the output image, although sharp, is unacceptably dark; it is poor in

contrast and brightness expected of a good enhancement.

5. Applications

Image enhancement is used for enhancing a quality of images. The applications of image enhancement are Aerial imaging, Satellite imaging, Medical imaging, Digital camera application, Remote sensing.

Image enhancement techniques such as spatial and transform domain technique are important techniques (V. K.Shandilya *et al*, Nov.2012). Most of the techniques are useful for altering the gray level values of individual pixels and hence the overall contrast of the entire image. But they usually enhance the whole image in a uniform manner which in many cases produces undesirable results. There are various techniques available which produce highly balanced and visually appealing resultsfor a diversity of images with different qualities of contrast and edge information and it will produce satisfactory result.

Conclusion

The literature review gives the current status of the research on emphasizing the image enhancement required for diagnosing lesions of pelvic lesion of human (female) body. There is scope for getting clarity of images for perfect diagnosis of diseases related to the gynecology.

Hence statistical characteristics of the image to enhance is necessary. For this purpose this review is first step for analyzing the enhancement of diagnostic images.

References

Kirkshy & Ted Dubinskys (1999), Color Doppler ultrasound useful in diagnosis of ovarian cancer. clin obstetrics & gynecology, 42(4), 902-15.

Siim Kurjak and Haroldschulmanetal (1992), Transvaginal ultrasound Color flow & Doppler wave form of post menopausal Adnexal masess. Obstet gynecol, 80-917-21.

jean-noel-Buoy, Michel (1996), Characterization of adnexal masses; combination of color Doppler and conventional sonography compared with spectral Doppler analysis and conventional sonography alone, AJR , 166, 385-93.

Zeewiner, Israel Thaler *et al* (1992): Differentiating Benign from Malignant ovarian tumors with Trans vaginal color flow imaging obstet gynecol.,79,pp 159-62.

Ulrikehamper, Sheila sheth *et al* (1993): Trans vaginal color Doppler sonography of adnexal masses and difference in blood flow impedance in benign & malignant lesions . AJR,160, pp 1225-28 .

Patel MD.(1996), practical approach to Adnexal masses, Radiol clin north AM; 44, 879-899.

Brown DL, Doubilet Pm Miller *et al* (1998); Benign and malignant ovarian masses selection of most discriminating gray scale and Doppler sonographic features Radiology:208,103-110.

Acta obstet Gynecol scand. (1995), Oct.734-9

Bryan Bromley, Howard Goodman (1994) Comparison between sonographic morphology and Doppler velocity wave form in Diagnosis of ovarian malignancy. Obstet Gynecol;83:434-37.

Gold care M, Buchan H (1993) , Fair weather JMorbidity following Pelvic inflammatory diseases .Brit jobstet .Gynecol:100:558-562.

Wise BG, Burton G,cutnerA, Cardozo LD(1992). Effect of vaginal ultra sound probe on lower urinary tract function. British journal of urology70 12-16.

Snehal O.Mundhada, V. K.Shandilya (Nov.2012) Spatial and Transformation Domain Techniques for Image Enhancement, International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 1, Issue 2, pp 213-216.

Christina Pahl, Eko Supriyanto, Nasrul Humaimi Bin Mahmood, Jasmy Yunus (2012), Cervix Detection Using Squared Error Subtraction, Asia International Conference on Modelling & Simulation, pp121-125.