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NEED OF IMPROVEMENT IN QUALITY OF DIAGNOSTIC IMAGES OF PELVIC REGION

[1]Sadanand L. Shelgaonkar, [2]Anil B. Nandgaonkar,

[3]Dr. Prashant Deshpande

[1]Research scholar at Pacific Academy of Higher Education and Research University, Udaipur, Rajasthan, (India)

[2]Guide at Pacific Academy of Higher Education and Research University, Udaipur, Rajasthan, (India)

[3]Dr. Prashant Deshpande M.B.B.S, DMRD Aurangabad, (India)

ABSTRACT

The image processing branch of engineering discipline play a vital role in biomedical field. Doctors all over the globe face serious challenges in detecting problems related to human-female pelvic region. For examining a patient, doctor needs clarity in images taken from diagnostic equipment's like CT SCAN, MRI, & Ultrasound scanner. This paper highlights the need of improvement in the quality of diagnostic images.

Index Terms: Adnexa, Cervix Lesions, Ovaries, Spatial domain, Ultrasound

I. INTRODUCTION

A lesion in a tissue is caused due to damage, injury or disease. It may occur in any parts of the body especially in skin, brain, mouth but this paper is focusing on the lesion of the pelvic region The types of lesions are Seborrhoeic keratosis, Melanocytic nevus, actinic keratosis, basal cell carcinoma, squamous cell carcinoma, melanoma [6]. Traditional techniques such as visual inspection with acetic acid and cervicography were used in early days for lesion diagnosis [17]. Computer aided diagnosis are more accurate and holds a lot of demand in recent years [6]. Different types of Computer aided diagnosis methods are Computed Tomography [10], Magnetic Resonance Imaging [9], Mammography, Ultrasonography [8], Positron emission Tomography [7] which are developed for easy diagnosis for the different types of lesion. Imaging techniques are used to diagnose various types of cancers in the pelvic region of human female. Recently developed imaging techniques for identifying the lesions are mostly algorithm based and have increased the diagnostic specificity in this domain. Correct diagnosis.

II. REVIEW

In the past few decades there was no definite clinical test for examining the lesions the female internal genital system i.e. uterus, ovaries. In 1902 kelling used air injection in abdominal cavity. Later rectal examination,

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bimanual examination was carried out but the accuracy of the diagnosis was limited. Work done for the diagnosis of ovaries for the malignment and be-nigh, diagnosis of fallopian tube have a lot of scope of further research and improvement.

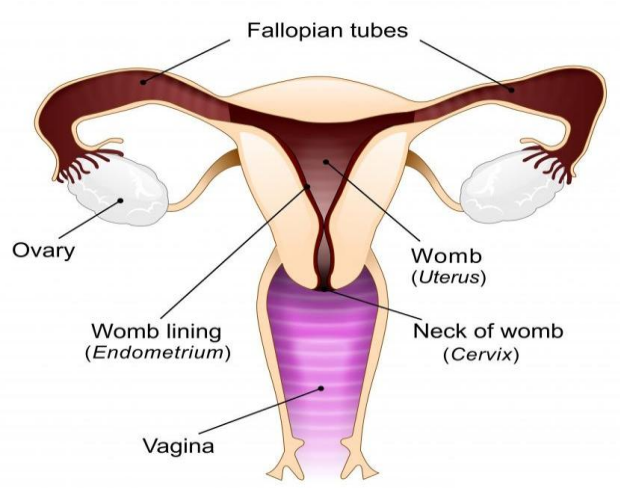

Fig 1 Gynecological

Even after availability of modern medical equipment's and technology, up to certain extent exact diagnosis of female genital organs remains unachieved. Zhan et al [1] adopted Level set method which included gaussian distribution function for enhancement of visualization of the lesion tissue whereas it also faced a drawback of Inability to handle complex structures of lesions under low quality. Harmouche et al [2] developed the methodology for classification of multiple sclerosis lesions using markov random field. It contributed for the classification of lesions however it suffers due to sticking with local optimal points to establish the relativity. Conditional random field, which is a member of the family of markov random field, has been exploited in [3] determine the lesions in the uterine cervix. Since the imaging systems often produce misalignment in the resultant image, a window based scheme has been used along with the conditional random field. The window based processing improves the image for the betterment of diagnosis accuracy. The noise removal task has been considered by the conditional random field, yet it suffers due to iterative scaling problem. As a result sufficient image enhancement cannot be achieved. Alush et al [4] introduced Water shed segmentation methodology which suffered from over segmentation but was able to characterize the regional intensity In [5], neural network has been deployed to understand the degrees of lesions. The neural network supports image enhancement, unless the data interpolation deviates from the actual data. Moreover, the finite element modeling technique interpolates based on the statistical nature of the image. The lack of practical measurements may degrade the performance of the neural network. To the best of our knowledge, characterization of suspicious lesion images using a purely data driven approach has not yet been attempted. The gradient based method [18] and the contrast differentiating methods for segmenting the lesions are inefficient against intensity variation, image acquisition devices, etc. The multispectral imaging methods are expensive [19]. It is well known that the ultra sound images are cost efficient and exhibit hassle free usage. However, very few works have focused on exploiting the

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ultrasound modality for lesion diagnosis. Moreover, there is no reliable contribution reported in the literature for diagnosing cervical lesions from the pelvis portion of the humans, especially females.

A. Method for Image Enhancement

For the identification of lesions in the pelvic region, uterus, ovaries, adnexa are to be tested. Image enhancement is done to improve the visual appearance of an image. In medical imaging it is necessary to improve the images by adjusting the contrast and by removing the blurring, noise. Based on direct manipulation of the pixels in an image it can be enhanced by the techniques of point processing and mask processing The two types of Image Enhancement methods are:

- Spatial Domain
- Frequency Domain

2.1 Spatial Domain

For *i*mproving the interpretability or perception of information in images for human viewers and for providing better images to doctors for diagnosis of lesions in the female pelvic region spatial domain methods can be used.[11] Due to low contrast doctors cannot make out the effectively diagnose the lesion in the human pelvic region. However image processing techniques such as detection, segmentation, recognition were carried out for image enhancement but they were found to ineffective for medical imaging purposes. So for medical imaging spatial domain techniques acts directly on the pixels. The pixels values are manipulated to achieve desired enhancement. Spatial domain works in point processing operation and spatial filter operation. Techniques such as log transformation technique, power law transformation technique act on direct manipulation of pixels. They are used as they alter the grey level values of each pixel and hence improve the overall contrast of the image[12]. But they usually enhance the whole image in a uniform manner which in cases produces undesirable results.

- **Log Transformation Technique**: Log transformation is one of the elementary methods for image enhancement and it helps in enhancing the contrast of the image. Its general form of log transformation is given as,

$$s = c \times \log(1+r) \quad (1)$$

Where s is the output value of the pixel, r is the input value of each pixel and c is a constant[14]. This transformation maps a narrow range of low gray-level values in the input image into a wider range of output levels. The opposite is true of higher values of input levels. We would use this transformation to expand the values of dark pixels in an image while compressing the higher-level values [13]. To expand the bright levels we would use the inverse logarithmic transformation.

- **Power Law Transformation:** Power law transformation is another commonly used grey level transformation technique. Its general form is given as,

$$s = c \times \gamma \quad (2)$$

Where c and γ are positive constants. As in the case of the logarithmic transformation, power-law curves with

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fractional values of γ map a narrow range of dark input values into a wider range of output values, with the opposite being true for higher values of input levels [15]. We also note that the above equation reduces to the identity transformation when c = γ = 1. A variety of devices used for image capture, printing, and display respond according to a power law. By convention, the exponent in the power-law equation is referred to as gamma. The process used to correct this power-law response phenomenon is called gamma correction.

- **Histogram equalization:** This method usually increases the global contrast of images, especially when the usable data of the image is represented by close contrast values. Through this adjustment, the intensities can be better distributed on the histogram [16]. This allows for areas of lower local contrast to gain a higher contrast. Histogram equalization accomplishes this by effectively spreading out the most frequent intensity values. Its general form is

$$S_k = \frac{(L-1)(r_k - r_{kmin})}{r_{kmax} - r_{kmin}} \qquad (3)$$

Where k = 0, 1, 2….. L-1

r and s are the input and output pixels of the image, L is the different values that can be the pixels, and r_{kmax} and r_{kmin} are the maximum and minimum gray values of the input image[17]. A key advantage of the method is that it is a fairly straightforward technique and an invertible operator

2.2 Frequency Domain

Frequency domain techniques are based on the manipulation of the orthogonal transform of the image rather than the image itself. 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 [17]. 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 [18]. We see one technique of transformation domain i.e Alpha rooting technique.

III. PROPOSED METHODOLOGY

The literature review reveals the current status of the research on emphasizing the enhancement required for diagnosing lesions. While few contributions could be found for lesions diagnosis in pelvic region, rest of the contributions have focused on the segmentation and not on enhancing the image. This proposal addresses the challenges reside on enhancing the image from noise and misalignment problem and proposes the methodology based on supervised learning. Inspired from the neural network, our methodology adopts deep belief neural network for dual purposes. Firstly, it will detect the misalignment of the image followed by estimating the actual position of the image. Secondly, it will estimate the statistical characteristics of the image to enhance the image

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from its noisy environment and improve contrast of the image. By defining a image based diagnosis method for cervical lesions from ultrasound images will result in a cost efficient diagnosis method. The precise methodology will predict the early diagnosis of such lesions and hence it shall be treated effectively.

IV. CONCLUSION

The adopted methodology will be developed in MATLAB and the performance will be investigated using renowned metrics such as PSNR, MSE or SDME (Second derivative like measure for enhancement). Comparative analysis will be made against conventional enhancement mechanisms to demonstrate the performance of the proposed enhancement methodology.

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