ABSTRACT

Medical diagnostics procedures have grown to a greater extent with sophisticated imaging devices. Computer aided solutions have contributed significantly for automatic examination of medical images and interpreting the images to provide helpful information for enhancing the medical expert’s diagnostic procedure. Many researchers have proposed different methods during the previous decades for automatic detection of abnormalities in human organs. However, detection of aberrations in ultrasound ovarian images is still being done manually by medical experts that can result in error.

One of the major issues concerned with women’s health is the ovarian abnormalities due to follicular formation that are perceived as Cyst and Polycystic Ovarian Syndrome (PCOS). The follicular formation in ovaries obstructs the balance of follicle stimulating hormones and luteinizing hormones. These lead to the problems of infertility and tumour. A study on medical diagnostics report shows that in recent times there is an increase in the occurrence of ovarian aberrations like ovarian Cyst and PCOS.

The radiologists and gynaecologists are considering the ultrasound imaging system as an effectual technique to screen the women reproduction system. In screening of ovarian images, the number of follicles and its size are examined manually to detect the aberrations that can be inaccurate. Hence, the research is dedicated to develop a Computer Assisted System (CAS) with new techniques for automatic and accurate detection of aberrations, the Cyst and PCOS in ovarian images. The development of this
system will be a promising solution among the medical experts in giving useful information for better diagnostics and treatment to the patients.

Ultrasound ovarian images are inherent with speckle noise and hence are preprocessed using Lee, Kuan, Frost, Gaussian, Wiener, Median, Hybrid Median, Modified hybrid median and Fuzzy filtering techniques. The results are analyzed using performance metrics. From the results, it is inferred that the Modified hybrid median filter and Fuzzy filter performances are better. Hence, Modified hybrid median filter and Fuzzy filter are hybridized for denoising the ovarian images more effectively.

At first, the ovarian images are segmented using conventional Otsu thresholding technique. This technique has been modified to improve the segmentation results. Hybrid region based active contour method is proposed to segment the follicles. This method requires an initial mask and is chosen manually. However, defining the initial mask more accurately will yield a better segmented output. Hence, the modified Otsu method is used to define the initial mask in the region based active contour method.

Recently, nature inspired algorithms are applied to solve many optimization problems. In this research, threshold selection is viewed as a nondeterministic problem and hence nature inspired algorithms are proposed to find an optimal threshold. Every algorithm is intended to maximize the fitness function, the between-class variance of the modified Otsu method. The optimization algorithms, namely, Particle Swarm Optimization (PSO) and its variants, Pigeon Inspired Optimization (PIO), Invasive Weed Optimization (IWO) and its variant are implemented to find an optimal threshold. Their performances are analyzed with quality metrics for correct segmentation of follicles.
From the segmented results, the geometrical features, Area, Perimeter, Major Axis, Minor Axis, Eccentricity, Extent, Circularity and Tortuosity are extracted to recognize the true follicles and compute the Follicle count and size. The SVM classifier uses these features to classify the ovarian image as Normal, Cyst and PCOS. The classification accuracy is found to be higher for the segmented results of MIWO algorithm. Also, the results of MIWO algorithm are consistent with medical expert’s opinion.