Detection of Ovarian Cyst in Ultrasound Images using Super pixel segmentation method

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***Abstract*: Detection of cyst in the ovary is as essential as to treat the patient with Polycystic Ovarian Syndrome (PCOS). Manual methods to diagonise an ovarian cyst in ultrasound image have always produced results with some error. Many automated algorithms have been used for ovarian cyst detection in ultrasound images. This paper discusses the detection of cyst in ovarian ultrasound image with an accuracy reaching 90%, using the super pixel Algorithm.**

***Index Terms*: Cyst detection, Ovarian cyst, Polycystic ovarian syndrome, super pixel algorithm.**

I. INTRODUCTION

The current world has more of its women population suffering from Poly Cystic Ovarian Syndrome (PCOS). It is estimated that approximately 6-10% of women worldwide are suffering from PCOS syndrome about 50% of them being not diagnosed. PCOS being a hormonal disorder is very common in women of reproductive age.[1] In this syndrome the menstrual cycle is affected and cycle becomes irregular .The release of eggs regularly fails as the ovaries develop follicles of fluid. These follicles are the cysts of different sizes causing PCOS. Diagnosis of cyst is manually done by physical examination, Ultrasound imaging of the ovary. The physical diagnosis involves the measurement of Blood pressure, Body mass index (BMI), size of the waist, hair growth in skin, acne, hair loss and thyroid malfunction.[1][2] The other methods involve pelvic examination, blood test, level of androgens in blood and irregular periods. Automated detection of cyst from the Ultrasound images is a recently growing trend, that can help doctors to assess the shape and size the cyst that needs to be treated. The purpose of this study was to evaluate the performance of the Super pixel Algorithm in detecting and segmenting the cyst from the given ultrasound images.

II. MATERIALS AND METHODS

Segmentation of an image leads to processing the data and extracting details like volume, density, intensity etc. There are many techniques that can segment the images like Thresholding methods, stochastic model methods and so on. In this study we have used super pixel algorithm method.

SUPER PIXEL SEGMENTATION:

In recent years, image segmentation using superpixels has been gaining attention. In this algorithm, the superpixels can group the pixels in the image as regions. These regions can replace the pixel grid structure in the images. This algorithm can detect the repetitive patterns in the image. This detection can reduce complex calculations and speeds up the process. Many types of clustering techniques like Simple Linear Iterative Clustering Superpixel (SLIC) segmentation, K-Means algorithm. [7] [8] During the research, Examining large number of pixels for segmentation, was a time consuming and tedious process. In the SLIC algorithm, the number of K initial cluster centers is randomly defined. Then the algorithm assigns and updates parameters iteratively. Here based on similarity, each pixel belongs to the closest cluster. Further, the clusters can be updated in terms of their member pixels which have been assigned during the updating step; the process would continue until convergence is reached. [9] [10] [11] Each pixel of the image has relevance with the nearest cluster.

III. PROPOSED WORK:

In the proposed method, the cyst from the ultrasound image is segmented using the superpixel algorithm method. The superpixels are considered as the nodes for identifying the pixels with same kind of information. The superpixel finds the region ROI which can be called as the Cyst area. Then the next image processing technique called the Edge detection method is implemented. This process produces output image with specific cyst area edges detected. Fig 1 gives the diagrammatical representation of the process flow of the proposed work.

1. Preprocessing:

This preprocessing step is generally the first step in any image segmentation procedure. This step is performed to make the obtained ultrasound image suitable for for processing. This usually involves filtering of unwanted noises, distortions in the image. This process gets rid of the artifacts like noise and intensity inhomogeneity. This can be done using a NLM filter.[] After the image is filtered, the determination of Region of Interest and computation of superpixels is employed.

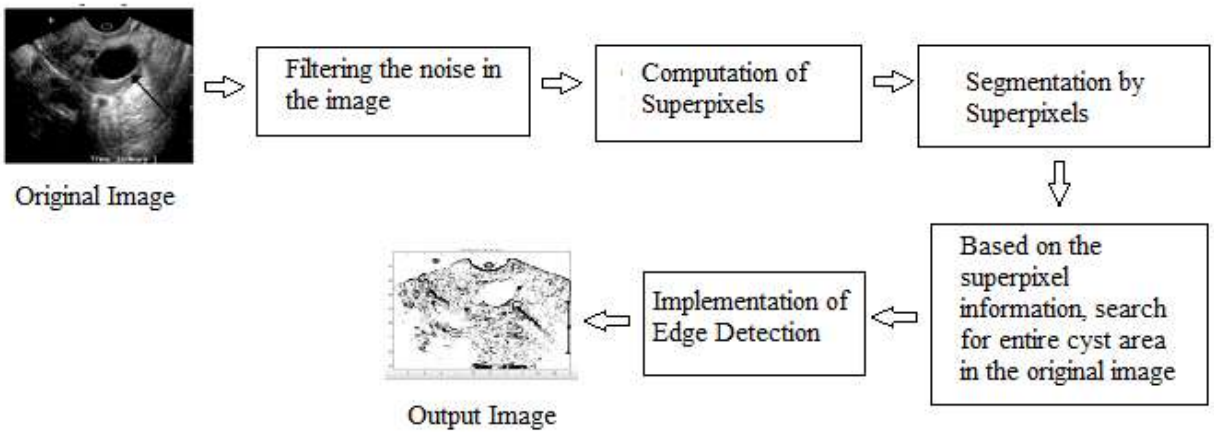

Fig 1. Process Flow diagram of the proposed work

2. Computation of Superpixels:

Now the image is divided into smaller blocks based on a central value of the pixels. This common central value is calculated using the mean, median, mode of the pixels in the ROI. For example, the mean value of the cyst area is calculated by calculating the mean of all pixel values in the area. Likewise the median and mode values were also calculated.

Fig 2.a) Original Image

Fig 2.b) Filtered Image

3. Application of superpixel algorithm:

The segmentation is performed on the superpixels in the image. This gives the very important information of this proposed work, the entire cyst area in the ultrasound image. The segmented image is fed as an input to this algorithm. This algorithm is created to have a very clear image of the cyst which will enable the measurement of the size of the cyst.

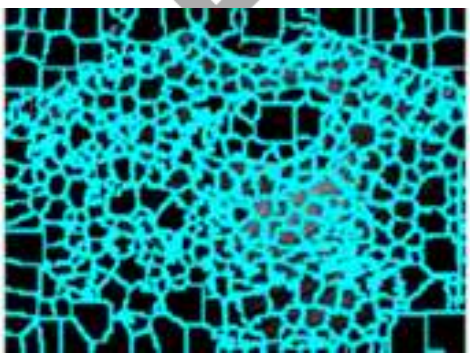

Fig 3. Superpixels applied on the image

4. Implementation of Edge Detection:

The edge detection algorithm is applied on the cyst area. In this method, the points in which the brightness of the image changes were organized into a set of curved line segments. This detection of sharp changes in the brightness of the image can capture the

important details, discontinuities in surface orientation. These detected curves are the line segments that indicate the boundaries of the cyst regions. Application of edge detection algorithm results in reduction of the data that was to be processed. Because this algorithm preserves only the details with details of the cyst region and gets rid of the redundant data that is irrelevant. Further, this algorithm simplifies the process of interpreting and extracting details from the original image. It can be claimed that edge detection, can make it possible to identify even a very minute cyst in an ultrasound, thus enabling an early detection and treatment of poly cystic ovary syndrome.

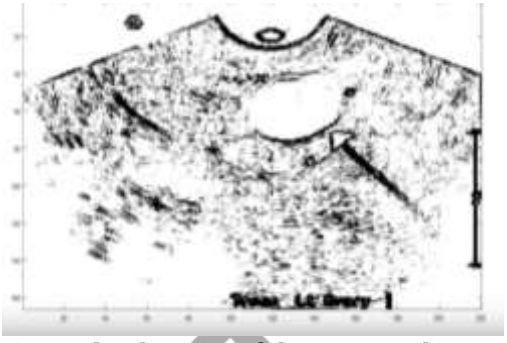

Fig 4. Edge detection of the segmented image

IV. CONCLUSION AND FUTURE WORK

The present study shows that the superpixel algorithm has performed successful in finding the entire cyst region in the ultrasound image. This method gave visual similarity in segmentation when compared with the manual segmentation method. This process of using the superpixel algorithm method is mainly due to avoid some pitfalls of other automatic segmentation methods. It is true that even after performing with segmentation technique, specialist intervention is necessary. The input parameter optimization was found to be an essential part especially during the computation of superpixels. After scrutinization of the parameters, we can suggest that this is an ideal method. The results obtained through this method can also be used as an input for further research analysis.

Future work has been planned to be executed in order to validate the conclusions made. As a part of that the conclusions at which the authors arrived were formatted and made ready to be published. Optimisation of the input parameters, measurement of the exact volume of the cyst region can be calculated from the results of the current study.

V. ACKNOWLEDGMENT

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