# Segmentation and Analysis of Fibroid from Ultrasound Images

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## ABSTRACT
Over the last few years the Segmentation methods became very popular in image processing and analysis. Fibroid segmentation from Ultrasound Image is a complex problem in the field of medical imaging. Fibroids are Non Cancerous tumors, which grow in Female body. Sonologists use the technique called Ultrasonography, to solve diagnostic problems such as identifying the abnormal tissues or fibroids. They routinely use ultrasound information to develop an image. But images contain noise with maculation that leads to poor image quality. So it is challenge for the Researcher to apply Image Processing Concepts & Efficient algorithms for detecting & extracting the Fibroids from Ultrasound Images. Several methods of segmentation are employed for proper segmentation of images. among all of these methods, Active contour or GVF snake method offers several advantages over other traditional segmentation techniques, because the snake is based on a unique type of external force field called GVF or Gradient Vector Flow, which can start far from the object boundary, continually moving by covering longer range will converge to boundary concavities accurately. So this proposal reflects on the segmentation of the fibroid from the 2D ultrasound images by using different segmentation technique such as GVF Snake method.

## General Terms
Image Processing

## Keywords
Ultrasound Image, Fibroid Segmentation, active contour

## 1. INTRODUCTION
The Image Processing techniques are used efficiently in medical Applications. Many medical instruments are used for diagnosis for example to detect unwanted tissues that grow in human body. One such instrument is ultrasound system, which generates ultrasound images.

### 1.1 Procedure for ultrasound system
- The Ultrasound system is composed of a computer, ultrasound probe consisting of source and receiver, and a display. The system transmits high frequency signals into the body through the probe.
- These signals travel into body, hit the boundary of tissues. Some signals are reflected back, while others travel further to reach tissues and reflected back.
- The reflected signals are received by the computer system through the probe.
- The system determines the distance between tissues to the probe using speed of sound signals in body and also speeds of sound signals in tissues, and calculates time between them.
- The distances and intensities of the echoes between probe and tissues are displayed on the screen by the system, in the form of two-dimensional image.

Fibroids are muscular tumors or malignant tumors that grow in or over the uterus in the female body. Normally these are called as Uterine fibroid or Myoma. They are non cancerous tumors and less harmful, sometimes it causes infertility. Ultrasound imaging (UI) is an imaging technique used in medical field to detect the abnormal tissues, which are present in human body. Due to high resolutions and a large number of image slices Ultrasound Images cannot be examined manually.

So the image processing techniques are used to identify the fibroids from Ultrasound Images. But it is very difficult to segment & extract the fibroid from Ultrasound Images because of poor image quality due to noise with maculation. So a suitable method will be required such as traditional Active Contour method but it has some limitations so instead of doing the segmentation using traditional snake method, this work proposes a unique improved method known as GVF Snake or Active contour for segmentation of the fibroid.

The Applications of snakes are Edge detection, Shape modeling, Segmentation and motion tracking. Section 2 of this paper describes about previous work of the Literature Survey. Section 3 discusses on Methodology of the Proposed Work. Section 4 focuses on Expected Results and Section 5 describes about the Conclusion.

## 2. RELATED WORK
The Researcher has to define the Research problem and study the literature related to his problem and make sure that the work he has undertaken is not the repetition of work which is already done but it is an implementation of new ideas based on related literature. It also helps him to define his problem more specifically. Main aim of research is to contribute something to the society. Research efforts in Image Processing Techniques have been contributed in the development of Medical Sciences and improved the vision of medical images. As Ultrasound images have poor image quality due to speckle noise, Many techniques are available to remove the speckle Noise because it is necessary to remove the Noise, to improve the image quality that will help the researcher to segment the fibroid exactly[1-2] . So many Segmentation algorithms are also available in the Survey. Few of them are Region based, Region Growing, watershed and active contour methods [3-5]. There are many papers available related to the proposed method.

One is "Segmentation of Uterine Fibroid Using Morphology: An automatic approach" was proposed by Jeyalakshmi, T.R. and K.Ramar [6]. In this Paper the author presented segmentation based on mathematical morphology, preprocessing is done using MIC algorithm (Morphological Image Cleaning) and it was fully automatic, as there is no human interventation to provide the seed point for segmentation of the image. "Filtering and Segmentation of a Uterine Fibroid with an Ultrasound Images" was proposed by J. Saranya and S. Malarkhodi [7]. In this paper author used Lee filter to clean the Image and contour method is used to segment the image but contour method has limitation such as poor convergence to boundary concavities when locating object boundaries.

There was another work "Segmentation and Feature Extraction of Ultrasound Images by Modified Level Set Method and chain-vese method using SRAD filter" was proposed by Hemanth Kumar et al [8]. This paper presents 5 different Ultrasound B-mode Images like Kidney, Liver, and Uterus. Here SRAD (Speckle reducing Anisotropic Diffusion) Filter is used to reduce Speckle Noise and segmentation by Level Set & chain-VESE Methods.

Arpana M. Kop and Ravindra Hegadi [9] proposed "Kidney Segmentation from Ultrasound Images using Gradient Vector Flow". This Paper presents traditional snake method that solves the Euler's equation for U shaped object but cannot capture completely the concave region. Whereas when GVF is applied the external forces accurately detect object boundaries within boundary concavity and completely converges the object

"Endoscopic image classification based on active contours without edges" by B. V. Dhandra e.t al10], here author used energy minimization algorithm to segment the images. Results show that abnormal images generate number regions as compared to normal images.

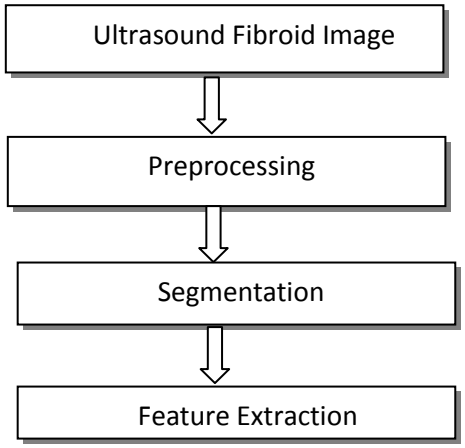
D. Jayadevappa et al [11] proposed "A Hybrid segmentation model based on watershed and gradient vector flow for the detection of brain tumor". In this literature the researcher proposed the watershed method with GVF snake to simplify the computational complexity and improved the insensitivity to noise & capture range.

Many researches have been conducted by using different methodologies on segmentation of parts from Ultrasound Images. Traditional segmentation methods are fast, but do not capture the object accurately. As Ultrasound images contains speckle noise and poor signal to noise ratio due to this Image quality also degraded so suitable method to overcome such difficult is an alternative.

As per review of the literature, till today no researchers has been proposed a segmentation & analysis of fibroid from ultrasound images using GVF snake and also rare work have been done on fibroid ultrasound images so Researcher is interested to propose & implement this method. This Method overcomes the limitations of traditional active contour method. As traditional active contour method has two difficulties first, is likely converge wrong results, second, is progressing into boundary concavities (poor convergence to concavities).

# 3. METHODOLOGY

The proposed method has following stages; Ultrasound Fibroid Image, Preprocessing, Segmentation and Feature extraction.




## 3.1 Ultrasound Fibroid Image

Ultrasound scanned fibroid Image is used as Input.

## 3.2 Preprocessing

Preprocessing is the Process of Noise Reduction. The Noise is acoustic interference (speckle noise) and artifacts which are present in the Images, which degrade the quality of Image.

### *3.2.1 The Sequence of preprocessing steps are as follows -*

- Read the image.
- Crop the unwanted area from the Ultrasound image.
- Remove the noise by using one or more Noise Removal Methods.
- For e.g., Morphological Operation, Filters, Thresholding, Wavelets.

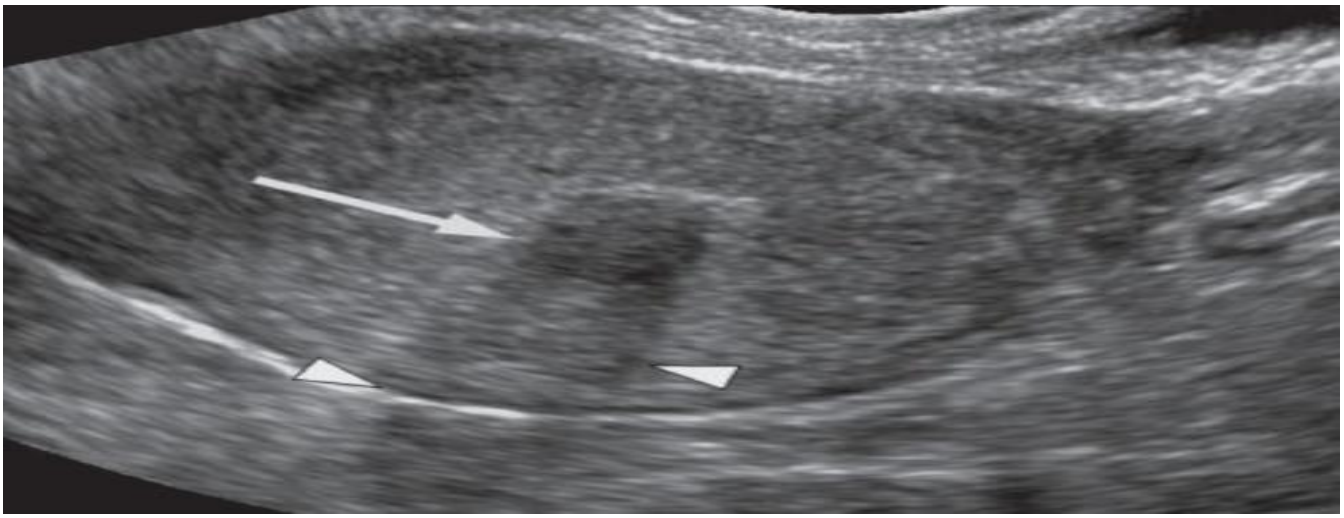


**Fig 2: Original Ultrasound Image**

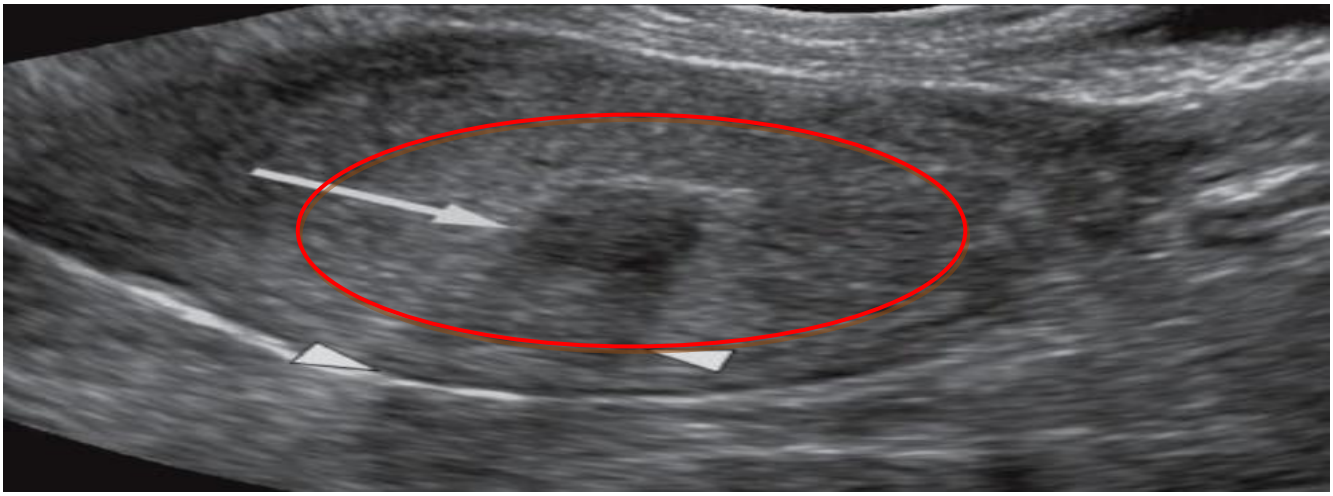


**Fig 3: GVF-Snake starts far from the object.**

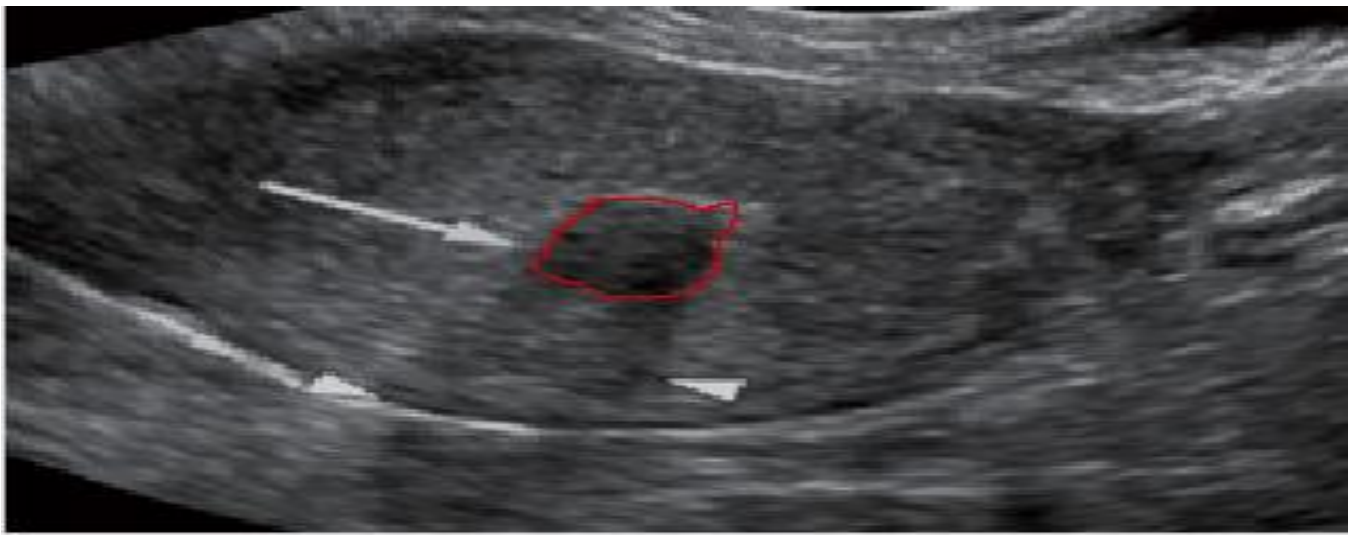


**Fig 4: GVF-Snake capture the object: Segmenting the Fibroid**

## 3.3 Segmentation

Image Segmentation is the first step in image analysis and pattern recognition. Image Segmentation refers to the decomposition of scene into its components.

### *3.3.1 Different methods used in image processing for* Segmentation of fibroids

- Many Image segmentation methods exist, few of them are Region-based approaches, Region growing method, Morphology based approaches, Active Contour or Snake based approaches and Gradient Vector Flow-Snake Approaches.

- The traditional Active Contour or Snake is automatically generated curve in an image to locate the object boundaries or it is a traditional method of capturing the object, i.e. it starts from close to the boundary of object and covers the boundary concavities.

- Among all these methods, Active Contour or GVF Snake Method is more efficient, so we have chosen this method for our proposed work.

### *3.3.2 Demonstration of fibroid segmentation (Refer Figures 2, 3, 4)*

- The disadvantage of the traditional Snake is it cannot completely cover the boundary concavities and cannot capture longer range. So GVF snake is proposed because it can capture longer range and accurately segment the object.

- The GVF Snakes are inherently different from previous snakes. Because GVF snakes have advantages over previous snakes such that these have external force this enables the active contour move into the boundary concavities.

- In proposed method initialization of snake is in all orientation towards the boundary of the object and it does not require prior knowledge about to reduce or expand the object boundary and this is not possible in traditional snake.

- Hence the unique kind of GVF Snake can starts far from the object boundary and capture the object boundary concavities accurately.

- Gradient Vector Flow:
  The GVF is defined to be a vector field
  $V(x, y)= (u(x,y), v(x,y))$.
  $V(x,y)$ is Energy Minimization functional.
  U and v are time derivatives.

## 3.4 Feature Extraction

Measure and Extract the shape based features namely area, diameter, accuracy and other essential measures from Ultrasound Fibroid Images.

# 4. EXPECTED RESULTS

In Literature, Many works has been carried out related to fibroid segmentation. But till today no method is completely efficient to accurately segment the fibroid. So, the robust method, GVF Snake for segmentation of fibroid from Ultrasound Image will be used to improve the Accuracy Rate of Existing Algorithms.

# 5. CONCLUSION

Segmentation and analysis of fibroid from ultrasound image using GVF snake has been proposed. Because GVF Snake is External Force that has large capture range, it starts far from the boundary of the object, iteratively moves towards inside and exactly extracts and segments the region irrespective of any type & shape of the Fibroid object.

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