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AN EFFICIENT LEVEL SET METHOD FOR IMAGE SEGMENTATION

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ABSTRACT

Overhere we introduced diffusion term into level set equation for stability of level set function and iteratively solve equation in two steps for quick and better implementation and get required red results. Hence we named it is named as two step splitting method for image segmentation. First iterating the LSE equation and the second step regularizes the level set function obtained in the first step to ensure stability, and thus re-initialization procedure is completely eliminated from LSE.

KEYWORDS: TSSM,Image processing,LSE.

INTRODUCTION

Image segmentation being most fundamental and difficult problems in image analysis and is an important part in image processing. Looking at today's computer era, image segmentation is a basic component and is the process of partitioning an image into meaningful regions or objects. Image segmentation methods can be categorized on the basis of two properties discontinuity and similarity. The goal of segmentation is to simplify an image with its presentation of an image into something which is more meaningful and easier to analyze . Image segmentation being the core concept of image processing. The main goal of segmentation is to divide an image into parts having strong correlation with areas of interest in the image.

Other practical applications of image segmentation are machine vision, traffic control system; face and finger print recognition and locate objects in satellite images. A visualization image called MRI, image with a detailed internal structure of any object. It provides comparable resolution with far better contrast resolution. It distinguishes itself from other modalities and can be applied for volumetric analysis of muscles, heart and cancer etc. Level set method has been playing a vital role in extracting the contours in an image. The proposed algorithm, with the help of reaction diffusion term helps in easily finding out the contours in an image considering computation cost and time. Firstly, thresholding is applied to the image. The importance of applying thresholding is to ignore the unnecessary parts of the image that is not required for image segmentation. Then applying Gaussians filter to remove the noise from the image. Thereafter applying Level set method to the image and then applying the reaction diffusion to detect the contour from the image.

The level set method (LSM) was introduced by Osher and Sethian [2]. It is a numerical technique that is used to track interfaces and shapes. The main advantage of LSM is anyone can perform numerical computations which includes curves and surfaces on a fixed Cartesian grid and there is no need to parameterize these objects. function Φ, called the level set function with higher dimension. The geometric characteristic and the motion of the front are computed with this level set function [3]. The interface in now represented implicitly as the zero level set for this scalar function. For the rest of the image space, this function is defined as the signed distance function from the zero level set..

MATERIALS AND METHODS

Two Step Splitting Method (TSSM)

A Two step algorithm to implement Diffusion has been proposed in to generate the curvature-dependent motion. In the reaction function is first forced to generate a binary function with values 0 and 1, and then the diffusion function

is applied to the binary function to generate curvature- dependent motion. Different from, where the diffusion function is used to generate curvature-dependent motion, in our proposed LSM, the LSE is driven by the reaction function, i.e., the LSE equation. Therefore, we propose to use the diffusion function to regularize the LSF generated by the reaction function. To this end, we propose the following two step method to solve the equation.

Step 1: Solve the reaction term *till some time* T_r to obtain the intermediate solution, denoted by $\varphi n+1/2 = \varphi^n$;

Step 2: Solve the diffusion term $\varphi t = \varepsilon \Delta \varphi$, $\varphi(x,t=0) = \varphi n+1/2$ till some time T_d , and then the final level set is $\varphi n+1 = \varphi(x,Td)$.

1.1 Building Block and Workflow of Proposed Approach

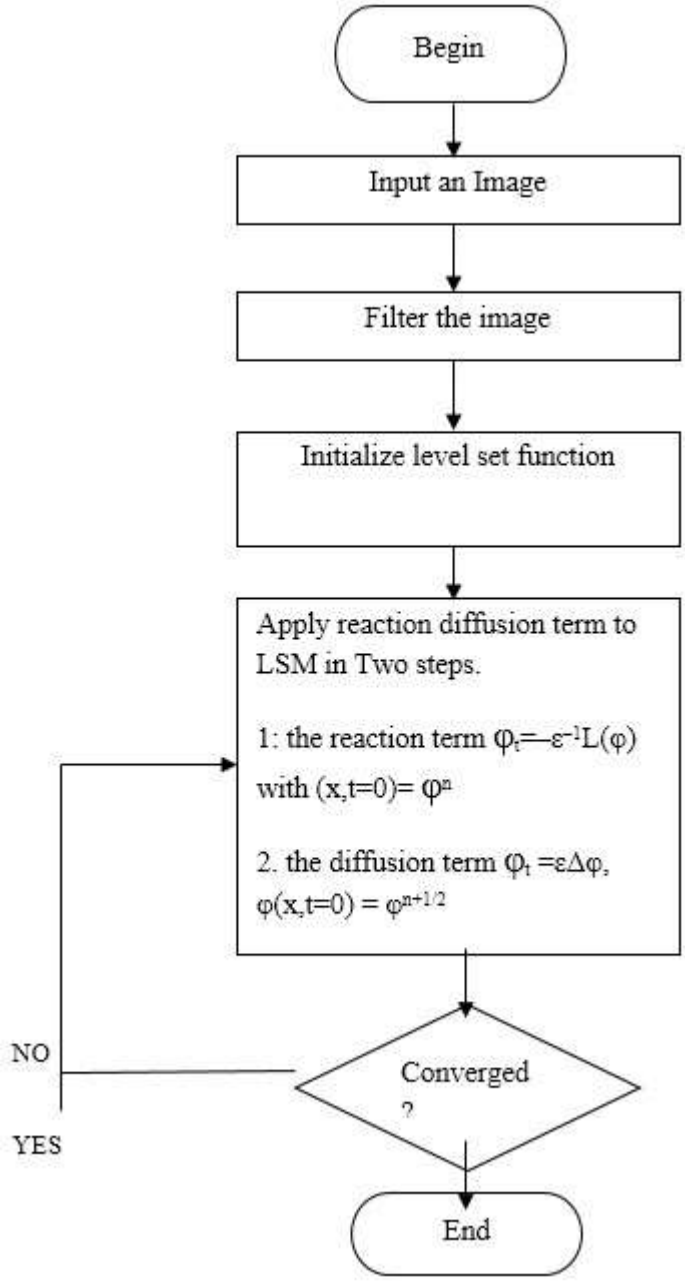

Figure 1.1: Work Flow of Algorithm.

RESULT AND DISCUSSION

The result shows that using level set method applying the reaction diffusion equation in the LSF, it shows promising results. The contour can be well detected and there is no need to initialize the level set function.

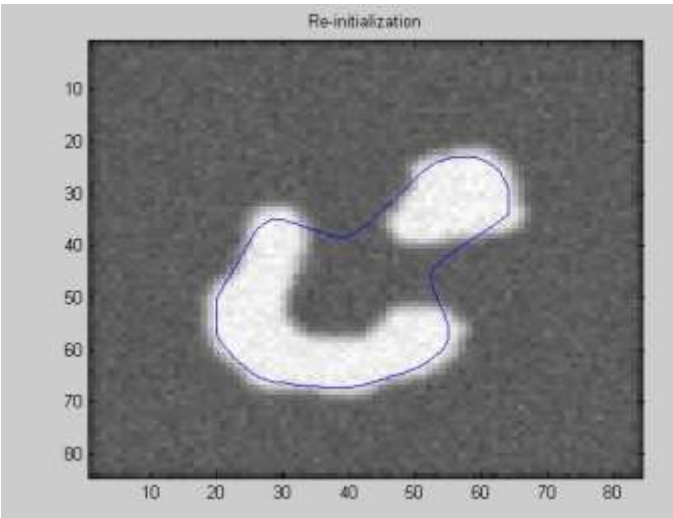

Figure 1.2 : Applying Level set method with Re-initialization on noisy image

On applying the level set method with re-initialization process, the contour is not sill detected finally. The evolution stops after certain number of iterations making the final contour undetected.

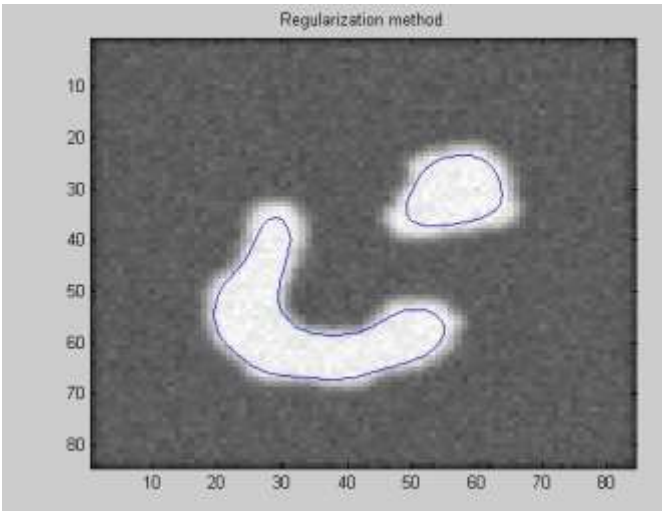

Figure 1.3: Applying Distance Regularization LSM on noisy image

On applying the Distance Regularization Level set evolution, the evolution curve shrinks in the area of interest that is the final contour at which the tumour has to be detected. Also it take many iterations and excessive computation time.

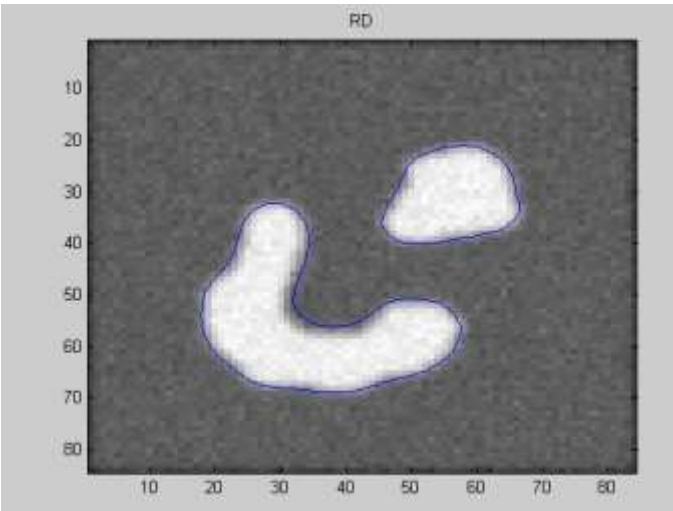

Figure 1.4: Applying level set method with two step splitting method on noisy image

On applying the level set method with the reaction diffusion process, the exact contour is detected and the number of iterations taken to execute the final contour is comparatively less and also the number of iterations as compared to previous methods.

CONCLUSION

The proposed level set method with diffusion is implemented with two step splitting method. Firstly the energy function is implemented for the proposed method. The energy function shows quite good performance as compared to the energy function of previous methods. Also the re-initialization process is omitted in the method leading to level set method free of its re-initialization process. Thereafter implementing the proposed method on noisy image, giving promising results in less execution time and less number of iterations. Thereafter the same was performed on high dimensional images giving again the same promising results.

The future aspect of the proposed method will be to make the method more robust and making it performs on live images taken from a video frame.

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