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Role of Active Contour in Image Processing

Manjeet Kaur[1], Sukhpreet Kaur[2]

[1, 2]Department of Computer Science, Shaheed Udham Singh College of Engineering & Technology, Tangori, Punjab, India

Abstract: ***With the growing research on image segmentation, it has become important to provide readers with an overview of the existing segmentation techniques. The active contour is one of the most successful models in image segmentation. Active contours are used extensively in computer vision and digital image processing to locate object boundaries. It consists of evolving a contour in images toward the boundaries of objects. Its success is based on strong mathematical properties and efficient numerical schemes based on the level set method. In this paper, we review and classify active contour models in literature.***

Keywords: Segmentation, Image Processing, Active Contour

1. Introduction

Image processing is a rapidly emergent area of computer science. Its growth has been uplifted by technological achievements in digital imaging, computer processors and mass storage devices. The flexibility and affordability of various streams are now made path to digital systems. Examples are medicine, remote sensing and security monitoring etc.., and the other sources also produce huge amount of digital image data day to day, which cannot ever be examined manually. Digital image processing is concerned primarily to extract useful information from images. Ideally, this is done by computers, with little or no human intervention. Image processing algorithms may be placed at three levels. At the lowest level are those techniques which deal directly with the raw, possibly noisy pixel values, with denoising and edge detection being good examples. In the middle are algorithms which utilize low level results for further means, such as segmentation and edge linking. At the highest level are those methods which attempt to extract semantic meaning from the information provided by the lower levels [5].

Image Segmentation is technique used to find objects of interest from the background. The object pixels would be black (min intensity) and background pixels white (max intensity). Segmentation refers to the process of partitioning a digital image into multiple segments . The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze.

Active contour or Snake model is an extensively-used method in image segmentation and target detection, a bordering method based on partial gradient. Firstly, an initial contour is placed near the interesting object via users or other automatic processes, and the contour will be changed by the internal and external energy. The external energy guides the active contour to move towards the border of the object while the internal energy helps maintain the smoothing and topology of the active contour. When the energy reaches its minimum degree, the active contour will shrink to the border of the object to be detected. But the active contour model is always sensitive to the noise. More importantly, the result produced thereupon usually relies on the initiation and lacks enough topology adaptation [5].

2. Related Work

There is much research work in the field of object detection over the past decades. Some of the work done has been discussed. Ch. Sri Veera Sagar et al. proposed a new methodology for the edge detection of complex radar images. It includes the edge improvisation algorithm with edge detection. The use of discrete wavelet transform in the edge improvisation algorithm is justified. Then region based active contour model is used as edge detection algorithm. They used distribution fitting energy with a level set function and neighborhood means and variances as variables. Results show the accuracy of the proposed scheme using different images [5]. B. Wang et al. proposed a algorithm based on background modeling and active contour model for moving object edge detection. It uses the background modeling to complete moving object detection, then it uses quad-tree decomposition method to contain the corresponding to the foreground image, through the data distribution density of the sparse matrix, it calculates the seed points corresponding to the regions which are containing the moving object. Results show that the proposed algorithm can effectively obtain the object outlines of multi-moving objects and the edge detection results are close to the judgment of the human visual, parallel contour extraction makes the algorithm has good real-time [1]. B.S Saini et **al.** compared two methods of image segmentation based on level sets i.e edge based and region based active contours. Results show that if iteration is controlled then edge based can able to locate ROI more accurately as compared to other method. Region based either go far beyond cancer periphery or confined within periphery gives false information regarding the spread of cancer in body. Quantitative comparison is also done which shows that edge based is giving far more accurate idea of location and spread of cancer [2]. Bryan Catanzaro et al. examined efficient parallel algorithms for performing image contour detection, with particular attention paid to local image analysis as well as the generalized eigensolver used in Normalized Cuts. The efficiency gains they realized enable high-quality image contour detection on much larger images than previously practical, and the algorithms they proposed are applicable to several image segmentation approaches. Efficient, scalable, yet highly accurate image contour detection will facilitate increased performance in many computer vision applications [3]. Yunyun Yang et al. presented an modified active contour model for fast multiphase image segmentation based on the piecewise

constant Vese-Chan model and the split Bregman method. By applying the globally convex image segmentation technique to the piecewise constant Vese-Chan energy functional, they defined a new biconvex energy functional to guarantee fast convergence. Modified model has been tested with synthetic and real images. Experimental results show that the modified model can obtain similar results to the Vese-Chan model but is much more efficient[18]. Ray, N et al. proposed to minimize a novel region-based energy functional based on Bhattacharya coefficient involving histograms of image features. The optimization of the proposed energy functional simply consists of two very efficient searches if a crude segmentation such as a bounding box around the region of change is sufficient. They illustrated encouraging results on finding bounding box around abnormality from brain MRI, object detection for maritime surveillance, and segmenting oil-sand particles from conveyor belt images [14].

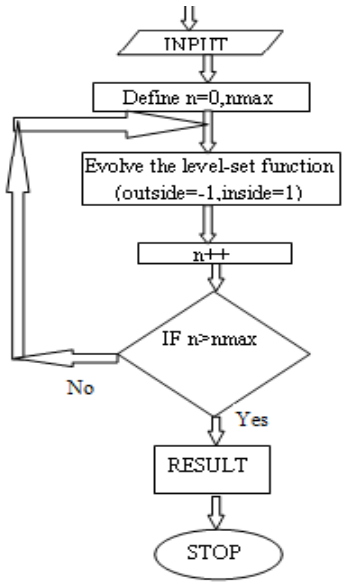
3. Proposed Methodology

This work is related to find out the optimal solution for minimization problem of the active contour and algorithm is given below:

a) Initialization n=0, nmax
b) repeat

- n++
- Compute(c1 , c2)
- Evolving the level-set function (outside = -1, inside = 1)
- out = find(Φ < 0);
- in = find(Φ > 0);
- c1 = sum(Img(in)) / size(in);
- c2 = sum(Img(out)) / size(out);
- for all (x, y)
- fx(x, y) = (Φ (x+1, y)- Φ (x-1, y))/(2*delta_s); where delta_s is between (0.1, 1.0)
- Repeat steps until the solution is stationary, or n>nmax , or The energy is not changing or contour is not moving

3.1 Flow Graph



4. Conclusion

In this study, the overview of Various Active Contour methods applied for image Processing is explained briefly. This study provides a simple guide to those researchers who carried out their research study in image segmentation. As the Active Contour is affected by lots of factors, such as: energy minimization, spatial characteristics of the image continuity, texture, image content. Due to these factors image segmentation is a challenging problem in digital image processing and is still a pending problem in the world.

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