Image Segmentation in the Presence of Intensity in Homogeneities by using Level Set Method with MRI and Satellite Images

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Abstract- This paper proposes a novel region-based method for image segmentation, which is able to deal with intensity inhomogeneities in the segmentation. Intensity inhomogeneity often occurs in real-world images, which presents a considerable challenge in image segmentation. Here we can take both mri images and also satellite images. First, based on the model of images with intensity inhomogeneities, we derive a local intensity clustering property of the image intensities, and define a local clustering criterion function for the image intensities in a neighborhood of each point. This local clustering criterion function is then integrated with respect to the neighborhood center to give a global criterion of image segmentation. Our method has been validated on synthetic images and real images of various modalities, with desirable performance in the presence of intensity inhomogeneities. Experiments show that our method is more robust to initialization, faster and more accurate than the well-known piecewise smooth model. As an application, our method has been used for segmentation and bias correction of magnetic resonance (MR) images with promising results.

Index Terms:-Bias correction, image segmentation, intensity inhomogeneity,level set, MRI,satellite image.

I. INTRODUCTION

The level set method, originally used as numerical technique for tracking interfaces and shapes, has been increasingly applied to image segmentation in the past decade. In the level set method, contours or surfaces are represented as the zero level set of a higher dimensional function, usually called a level set function.

With the level set representation, the image segmentation problem can be formulated and solved in a principled way based on well-established mathematical theories, including calculus of variations and partial differential equations . An advantage of the level set method is that numerical computations involving curves and surfaces can be performed on a fixed Cartesian grid without having to parameterize these objects. Moreover, the level set method is able to represent contours/surfaces with complex topology and change their topology in a natural way.

Existing level set methods for image segmentation can be categorized into two major classes: region-based models and edge-based models. Region-based models aim to identify each region of interest by using a certain region descriptor to guide the motion of the active contour. However, it is very difficult to define a region descriptor for images with intensity inhomogeneities. Most of region-based models are based on the assumption of intensity homogeneity.

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A typical example is piecewise constant models proposed in level set methods are proposed based on a general piecewise smooth formulation originally proposed by Mumford and Shah .These methods do not assume homogeneity of image intensities, and therefore are able to segment images with intensity inhomogeneities. However, these methods are computationally too expensive and are quite sensitive to the initialization of the contour, which greatly limits their utilities. Edge-based models use edge information for image segmentation. These models do not assume homogeneity of image intensities, and thus can be applied to images with intensity inhomogeneities. However, this type of methods are in general quite sensitive to the initial conditions and often suffer from serious boundary leakage problems in images with weak object boundaries.

II. IMAGE SEGMENTATION:

In computer vision, 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. Image segmentation is typically used to locate objects and boundaries in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics.

The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristics.

- Thresholding
- Edge finding
- Binary mathematical morphology
- Gray-value mathematical morphology

In the analysis of the objects in images it is essential that we can distinguish between the objects of interest and "the rest." This latter group is also referred to as the background. The techniques that are used to find the objects of interest are usually referred to as segmentation techniques - segmenting the foreground from background. In this section we will two of the most common techniques thresholding and edge finding and we will present techniques for improving the quality of the segmentation result. It is important to understand that:

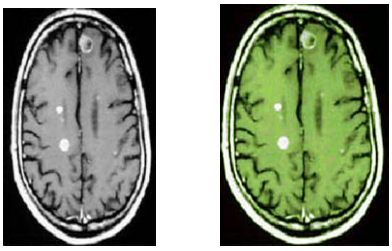
1. There is no universally applicable segmentation technique that will work for all images, and,
2. No segmentation technique is perfect.

III. PROJECT DESCRIPTION:

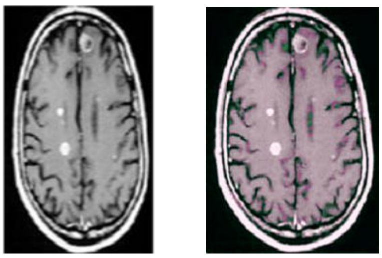
In this project,we are taking both magnetic resonance images and satellite images.first we are taking magnetic resonance image,In mri image,we will use k-means clustering algorithm. k-means clustering is a method of cluster analysis which aims to partition *n* observations into *k* clusters in which each observation belongs to the cluster with the nearest mean. This results in a partitioning of the data space into Voronoi cells. This algorithm tends to find clusters of comparable spatial extent, while the expectation-maximization mechanism allows clusters to have different shapes.Next we can take satellite images,in this satellite images use cannys edge detection algorithm to detect the edges in the image. The level set method was developed in the 1980s by the American mathematicians Stanley Osher and James Sethian. It has become popular in many disciplines, such as image processing, computer. graphics, computational geometry, optimization, and computational fluid dynamics. A number of level set data structures have been developed to facilitate the use of the level set method in computer applications. The level set method, originally used as numerical technique for tracking interfaces and shapes , has been increasingly applied to image segmentation.

IV. K-MEANS CLUSTERING ALGORITHM:

In data mining, *k*-means clustering is a method of cluster analysis which aims to partition *n* observations into *k* clusters in which each observation belongs to the cluster with the nearest mean. This results in a partitioning of the data space into Voronoi cells. The term "*k*-means" was first used by James MacQueen in 1967, though the idea goes back to Hugo Steinhaus in 1957.The standard algorithm was first proposed by Stuart Lloyd in 1957 as a technique for pulse-code modulation, though it wasn't published until 1982.



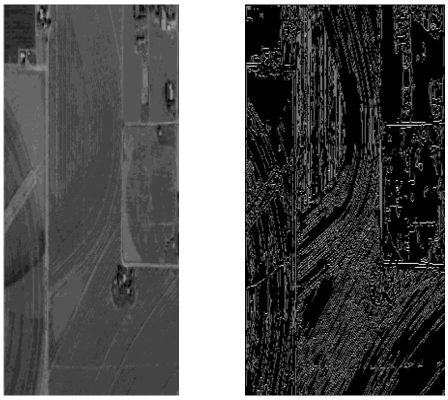
k-means clustering algorithm is used to find the colour information and clustering information. this algorithm is better useful than other clustering algorithms like c-means and h-means algorithms.

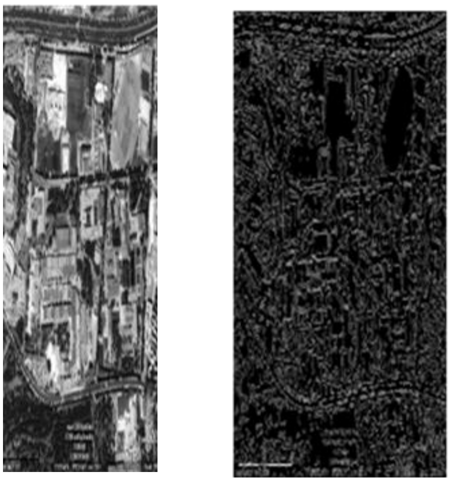


k-means algorithm is also referred to as Lloyd's algorithm, particularly in the computer science community. *k*-means clustering in particular when using heuristics such as Lloyd's algorithm is rather easy to implement and apply even on large data sets. As such, it has been successfully used in various topics, ranging from market segmentation, computervision, geostatistics, and astronomy to agriculture.

V. CANNYS EDGE DETECTION ALGORITHM:

Cannys edge detection algorithm is used to detect the edges in the image. The Canny edge detector is an edge detection operator that uses a multi stage algorithm to detect a wide range of edges in images. It was developed by John F. Canny in 1986. Canny's aim was to discover the optimal edge detection algorithm. In this situation, an "optimal" edge detector means: good detection, good localization, minimal response.





Cannys edge detection algorithm is used to finding the edges in the input image.cannys edge detection algorithm is better useful than other algorithms like sobel,prewitt,laplacian,zero cross,roberts methods. The Canny method finds edges by looking for local maxima of the gradient of I. The gradient is calculated using the derivative of a Gaussian filter. The method uses two thresholds, to detect strong and weak edges, and includes the weak edges in the output only if they are connected to strong edges. This method is therefore less likely than the others to be fooled by noise, and more likely to detect true weak edges.

VI. CONCLUSION

We have presented a variational level set framework for segmentation and bias correction of images with intensity inhomogeneities. Based on a generally accepted model of images with intensity inhomogeneities and a derived local intensity clustering property, we define an energy of the level set functions that represent a partition of the image domain and a bias field that accounts for the intensity inhomogeneity. Segmentation and bias field estimation are therefore jointly performed by minimizing the proposed energy functional. The slowly varying property of the bias field derived from the proposed energy is naturally ensured by the data term in our variational framework, without the need to impose an explicit smoothing term on the bias field. Our method is much more robust to initialization than the piecewise smooth model. Experimental results have demonstrated superior performance of our method in terms of accuracy, efficiency, and robustness. As an application, our method has been applied to MR image segmentation and bias correction with promising results.

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