Performance Evaluation of Image Segmentation Using Fuzzy C Means Clustering

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***Abstract*—The use of image segmentation is to partition an image into meaningful regions with respect to a particular application. The application of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. The result of image segmentation is a set of segments that collectively cover the entire image. Every pixels in a region are similar with respect to some characteristic or computed property, such as color ,intensity..etc. The purpose of clustering is to identify natural groupings of data from a large data set to produce a concise representation of a system's behavior. Fuzzy c-means is a data clustering technique in which a dataset is grouped into n clusters with every data point in the dataset belonging to every cluster to a certain degree.**

***Index Terms*-Image segmentation, fuzzy c means clustering, mutual Information**

I. INTRODUCTION

The use of image segmentation is to cluster pixels into salient image regions, for example: regions corresponding to individual surfaces, objects, or natural parts of objects.

Fuzzy logic is a form of many-valued logic; it deals with reasoning that is approximate rather than fixed and exact. Fuzzy comes from fuzzy logic. FCM algorithm takes high computational complexity, but give much information form an image. The purpose of this paper is to segment the image using fuzzy c means clustering.

Previous work like fuzzy c means using spatial neighbor information &Fuzzy c-means clustering for image segmentation using the adaptive spatially median neighborhood information is done. This paper contribute good image segmentation using fuzzy c means.

II. OVERVIEW OF IMAGE SEGMENTATION

Image segmentation is an initial step in a series of processes aimed at overall image understanding
Applications of image segmentation include:
1) Identifying objects in a scene for object-based measurements such as size and shape
2) Identifying objects in a moving scene for object-based video compression .
3) Identifying objects which are at different distances from a sensor using depth measurements from a laser range finder enabling path planning for a mobile robots .Below represents an example of image segmentation using edge detection technique.

Fig 1. Example of Image Segmentation

Segmentation is used in the field of Medicine like magnetic resonance imaging (MRI). Magnetic resonance imaging (MRI), nuclear magnetic resonance imaging (NMRI), or magnetic resonance tomography (MRT) is a medical imaging technique used to visualize internal structures of the body in detail.Image segmentation is used in Recognition Tasks such as facial recognition ,Finger print recognition, Iris recognition.

Issues related to image segmentation include:

1)Segmentation of nontrivial images is very difficult task.
2)Segmentation should not be processed when objects of interest in an application have been isolated.
3)Start with a set of seed points & from this grow regions by appending to each seed points those neighbouring pixels that have similar property. Seed point selection based on same gray level or pixels evenly spaced on a grid.
4)Seed selection is a problem.

III. TECHNIQUE OF IMAGE SEGMENTATION

Below presents different technique of image segmentation.
1) Edge based image segmentation technique
2) Quadtree technique
3)Fuzzy c means clustering technique
We will describe these technique one by one.
1)Edge based image segmentation technique:
First step, the canny edge detector is used to process the two parameter images and then the derived edges are added to derive the final edge detection results.Edge detection is the come from a set of mathematical methods which aim at identifying points in a digital image at which the image brightnesschanges sharply or has discontinuities. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed edges.
2)Quadtree technique:
The Quadtree structure allows to divide an image within a complete tree representation, including neighboring information. This spatial information can be further used bya merging strategy,which joins the Quadtree leaves using color and edge information.
3)Fuzzy c means clustering technique:
The use of clustering is to identify naturalgroupings of data from a large data set to produce a conciserepresentation of a system's behavior. Fuzzy c-means (fcm) is a data clustering method in which a dataset is groupedinto n clusters with every datapoint in the dataset belongingto every cluster to a certain degree.

IVCLUSTERING TECHNIQUE

Clustering algorithms may be classified as listed below:
1) Exclusive Clustering
2)Overlapping Clustering
In the first case data are grouped in an exclusive way, so that if a certain datum belongs to a definite cluster then it could not be included in another cluster. The second type, the overlapping clustering, uses fuzzy sets to cluster data, so that each point may belong to two or more clusters with different degrees of membership. K-means is an exclusive clustering algorithm, Fuzzy C-means is an overlapping clustering algorithm

- K-means clustering

It is an iterative technique that is used to partition an image into K clusters. K-means is one of the simplest algorithms that solve the well known clustering problem.

- C-means clustering

In K means clustering, data is divided into distinct clusters, where each data element belongs to exactly one cluster. In fuzzy clustering (also referred to as soft clustering), data elements can belong to more than one cluster, and associated with each element is a set of membership levels. These indicate the strength of the association between that data element and a particular cluster. Fuzzy clustering is a process of assigning these membership levels, and then using them to assign data elements to one or more clusters. The FCM algorithm attempts to partition a finite collection of n elements X = {x1,...,xn} into a collection of c fuzzy clusters with respect to some given criterion

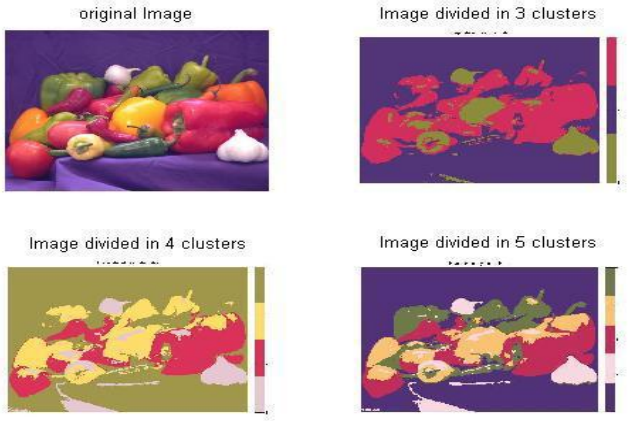

Fig 2 K means clustering

Fig 3 C means clustering

VQUANTITATIVE MEASURE

1)Mutual Information:

The mutual information of two random variables is a measure of the variables' mutual dependence. The most common unit of measurement of mutual information is the bit.Below table shows less value for fuzzy c means clustering which is mosy suited for underwater imagees.

UNDERWATER IMAGE	DIFFERENT ALOGRITHMS BASED ON MUTUAL INFORMATION		
	FUZZY C MEANS	***QUADTREE***	***EDGE DETECTION***
UNDERWATER TITANIC IMAGE	0.17	0.24	0.68

TABLE I. Comparison of different algorithms for underwater Images based on mutual information

VICONCLUSION

After evalution we can conclude that Fuzzy C means clustering method give less value for mutual information which is well suited for image segmentation.

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