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An approach for image segmentation using fuzzy C-mean clustering

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Abstract
Segmentation was used to identify the object of image that we are interested. We have three approaches to do it. The first is Edge detection. The second is to use threshold. The third is the region-based segmentation. It does not mean that these three of that method can solve all of the problems that we met, but these approaches are the basic methods in segmentation. Fuzzy c-means (FCM) algorithms with spatial constraints (FCM_S) have been proven effective for image segmentation. In this paper, by incorporating local spatial and gray information together, a novel fast and robust FCM framework for image segmentation, i.e. Fast Generalized Fuzzy c-means clustering algorithms (FGFCM), is proposed. FGFCM can mitigate the disadvantages of FCM_S and at the same time enhances the clustering performance. Furthermore, FGFCM not only includes many existing algorithms, such as fast FCM and Enhanced FCM as its special cases, but also can derive other new algorithms such as FGFCM_S1 and FGFCM_S2 proposed in the rest of this paper. The major characteristics of FGFCM are: 1) to use a new factor Sij as a local (both spatial and gray) similarity measure aiming to guarantee both noise-immunity and detail-preserving for image, and meanwhile remove the empirically-adjusted parameter α; 2) fast clustering or segmenting image, the segmenting time is only dependent on the number of the gray levels q rather than the size N (>>q) of the image, and consequently its computational complexity is reduced from O(NcI1) to O(qcI2), where c is the number of the clusters, I1 and I2 (<I1, generally) are the numbers of iterations respectively in the standard FCM and our proposed fast segmentation method. The experiments on the synthetic and real-world images show that FGFCM algorithm is effective and efficient.

Keywords: FCM, FGFCM, FCM_S, SEGMENTATION, MATLAB

Introduction
There are many definitions: Segmentation subdivides an image into its constituent regions or objects (Gonzales, pp567).Segmentation is a process of grouping together pixels that have similar attributes (Efford, pp250).Image Segmentation is the process of partitioning an image into non-intersecting regions such that each region is homogeneous and the union of no two adjacent regions is homogeneous (Pal, pp1277) Segmentation is typically associated with **pattern recognition** problems. It is considered the first phase of a pattern recognition process and is sometimes also referred to as **object isolation.**
When we say w e ”extract “ an object in an image, we mean that we identify the opixels that make it up. To express this information, we create an array of the same size as the original image and we give to each pixel a **label.** All pixels that make up the object are given the same label. The label is usually a number, but it could be anything: a letter, or color. Often label images are also referred to as classified images as they indicate the **class** to which each pixel belongs.

Why segmentation is difficult?
It can be difficult for many reasons:
- Non- uniform illumination
- No control of the environment
- Inadequate model of the object of interest
- Noise

Why segmentation is useful?
Segmentation algorithms have been used for a variety of applications. Some examples are:
•Optical character recognition (OCR)
•Automatic Target Acquisition
•Colorization of Motion Pictures
•Detection and measurement of bone, tissue, etc, in medical images.

Segmentation techniques can be classified as either contextual or non-contextual.

Non-contextual techniques ignore the relationships that exist between features in an image; pixels are simply grouped together on the basis of some global attribute, such as grey level.

Contextual techniques, additionally exploit the relationships between image features. Thus, a contextual technique might group together pixels that have similar grey levels and are close to one another.
A simple non-contextual technique is named Thresholding

2. Proposed Work

Fuzzy c-mean Technique for Image Segmentation

The images produced by MRI scans are usually gray images with intensity in the range 0-255. The GM of the brain consists of the cortex that lines the external surface of the brain and the gray nuclei deep inside of the brain, including the thalami and basal ganglia. WM is comprised of the neuronal axons that interconnect different regions of the brain and serve as the interface between the brain and the rest of the body. The watery fluid, CSF acts as a cushion for physical shocks. The WM constitutes a connected region that is bordered by GM and CSF as shown in Fig.1. In Fig.1, for the display purpose WM is shown in gray color, GM as white color and CSF as black color. In MRI of head scans, the picture of organ is usually surrounded by air particles, known as background (bck) in order to make a matrix representation.

Fuzzy C-Means (FCM)

FCM partitions a set of n objects x {x, x,..., xn} in Rd dimensional space into c(1 < c < n) fuzzy clusters with y = {y1, y2, y3,..., yc} cluster centers or centroids [6]. The fuzzy clustering of objects is described by a fuzzy matrix μ with n rows and c columns in which n is the number of data objects and c in the number of clusters. μij, the element in the ith row and jth column in μ, indicates the degree of association or membership function of the ith object with the jth cluster. The objective function of FCM algorithm is to minimize the following equation.

$$J_m = \sum_{j=1}^{c} \sum_{i=1}^{n} u_{ij}^m d_{ij}$$

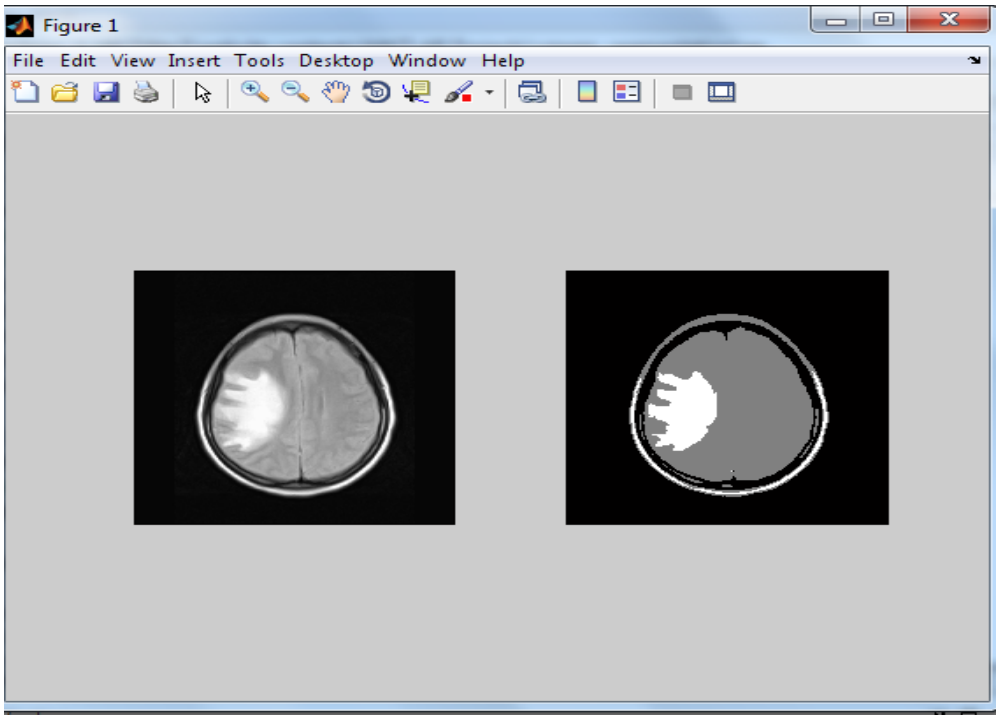
where

$$d_{ij} = \left\| x_i - y_j \right\|$$

In this servey there are various latest techniques used in image segmentation which are very useful in medical field for diagnosis of a problem.m(m > 1) is a scalar termed as weighting exponent. M controls the fuzziness of the resulting clusters and dij is the Euclidian distance from object i x to the cluster center y j.
The yj, centroid of the jth cluster, is obtained as:

$$y_j = \frac{\sum_{i=1}^{n} u_{ij}^m x_i}{\sum_{i=1}^{n} u_{ij}^m}$$

3. Simulation Results



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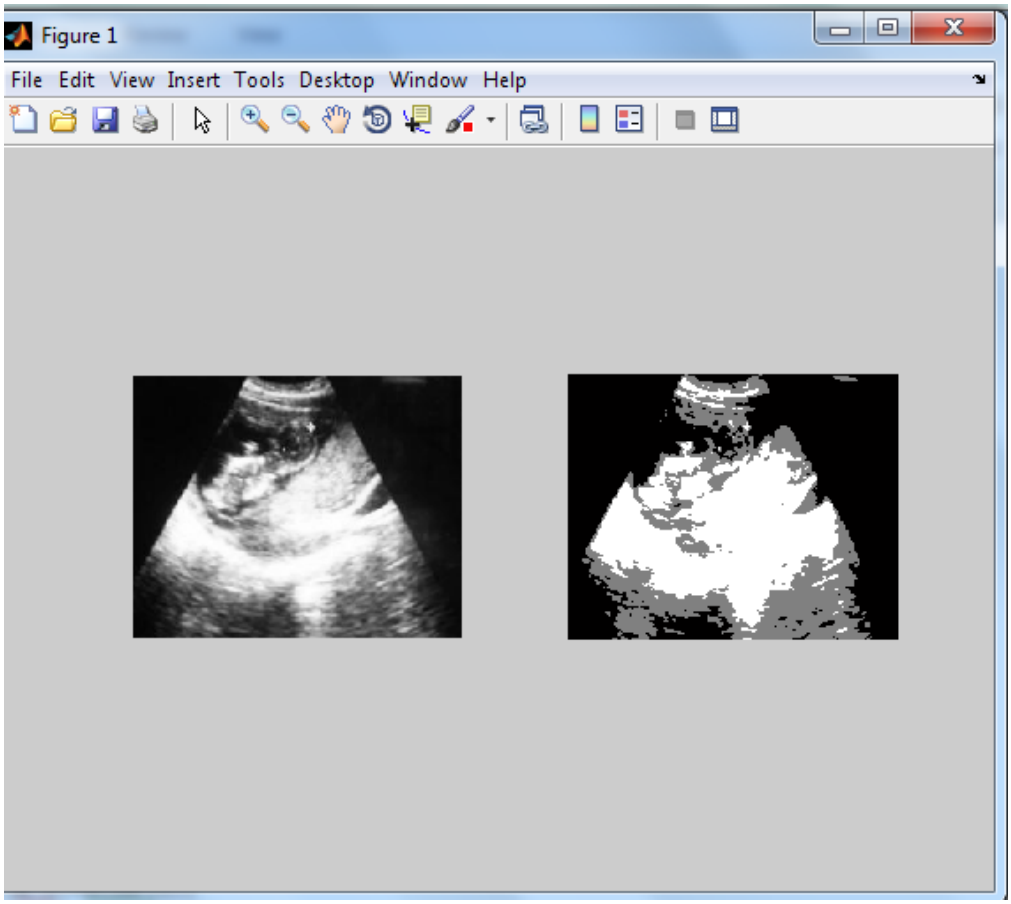

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4. Conclusion

Segmentation is an important step in advance image analysis and computer vision and therefore is an ongoing research area although a dense literature is available. The incorporation of spatial information in to the objective function of standard FCM yields successful results for robust and effective image segmentation of noisy images & techniques like DOF (depth of field) be applied to segment colored images.The techniques reviewed in this survey are applicable to analysis of MRI images and in future can be applied to other medical image types like CT and PET for better analysis. Furthermore in future a hybrid technique based on clustering algorithms and classifiers like Neural Networks and etc can be combined to work on input data set for better results and previously designed algorithm can be modified to work for color image segmentation.

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