An Approach on Edge Detection in Images Using Fuzzy C Means Clustering Method

R.Dhivya¹, R.Prakash², R.Thilepa³

¹Assistant Professor/ECE, Kingston Engineering College, Vellore
²Professor & Head/EEE, Vivekananda College of Engineering for Women, Tiruchengode
³Professor/EEE, Priyadarshini Engineering College, Vaniyambadi

Abstract: Edge Detection is a novel approach in Image processing step. In many procedures during this detection process noise occurrence results in change of quality in images. In this paper a different approach is proposed for Edge detection using Fuzzy C means clustering method with different values of pixels in images. This process exhibits ample resistance to the noise comparatively to other existing approaches. The numerical output values obtained has led to the implementation of the proposed Fuzzy C Means Clustering Approach in Edge detection. The main feature of this method is that the number of clusters can be identified in the assumed dataset.

Keywords: Edge Detection, Fuzzy C Means, Data sets, Clustering, Image Segmentation.

Introduction:

Edge Detection plays a vital role in many fields such as Image Processing, Pattern Recognition, Machine vision, especially in the areas of feature extraction and feature detection. By Edge detection features in an image can be determined clearly. Clustering is a process for classifying objects or patterns in such a way that samples of the same group are more similar to one another than samples belonging to different groups [2,5].

The conventional hard clustering method restricts each point of the data set to exclusively just one cluster. Fuzzy clustering is a soft approach that has been widely studied and successfully applied in image processing for edge detection [3]. Among the fuzzy clustering methods, fuzzy c-means (FCM) algorithm is the most popular method used in image segmentation because it has robust characteristics for ambiguity and can retain much more information than other conventional methods [1].

Although the conventional algorithms works well on most noise-free images, it has several limitations that it does not incorporate any information about spatial context, which cause it to be sensitive to noise and imaging artifacts [4]. Edge Detection reduces the amount of data and filters the unwanted information. This Fuzzy C means algorithm is a simple and typical algorithm which is widely used in the field of science and major engineering applications.

Literature Review:

Different approaches have been proposed in Edge Detection. Tolias et al. proposed a fuzzy rule-based scheme called the rule-based neighborhood enhancement system to impose spatial continuity by post-processing on the clustering results obtained using FCM algorithm.

In their approach, spatial constraint is imposed in fuzzy clustering by incorporating the multi-resolution information. Noordam et al. proposed a Geometrically Guided FCM (GG-FCM) Algorithm based on a semi-supervised FCM technique for multivariate image segmentation [6]. In their work, the condition of each pixel is determined by the membership. Image values of surrounding neighboring pixels and then is either added to or subtracted from the cluster. Recently, some approaches were proposed for increasing the robustness of FCM to noise by directly modifying the objective function [7].

Later, Zhang et al. incorporated a regularization term into a kernel-based fuzzy clustering algorithm. More recently, Li et al. incorporated this regularization term into the adaptive FCM (AFCM) algorithm to overcome the noise sensitivity of ACFM algorithm [8]. Although the latter two methods are claimed to be more robust to noise, they show considerable computational complexity.

Experimental results and comparisons with many reviews prove that on a variety of images show the proposed algorithm is effective and robust.
Methodology of proposed Work:

Figure 1: Methodology of Proposed Work

Fuzzy C-Means Clustering Method:

The Fuzzy C-Means (FCM) clustering method was first introduced by Dunn and later was extended by Bedeck. The algorithm is an iterative clustering method that produces an optimal c partition by minimizing the weighted within group sum of squared error objective function.

Fuzzy C means clustering approach is given by the following process,

\[
\text{FCM} = \sum_{i=1}^{a} \sum_{j=1}^{b} (U_{xj}) z (Y_{xi} V_{i}) \quad \text{(1)}
\]

Here X represents X={x1, x2, x3..... xn} and Ui is the membership of the function Ui for i\textsuperscript{th} cluster and Vi represents the centre of the cluster value represents the weightage of the cluster and (Y_{xi}, V_{i}) denoting the distance between the object and the cluster centre.

The algorithm is carried out in following steps,

Step 1:
Assign the values for z, b and other variables.
Step 2:
Initialize the Fuzzy matrix Z.
Step 3:
Set the loop counter and calculate the cluster centre values by,

\[
(V_{i}) = \sum_{k=1}^{a} (U_{ik}) m C V \sum_{k=1}^{a} (U_{ik}) z \quad \text{(2)}
\]

Step 4:
Calculate the membership function for i\textsuperscript{th} member and compute the values.
Step 5:
This procedure is repeated until the required value is obtained in edge detection.

Output Results and Discussions:

The main purpose of choosing these images are it can be easily partitioned by fuzzy c means method. The result of image segmentation was used to obtain effective edges and this improves the boundaries of images [9]. For the same computing proposal the identification time is more comparatively high in other methods and cost utilized for this process is mitigated. By the observation done in this method the boundaries are more accurate and the numerical process, number of steps in iteration to obtain the results is also reduced.

Figure 2: Edge Detected output of Images
Conclusion:

In this paper a different approach for edge detection using Fuzzy C Means Clustering approach is obtained. By this method it is able to incorporate any contextual information and feature space information into the image segmentation [10]. Different images have been taken for analysis to show that the proposed method is efficient, robust to noise and effective and validated. In future this method will be implemented for all types of images especially in medical and remote sensing fields, etc… with advanced features.

References: