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Image Segmentation: Using K-Means Algorithm and Threshold Method

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Abstract: Segmenting an image is the action of separating an image into various segments. Image Segmentation playscrucial role in computer perception it is used for object tracking and to analyze image boundaries. There are many techniqueswhich can be used for segmenting an image but the well-knowntechnique is K-Means clustering algorithm. The major purpose of K-Means clustering algorithm is of separating the image in K segments and to deleteunwanted region from the image.This paper explains about K-Means clustering algorithm and Thresholding technique for segmenting an image which produces better result.

Keywords: *Image segmentation, segments, K-Means clustering, thresholding.*

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I. INTRODUCTION

The image segmentation is one of the most efficient techniques in the field of digital image processing technology. Image processing is an action to convert an image into digital form and perform some operations on it, in order to get a better image or to get some useful data from it. Image is duplication of object.K-Mean clustering algorithm is used for large number of variables. Clustering is grouping of data or splitting a large dataset into smaller datasets of some similarity. One of most used clustering algorithm is k-means clustering. It is simple and computationally faster than the hierarchical clustering. But it produces different cluster result for different number of cluster. So it is required to initialize the proper number of number of cluster, k2. Again, it is required to initialize the k number of centroid. Different value of initial centroid would result different cluster. So selection of proper initial centroid is also an important task [1].

II. LITERATURE REVIEW

Many researchers are trying to develop new techniques which are more efficient than the existing methods, and shows better result. Some of the existing recent works are reviewed here.

H.P. Ng, S.H. Ong, K.W.C. Foong, P.S. Goh, W.L. Nowinski- 2006[2] proposed a methodology that incorporates k-means and improved watershed segmentation algorithm for medical image segmentation. By comparing the number of partitions in the segmentation maps of 50 images, they showed that their proposed methodology produced segmentation maps which have 92% fewer partitions than the segmentation maps produced by the conventional watershed algorithm.

Piyush M. Patel, Brijesh N Shah, Vandana Shah-2013[3] K-mean clustering for finding tumor in medical application which could be applied on general images and/or specific images (i.e., medical and microscopic images), captured using MRI, CT scan, etc. The algorithm employs the concepts of fuzziness and belongingness to provide a better and more adaptive clustering process as compared to several conventional clustering algorithms.

Juilee Anil Katkar, Trupti Baraskar-2015[4] proposed principle component Analysis to find the number of precise cluster and then they have used k-means algorithm for segmentation which is efficient method.

Nameirakpam Dhanachandra, Khumanthem Manglem and Yambem Jina Chanu-2015[1] proposed k-means clustering algorithm and subtractive clustering algorithm then finally a median filter(Median filtering is used as a noise removal in order to obtain a noise free image) is used to segment the image and remove the unwanted region from the image.

Preeti Panwar, Girdhar Gopal, Rakesh Kumar-2016[5] the comparison of two algorithms are done for several images and the results are produced. According to this paper k-means algorithm is efficient than thresholding method.

III. PROPOSED METHOD

The proposed method consists of k-means clustering algorithm. Using the k-means algorithm, the image is segmented into k number of cluster. First select k clusters and find the centroids. Calculate the distance of all data points to centroid and group the data item in appropriate cluster. And then the clustered image is applied into the thresholding technique for further segmentation.

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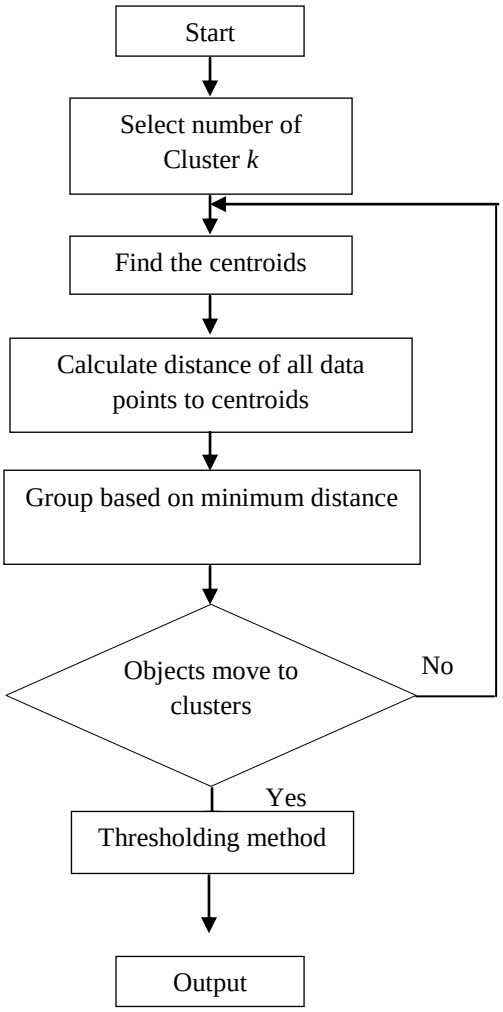


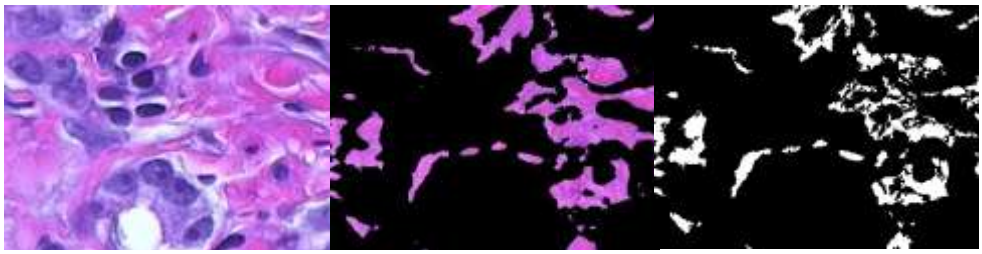
Fig.1 Process in k-means clustering algorithm and Thresholding Method

A. Thresholding

Image Thresholding is used for separating an image into a foreground and background. This image analysis technique is a type of image segmentation that separates objects by transforming grayscale images into binary images. Image thresholding is fundamentalmethod for image processing and pattern recognition.

IV. EXPERIMENTAL RESULT

According to the given methodology, the input image is segmented using k-means algorithm and then that segmented image is used in thresholding technique for further segmentation but the output image will be a gray scale image, because in thresholding technique the color image will be converted to gray image.



(a) (b) (c)

Fig. 2. K-means clustering and thresholding method (a) Original image (b) Image after applyingk-means clustering algorithm (c) Image after applying thresholding technique

V. PERFORMANCE ANALYSIS

The performance of this proposed techniques is measured by using segmentation parameters: Mean Square Error (MSE), Peak Signal-NoiseRatio (PSNR).

1. The mean squared error (MSE) or mean squared deviation (MSD) of an estimator measures the average of the squares of the errors or deviations that is, the difference between the estimator and what is estimated. The MSE is a measure of the quality of an estimator it is always non-negative, and values closer to zero are better[6].

$$MSE = \frac{1}{mn}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j) - K(i,j)]^2 \qquad (1)$$

2. Peak signal to noise ratio (PSNR) term for ratio between the maximum possible power of a signal and the power of corrupting noise that affects the fidelity of its representation. Because many signals have an extremely large dynamic range. PSNR is commonly used as measure of quality reconstruction of image. High value of PSNR indicates the high quality of image. PSNR is usually expressed in terms of the logarithmic scale [7].

$$PSNR = 10log_{10}\frac{max_I^2}{MSE} \qquad (2)$$

Table 1. Comparison of different images with MSE and PSNR values

Image	PSNR (k-means)	MSE (k-means)	PSNR (proposed method)	MSE (proposed method)
Data set image1	34.63	0.0081	35.24	0.0078
Data set image2	32.44	0.0144	33.94	0.0139

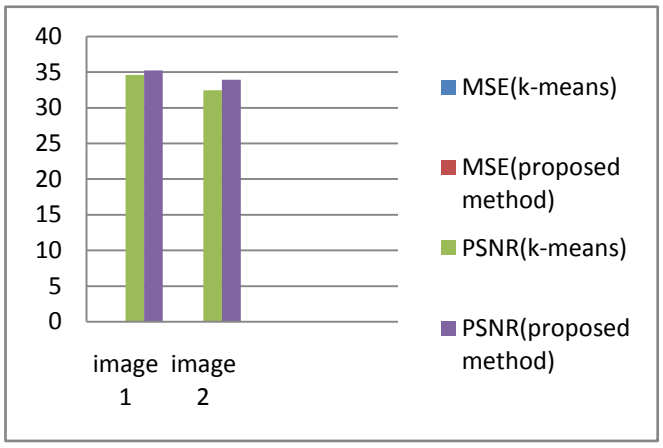


Fig.3 Comparison graph

VI. CONCLUSION

In this paper the image is segmented using k-means clustering algorithm and thresholding. The performance of this proposed method is calculated using the parameters like PSNR and MSE. The proposed method produces better result when compared to other methods. In future, the quality of the image can be improved and also get better performance values. We can also use many other clustering techniques for image segmentation.

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