

Adaptive Pillar K-Mean Approach for Image Segmentation



Engineering

KEYWORDS : - Image segmentation, clustering, k-mean algorithm, Pillar k-mean algorithm, adaptive k-mean algorithm

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ABSTRACT

Image segmentation is the process of partitioning a digital image into multiple segments. Adaptive K-means clustering algorithm is tries to develop K-means algorithm to obtain high performance and efficiency. This segmentation process includes a new mechanism for solves a selection number by determining the number of clusters using datasets from images by frame size and the absolute value between the means. Pillar algorithm segmentation process includes a new mechanism for clustering the elements of high-resolution images in order to improve precision and reduce execution time. The Pillar algorithm considers the pillars' placement which should be located as far as possible from each other to withstand against the pressure distribution of a roof, as identical to the number of centroids amongst the data distribution of image. Our research focus on image segmentation by using adaptive k-mean algorithm and pillar k-mean algorithm. This paper mainly focus on improve the segmentation quality in aspects of precision and execution time. The experimental results clarify the effectiveness of our approach to improve image segmentation quality based on precision and computational time using less iteration.

I. INTRODUCTION

Data mining is the process of extracting the information from a data set and transforming it into an understandable structure for further use. Data mining is primarily used today by companies with a strong consumer focus - financial, retail, communication, and marketing Organizations. While large-scale information technology has been evolving separate transaction and analytical systems, data mining provides link between the two. Clustering is the main part of the data mining. It is the task of assigning a set of objects into groups so that the objects in the same cluster are more similar to each other than to those in other clusters. Clustering algorithms can be categorized based on their cluster model, as hierarchical clustering, centroid-based clustering, distribution-based clustering, density-based clustering etc. Connectivity based clustering, also known as hierarchical clustering, is based on the core idea of the objects being more related to nearby objects than to farther objects. Such that, these algorithms connect "objects", to form "clusters" based on their distance. In centroid-based clustering, clusters are represented by central vector, which may not necessarily be a member of the data set. When the number of clusters is fixed to 'k' cluster, k-means clustering gives a formal definition as an optimization problem: find the k -cluster centers and assign the objects to the nearest cluster center, such that the squared distances from the cluster is minimized. In density-based clustering, the clusters are defined as areas of higher density than the remainder of the data set. Objects in these sparse areas that are required to separate clusters are usually considered to be noise and border points.

II. BACKGROUND AND RELATED WORK

In data mining, k-means clustering is a method of cluster which aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean value. k-means clustering tends to find clusters of comparable spatial extent, while the expectation-maximization mechanism allows clusters to have different shapes of image.

Image segmentation is the process of partitioning of digital image into multiple segments. The goal of segmentation is to simplify and/or change the representation of an image into something that is easier and meaningful to analyze. Image segmentation is used to locate objects and boundaries in images. Application of image segmentation is medical imaging, locate objects in satellite images, face recognition, iris recognition, fingerprint recognition, traffic control systems, brake light detection, machine vision, agricultural imaging – crop disease detection.

Adaption of k-mean algorithm for image segmentation^[6], tries to develop k-means algorithm to obtain high performance and efficiency. This method proposes to solves a selection number of cluster by determining the number of clusters using datasets from images by frame size and the absolute value between the means. Moreover, in order to evaluate the performance of the proposed method, the results of the proposed method and standard k-means and recently modified k-means are compared. The experimental results showed that the proposed method provides better output and increases the speed of the execution process.

Image segmentation using pillar k-mean algorithm^[7], includes a new mechanism for clustering having the elements of high-resolution images in order to improve precision and reduce computational time. The pillar algorithm considers the pillars' placement which should be located as far as possible from each other to withstand against the pressure distribution of the roof, which is here identical to the number of centroids amongst the data distribution. This algorithm is able to optimize the k-means clustering for image segmentation in aspects of precision and computational time. It designates the initial centroids positions by calculating the accumulated distance metric between each data point and all previous centroids, and then selects data points which have the maximum distance as new initial centroids of image. The experimental results clarify to improve the segmentation quality in aspects of precision and computational time.

III. ALGORITHM DESCRIPTION

This section is conducted for image segmentation using Adaptive pillar k-mean clustering algorithm.

Step 1. Read the dataset as a matrix

Read each pixel of input image in the form of matrixes. Here we can input image like,



Step 2. Calculate frame size

Calculate the means of each frame of image depending on the frame size and putting them in the means arrayed.for eg.

- Here we can give frame size as a 7,8,10 etc. and get mean like, 200,267,546,345,500,200 etc.

Step 3. Find number of cluster

1. Sort the means array in an ascending way. for eg.
 - Sorted array of above mean is 200,200,267,345,546,500.
2. Comparing between the current element and the next element in the means array. If they are equal, then keep the current element and remove the next, otherwise, keep both. Repeat above step until the end of the means array.for eg.
 - here in above example 200 is duplicate mean so second 200 will be removing.
3. Count how many elements remain in the means array. These are equal to the number of clusters and their values. From this we can decide number of cluster for k-mean clustering.for eg.
 - So in above example we get no of cluster is 5.

Step 4.Decide initial furthest centroid of cluster using pillar k-mean algorithm

1. Set initial centroid $C=\emptyset$.Already selected in the sequence of process= \emptyset and accumulated distance $DM= []$ where distance of centroid and data is added. Than Calculate distance D of each data and mean value of that particular data.for eg.
 - Here we get distance like 40,30,20,10 etc.
2. Set number of neighbours $nmin = \alpha \cdot n / k$.
3. Assign $dmax \text{ argmax}(D)$.here we have to decide maximum distance of all the data.and that maximum distance assign to $dmax$. For eg.
 - If we have distance from above example like 40, 30, 20, 10.than $dmax=40$.
4. Set neighbourhood boundary $nbdis = \beta \cdot dmax$. And Set $i=1$ as counter to determine the i -th initial centroid.
5. Now we have to add distance matrix D for each iteration into accumulated distance DM. Select Maximum argument of accumulated distance matrix $DM [x_{\text{argmax}(DM)}]$ to the k as the candidate for i th initial centroids.for eg.
 - for above example we have maximum argument as a 40 and suppose pixel value is 28 for distance 40.
6. Add k into Already selected in the sequence of process for further use. Like $SX=SX+ k$. Now Set D as the distance metric for each iteration between each data of X to already selected sequence of process.for eg.
 - here we add 28 as a sequence of process for further use.
7. Set number of data points of $nbdis$ which are less than our equal to Distance matrix D is assign to no. Now Assign accumulated distance matrix $DM (k) =0$.Ex.Distance of 28 is assign to 0.
8. If no is less than to number of neighbour's $nmin$ than Select Maximum argument of accumulated distance matrix $DM [x_{\text{argmax}(DM)}]$ to the k as the candidate for i th initial centroids. Now assign Distance of that Already selected in the sequence of process $SX=0$.
9. Now add k into centroid as a initial centroid.and Increment value of i by 1. If value of i is less than

our equal to k than add distance matrix for each iteration into accumulated distance. Finish in which C is the solution as optimized initial centroids.for eg.

- here we will get our first furthest centroid of one cluster.

Step 5.Create a group of objects

1. Find distance of each data to centroid. Grouping based on maximum distance .Now get new centres of cluster.
2. Calculate new color value for each pixel based on R, G, B values.
3. Checking the condition that if new color value is in range then make the group of pixels with new value or change grouping criteria and then go back to step 2.
4. Apply value of centroid to group of pixels.
5. Re-generate the image in from of image segmentation.

Step 6.Get output in the form of image segmentation.

Image segmentation by using this algorithm gets precise result and faster execution time.

IV. EXPERIMENTAL RESULT

We implemented our algorithm in JAVA on Intel Pentium i3 personal computer with 2 GB RAM on Windows XP service pack 2 OS having 120 GB hard disk.The input dataset are used Berkeley data set. The experimental result is a comparison of image done between Traditional k-mean,Adaptive k-mean, pillar k-mean and proposed method as shown in the figure 1 and comparison of graph done between Traditional k-mean, Adaptive k-mean, pillar k-mean and proposed method as shown in the figure 2. The experimental result shows that our proposed approach for image segmentation is able to improve the precision and enhance the quality of image segmentation with precise result and faster execution time.

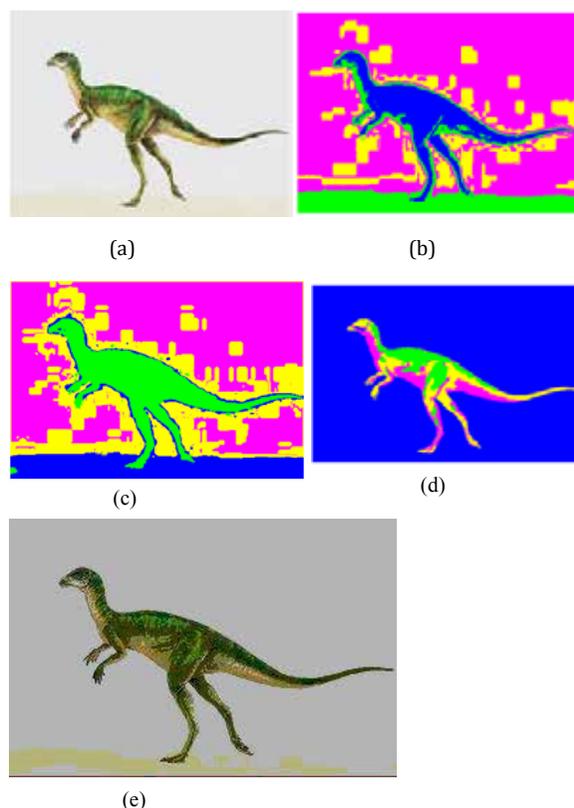


Fig.1 Comparison of image segmentation

(a) Image source (b) k-mean clustering(c) Adaptive k-mean (d) Pillark-mean(e)Adaptive pillar k-mean algorithm

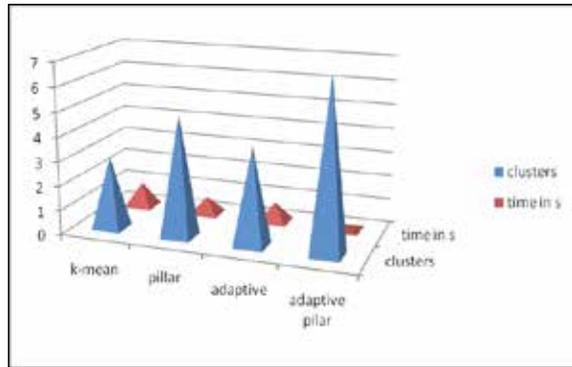


Fig.2 Comparison of time and no of cluster (a) Image source (b) k-mean clustering(c) Adaptive k-mean (d)Pillark-mean(e)Adaptive pillar k-mean algorithm

CONCLUSION

In this paper, we have presented new approach for image segmentation using adaptive pillar k-mean algorithm. The experimental result shows that our proposed approach for image segmentation is able to improve the precision and enhance the quality of image segmentation with precise result and faster execution time.

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