Segmentation using k means clustering

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Abstract

- Digital image processing is the use of computer algorithms to manipulate and analyze digital images. It involves various techniques for improving the quality, enhancing the information content, and extracting useful features from digital images.
- In this poster, we present our research on segmentation using k-means clustering, where we investigate the performance of this technique on different types of images and explore methods for improving its accuracy and efficiency.
- Digital image processing methods can improve the image analysis and they can be used for detecting different features that are not necessarily visible to the human eye

ref.(2)

Introduction

- Image segmentation is an essential task in image processing that involves dividing an image into regions with similar visual characteristics. This process is particularly useful for applications such as object recognition, image compression, and medical imaging.
- K-means clustering is a widely used unsupervised learning algorithm that can be applied to image segmentation by grouping pixels into clusters based on their similarity in intensity values.
- The resulting segmented image is divided into regions that share visual similarities, allowing for easy detection of objects and features of interest.

ref.(3),(2)

- The resulting segmentation can be useful for various applications such as object recognition, tracking, and analysis. And in medical

K means clustering

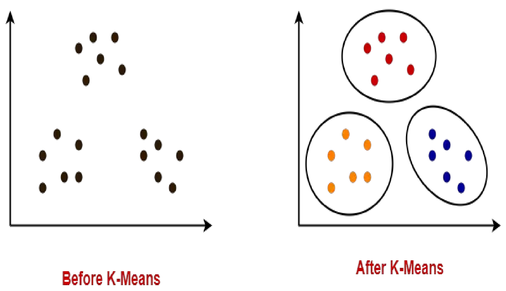
- The k-means algorithm is an iterative algorithm that starts by randomly initializing k cluster centroids. The algorithm then assigns each pixel to the nearest centroid, based on the distance between the pixel's visual features and the centroid's visual features.

ref.(5)

- After assigning all the pixels to the nearest centroid, the algorithm recalculates the centroid's visual features based on the pixels assigned to that centroid.
- Once the k-means algorithm has converged, each pixel is assigned to the cluster with the closest centroid. This results in the image being segmented into k regions, with pixels in each region sharing similar visual characteristics.
- The number of clusters k is a parameter that must be defined before applying the algorithm, and finding the optimal value of k is an important consideration in the segmentation process.

ref.(6)

- Example of K means clustering-



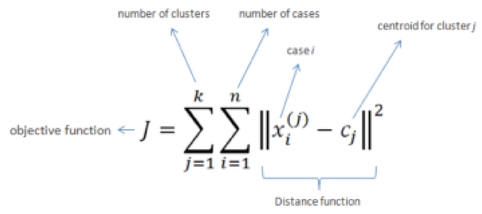
Algorithm And Process

- Steps for how we are achieving cluster approach –

1. Give the no of cluster value as k.
2. Randomly choose the k cluster centers
3. Calculate mean or center of the cluster
4. Calculate the distance between each pixel to each cluster center
5. If the distance is near to the center then move to that cluster.
6. Otherwise move to next cluster.
7. Re-estimate the center. ref.(1)

- In the k-means algorithm initially we have to define the number of clusters k. Then k-cluster center are chosen randomly.
- The number of clusters k is a parameter that must be defined before applying the algorithm, and finding the optimal value of k is an important consideration in the segmentation process.
- Mathematical expression –

for Euclidian distance -



$$J = \sum_{j=1}^{k} \sum_{i=1}^{n} \left\| x_i^{(j)} - c_j \right\|^2$$

ref.(4)

For a given cluster assignment C of the data points, compute the cluster means For a current set of cluster means, assign each observation as

$$S_i^{(t)} = \left\{ x_p : \left\| x_p - m_i^{(t)} \right\|^2 \leq \left\| x_p - m_j^{(t)} \right\|^2 \forall j, 1 \leq j \leq k \right\},$$

ref.(4)

- How this process take palace on a image let's see using block diagram it consists of various process –

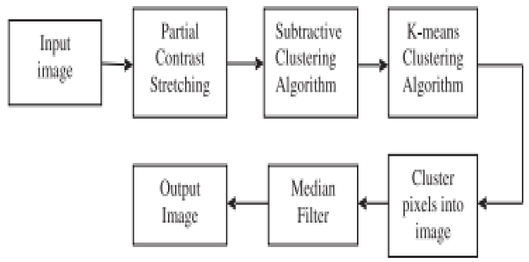


Fig. 2. Block diagram of the proposed algorithm.

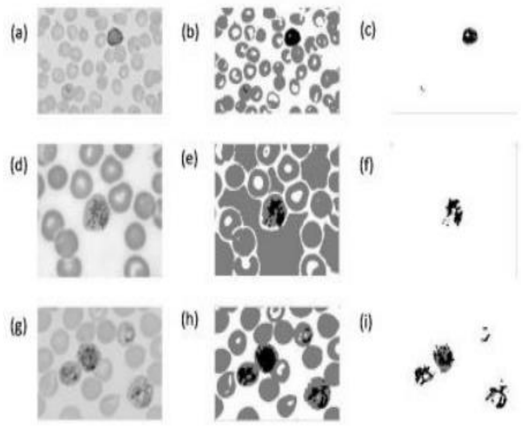
ref.(1)

- Using this we can see importance of segmentation using k means clustering

Results

- Here are results of this method using matlab compilation

here first image is Original image; then K-means algorithm; then individual detection .



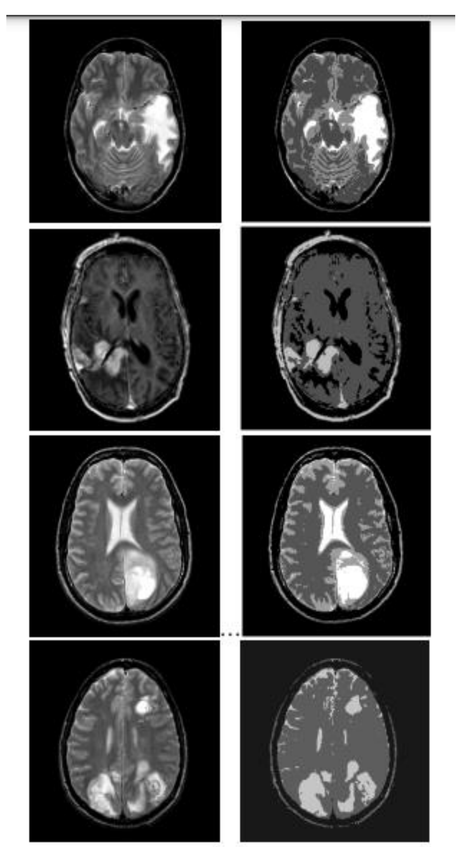


Figure 1. The original and resulting segmented

Application

- In object recognition, segmentation using k-means clustering can be used to isolate an object of interest in an image, making it easier to detect and classify. For example, in autonomous vehicles, k-means clustering can be used to identify pedestrians or other objects on the road, allowing the vehicle to respond appropriately
- In image compression, k-means clustering can be used to reduce the size of an image by grouping similar pixels together and representing them with a single value.
- In medical imaging, segmentation using k-means clustering can be used to identify regions of interest in an image, such as tumors or other anomalies.
- k-means clustering can be used in magnetic resonance imaging (MRI) to segment the brain into different regions for analysis.

ref(4),(5)

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