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# Comparison of k-means Clustering Algorithm with Pixel based Image Segmentation Algorithm

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***Abstract:*** ***In computer vision, image segmentation is always selected as a major research topic by researchers. Due to its vital rule in image processing, there always arises the need of a better image segmentation method. Clustering is an unsupervised study with its application in almost every field of science and engineering. One of most important operations in image analysis is segmentation. Segmentation can be considered as the first step and key issue in object recognition, scene understanding and image understanding. Segmentation separates an image into its component parts or objects. This paper focuses on the comparison between k-means clustering and pixel based segmentation algorithm. Color image segmentation has been the hotspot for the researchers in the image processing field. Color image segmentation using the neural networks, k-means clustering algorithm has yielded fruitful results. An advantage resulting from the choice of color space representation could be taken to enhance the performance of segmentation processes. The amount of information contained in the segmented objects is adopted as a measure to determine the segmentation rule. The experimental results show that the segmented image results are deemed effective.***

***Keywords: Segmentation, k-means clustering, Computer vision, Image processing, Color Image segmentation.***

## I. INTRODUCTION

Image segmentation is the process of partitioning an image into uniform and non-overlapping regions in order to find out meaningful information from the segmented images. These regions can be considered homogeneous according to a given criterion, such as color, motion, texture, etc. Image segmentation is always the researcher's first choice due to its leading rule in image processing research. Colored images have attracted many of the researches for analysis and processing. Much of the progress made in the image processing field in the past years can be attributed to the research on colored images [1]-[7]. Colored images mainly represent the color information of each pixel composing them. Image processing can be said to increase the perception properties of an image, may it be noise removal, enhancement and segmentation, all these features are well attained by the image processing techniques. Image segmentation has been the most important precursors for image processing based applications and has a crucial impact on the overall performance of the developed systems [8]. Image segmentation consists of dividing the input image into several regions having similar pixel properties within a single region. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is mainly used to form a set of segments that collectively cover the entire image. People are only interested in certain parts of the image in the research and application of the image. An advantage resulting from the choice of color space representation could be taken to enhance the performance of processes such as segmentation and feature matching because of the three fold increase in color signal dimension as compared to black and white images.This paper is organized in five sections. Section I and II consists of an introduction and work done on Image segmentation. Block diagram and flowchart of proposed algorithm is discussed in Section III. Section IV discusses the comparison of the proposed algorithm with k-means clustering. Section V gives Conclusion

## II. REVIEW ON PREVIOUS WORK DONE IN THE FIELD

Image segmentation refers to subdividing an image into its constituent regions or objects. Segmentation of image is based on one of the two properties of intensity values. First is discontinuity which means partition based on abrupt changes in intensity e.g. edges in an image. Second is similarity which means partition based on intensity similarity e.g. thresholding [1]. The goal of the image segmentation is to find the certain objects of interest which are depicted in the image. [2] The level to which the separation is carried depends on the problem being solved [3]. Level of segmentation is application dependent e.g. if we are interested in detecting movement of vehicles on a road and an aerial image is taken from satellite or helicopter. In this first step will be to extract the road from the image. Once the roads are identified then go for further analyses so that identification of different vehicles can be done., by doing this motion of vehicle can be analyzed. So it can be said that all subdivisions of an image at the 1st level should stop where we are able to identify the road component, the road component segments and after this subdivision of road component is carried out to identify the vehicles. But the segmentation of vehicle is not done as it is not the area of interest. There are many image segmentation algorithms such as segmentation based on edge detection algorithm, segmentation based on region growing , region

 

splitting and merging , segmentation based on thresholding, based on clustering . [4]. Color image segmentation is widely applied in multimedia analysis [5].For color image segmentation various techniques are used such as: feature-space methods and spatial-domain methods. Feature-space methods, such as clustering, intend to classify pixels to different groups in a pre-defined color space, whereas spatial- domain methods, such as regions growing, manipulate pixels to form connected regions. Since feature-based methods and spatial-domain methods both have their strengths, algorithms which combine two methods are developed, [6]. Among them, K-Means clustering is often applied as an essential step in the segmentation process.One of the most commonly used technique for image segmentation in K-means algorithm [7]. In recent image processing research, color image processing is getting high preference due to the reason that human eyes are more adjustable to brightness , so, we can identify thousands of colors at any point of a complex image, while only a dozens of gray scale are possible to be identified at the same time[7][8].*K-means* clustering is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. *K-means* clustering aims to partition *n* observations into *k* clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. For human beings colour provide the most important descriptions of the colour model. Colour printing is reproduction of an image of text in colours. A color model (also called color space or color system) is also defined as the specification of a coordinate system and a subspace within that system where each color is represented by a single point. In the proposed algorithm HSV color model is used. In HSV colourmodel : H: Hue - This represents purity of colour (i.e pure red. Green, blue) S: Saturation - represents the measure of the degree to which a pure color is diluted by white light. V: Value or Brightness - This describes the intensity or brightness of the colour from 0% to 100 %.

## III. BLOCK DIAGRAM OF PROPOSED ALGORITHM

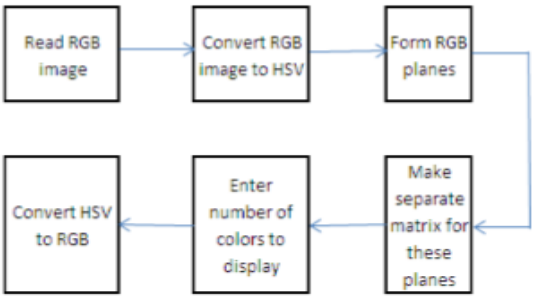


Figure1: Block diagram of proposed algorithm

The steps for k means clustering are as follows:

1) Read the colour image
2) Enhance the image
3) Convert the image into l*a*b colour space
4) Segment the feature vector using k means clustering
5) Label every pixel in the image using the results from k means clustering
6) Create segment image k-means clustering aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean.

This technique is used to cluster objects into clusters using Euclidean distance.The very first step in k- means clustering is to read the color image, then to enhance it. The next step in this technique is to convert the RGB image into l*a*b color space. After that feature vector is segmented using k-means clustering. Finally every pixel is labeled using the results from k-means clustering [8][9]. Figure 2 shows the flow chart of the proposed method.

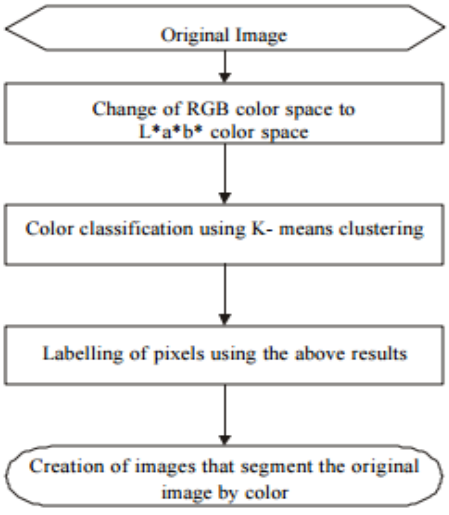


Figure 2: The steps for proposed algorithm are as follows:

 

1) Read RGB image
2) Convert it to HSV
3) Form RGB planes and single new matrix with these planes
4) Merge same rows
5) Enter number of colors to be displayed
6) Convert HSV to RGB
7) Display the image

In pixel based image segmentation algorithm R, G, B image is firstly converted to hsvimage. HSV color space is used because it gives the color according to human perception. After that the image is converted to 3 RGB planes then the pixels belonging to same color are merged together. After that total numbers of colors are displayed.

## IV. RESULTS AND DISCUSSIONS

In comparison to the k-means clustering, our research work has high efficiency. The term efficiency is defined as output divided by input. In the above table firstly the total number of colors in the image are calculated, after that colors retrieved are shown in both the cases. Efficiency is calculated by dividing retrieved images in both algorithms by the total number of colors in the image. Our set up is more efficient, compact and flexible because here the total number of colors from the image is automatically calculated. In every case shown in the table, the efficiency is more in case of proposed work.

Table1: Comparison of Proposed Algorithm with k-means clustering Algorithm

| S.No | Images | Total Number of colors | Number of relevant images | | Efficiency | |
|---|---|---|---|---|---|---|
| | | | Proposed algorithm | k-means clustering | Proposed algorithm | k-means clustering |
| 1 |  | 22 | 21 | 9 | 95.4 | 40.90909 |
| 2 |  | 13 | 12 | 4 | 92.3 | 30.76923 |
| 3 |  | 10 | 9 | 3 | 90 | 30 |
| 4 |  | 19 | 18 | 8 | 94.7 | 42.10526 |
| 5 |  | 24 | 22 | 6 | 91.6 | 25 |

Comparison of k-means clustering and proposed algorithm is explained by following points:
Color space: The color space used in k-means clustering algorithm is L*a*b, on the other hand the color space used in our algorithm is HSV.
Segmentation Technique: The segmentation technique used in k-means is based on clustering and in proposed work segmentation based on pixels is carried out.Moreover in the proposed work detection of total number of colors is automatic.

## V. CONCLUSION

Here we conclude that technique has been successfully achieved that can provide total number of colors from an image. This technique is very efficient and flexible because here we can get colors present in an image automatically. In medical field when the location and total number of colors are known then it can be helpful to identify the patients suffering from cancer and brain tumor can also be detected. So the pixel level segmentation algorithm is introduced to determine the total numbers of colors present in an image and segmentation is carried out on the basis of color. The efficiency of our research work is better as compared to the existing technique.

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