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Color Pixel Based Image Classification and Clustering Using Fuzzy Methods

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Abstract - Color has been a great help in identifying objects for many years. Color is the byproduct of the spectrum of light, as it is reflected or engaged, as received by the human eye and processed by the human brain. In day to day practice, it will be most likely use of color models: HSV, CMYK, L*A*B and RGB. This paper, the RGB models will be focused. The RGB color model combines Red, Green, and Blue light in various ways to reproduce a broad array of colors. The RGB color of an object will be classified by using Fuzzy logic according to the data given by the color data set. Several scientific researchers have been focusing their research in the field of tiger based research conservation. This paper has been implement with real time dataset for tiger images. This research work is highly useful and important for the social consequence of the tiger research conservation. The aims to provide a better understanding of the Fuzzy Logic algorithms to solving the real time life application for engineering technology, scientist and researcher. Experimental results are to demonstrate the color classification of tiger skin color and to be calculated with age of tiger, it is based on the skin color and stripes is a parameter values, by using the Fuzzy Logic algorithms are implementing with MATLAB stimulation tool.

Key Words: RGB color, Color Spaces, Pixel Classification, Fuzzy Logic, Tiger Image Data Set.

I. INTRODUCTION

The color image is a digital or numerical value of the image that includes color classification of the pixel and each pixel represents with own attributes. It is necessary to provide the three sample colors or color channel as for RGB (564–580 nm (red); medium-wavelength, peaking near 534–545 nm (green), short-wavelength light, near 420–440 nm (blue)) color pixels and color spaces are coordinating with some interpreted color values. There are more than three colors, dimensions in other color spaces, such as YCbCr, HSV, CIE, VIBGYOR, CMYK color model. Color is the characteristic of human visual perception described through color categories, with names such as red, blue, yellow, green, orange, or purple. This perception of color derives from the stimulation of cone cells in the human eye by electromagnetic radiation in the spectrum of light. Color categories and physical specifications of color are associated with objects through the wavelength of the light that is reflected from them. This reflection is governed by the object's physical properties such as light absorption, emission spectra, etc. The main purpose of the RGB color model is for the sensing, representation, and display of images in electronic systems, such as televisions and computers.

The colors are actually light waves. Each color has its own designated space within the spectrum. The choice of primary colors relates to the physiology of the human eye. If the visible portion of the light spectrum is divided into thirds, the predominant colors are Red, Green and Blue. The RGB color model is an additive color model in which red, green, and blue light are added together in various ways to reproduce a broad array of colors. These are colors that cannot be created through the mixing of other colors. They are colors in their own right. The three primary colors can be seen below RED - YELLOW - BLUE. Then, the primary colors have been mixed with other color will be produced with secondary color as given the below table1.

Table 1: combination of primary color and produced with secondary colors on the given table.

Yellow	+	Blue	=	Green
Blue	+	Red	=	Purple
Red	+	Yellow	=	Orange

The table 1 represents by the combination two primary colors to mixing with yellow and blue color to produce with new color as green and blue and red mixing with new color as purple and red and yellow mixing with orange color will be generated but these all the combination of two dimensional array of color combination. Again, as explained earlier, Color Theory is correct on the surface. It shows us how colors interact in a perfect world. In other

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words, it serves as a general compass to point us in the right direction. In this way of a three dimensional array has been constructed with 8 bits for the each integer value of RGB colors. RGB color space or RGB color system, constructs all the colors from the combination of the Red, Green and Blue colors. The red, green and blue use 8 bits each, which have integer values from 0 to 255. This makes 256*256*256=16777216 possible colors. (One crore sixty seven lacs seventy seven thousand two hundred and sixteen). Fuzzy clustering is a form of clustering in each data point which belong to more than one cluster. It involves assigning a data point to cluster such that items in the same cluster are same on the similarities and possible while items belonging to different clusters are as dissimilar as possible. Clusters are identified via similarity measures. These similarity measures include distance, connectivity, and intensity. Different similarity measures can be taken by the data and application.

A fuzzy logic inference engine is highly important in this color classification system. The MATLAB Fuzzy Logic Toolbox is used in this study as the centerpiece of the system in classifying colors and to display the results. A fuzzy logic inference engine is highly important in this color classification system. The MATLAB Fuzzy Logic Toolbox is used in this study as the centerpiece of the system in classifying colors and to display the results.

Fuzzy logic interface engine is highly important in the color classification system. The MATLAB tool used on the fuzzy logic tool box its more helpful of the color classification and clustering process to classify the accurate colors to split in the image. Upon the fuzzy set theory will be developed to classify the color based on the pixel clustering on the input color image. In the fuzzy logic operation is a traditionally used in the mathematical equation using the color classification & clustering task to be performed.

II. LITERATURE WORK

In the literature review the following authors describes color spaces, Fuzzy Logic and K-means algorithm.

K. Sakthivel et al [2014] describes a color image segmentation using SVM pixel classification of image. This paper is based on image segmentation is to cluster pixels into salient image regions. Segmentation could be used for object recognition, occlusion boundary estimation within motion or stereo systems, image compression, image editing, or image database lookup. These features are extracted using the homogeneity model and Gabor Filter. With the extracted pixel level features, the SVM Classifier is trained by using FCM (Fuzzy C-Means).The image segmentation takes the advantage of both the pixel level information of the image and also the ability of the SVM Classifier.

Nikita Sharma et al [2012] describes color image segmentation techniques can be compared with many methods such as K-means, thresholding edge based techniques and region based techniques. The thresholding is to be done based on color. The segmentation allows the elimination of a great amount of unwanted pixels, and retained only those pixels in object we are interested in Nilima Kulkarni et al [2012] the Researchers would evaluate their image segmentation techniques by using one or more of the following evaluation methods.

Faten abu shmmala et al [2013] describes the various color based image segmentation techniques to be applied for the different version of K-means in two spaces. And, authors to be calculate the performance of three different study as K-means, Weighted K-means, and inverse weighted K-means clustering algorithms for different types of color spaces (RGB and LAB color spaces).

Preeti rani et al [2016] describes a color based image segmentation methodology has been used for partition the colors in the segments. Segmentation partitions an image into distinct regions contains each pixel with similar attributes. In this authors to find the PSNR values to be calculated to the segment the images and generate the output and accurate in terms of color segmentation.

Arash abadpour et al [2008] describes a new color image segmentation method, which utilizes the general clustering algorithm with an innovative distance function. Comparison of the proposed method with an available clustering method which searches for similar cylindrical structures in the pixel domain. Dina khattab et al [2014] describes to evaluate the performance of color based image segmentation using the automatic Grabcut techniqus. In this method can be applied with some color spaces and to analysis the experimental results using different images with different color sapces.

S.M.Aqil Burney et al [2014] describes the analysis of K-means clustering algorithm for image segmentation methods. In this material how to work on the K-means clustering algorithm for some color spaces (RGB and LAB color spaces to be compared with this article) and find some measurement and to calculate the accuracy of the color space in RGB and other color spaces.

Gunjan mathur et al [2014] describes to analysis the performance of K-means clustering algorithm in different color spaces of color image segmentation. K-means clustering algorithm divides into K clusters based on the similarity between the pixels in that cluster. In this scenario is used to perform the Euclidean distance formula to define in K-means clustering, and applied variety of color spaces in various color images. Nameirakpam Dhanachandra et al [2015] proposed to analysis the various clustering techniques. Such as, K-means clustering, Fuzzy C-means clustering algorithm is apply for the segmentation of the color image and compared with the classical methods. R.R.Gharieb et al [2015] describes a new clustering techniques for Fuzzy C-means clustering algorithm. Fuzzy

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C-means with local membership based on weighted pixel distance and Kullback-Leibler divergence for image segmentation. A local membership is based on weighted distance and KL information divergence FCM algorithm. The local membership has been used for weighting the pixel to cluster center distance and for formulating KL membership divergence acting as a fuzzification and regularization function.

E.A.Zanaty [2012] describes is to analysis the number of clusters for kernelized fuzzy c-means algorithm for automatic segmentation of MRI images. The original Euclidean distance in the FCM is replaced by a Gaussian radial basic function classifier (GRBFC) and the corresponding algorithm FCM methods are derived. The derived algorithm are called as the kernelized fuzzy c-means and kernalized fuzzy c-means with spatial constraints (SKFCM).the hope is that the number of clusters with in an image can be determined automatically.

III. METHODOLOGY

The fuzzy algorithm has been a very important tool for analysis the image in clustering object in an image processing task. This algorithm more efficient to detect the noise and improve the accuracy of clustering. Algorithm to handle with different activities to perform the image based feature extraction. Fuzzy logic algorithms have described the fuzzy set of that are defined as the various color components. The goal of membership function is to describe colors follow the human intuition of color identification.

Fuzzy clustering has been proposed as a more applicable algorithm in the performance of these tasks. A color image that has undergone fuzzy clustering in Matlab. The original image is seen next to a clustered image. Colors are used to give a visual representation of the three distinct clusters used to identify the membership of each pixel. Below, a chart is given that defines the fuzzy membership coefficients of their corresponding intensity values. Depending on the application for which the fuzzy clustering coefficients are to be used, different pre-processing techniques can be applied to RGB images.

Fuzzy clustering algorithm attempts to partition a finite number of n elements$X = \{x_1, \ldots\ldots, x_N\}$, into a collection of c fuzzy cluster with respect to the given principle. Given a finite set of data and the algorithms to return the c cluster center list as $C = \{c_1, \ldots\ldots\ldots, c_c\}$ and partition matrix is $W = w_{i,j} \in [0,1], i = 1, \ldots\ldots\ldots, n, j = 1, \ldots\ldots\ldots, c$ where each element $w_{i,j}$ and the degree of the element is x_1 and final cluster c_1.

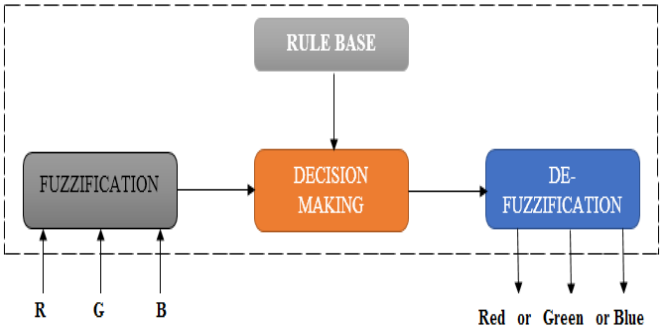

Figure 1: Block diagram on Fuzzy Rule using color classification and clustering task

Figure 1 is a representation of fuzzy rule using color classification and clustering task to be performed. Fuzzification is the process of mapping crisps input to fuzzy membership function. Fuzzy logic function is an important to differentiate but not only membership function a variable is to belong to the degree of membership operation.

The fuzzy membership spans from the range of values and it is overlapped. As the three sets of membership values are assigned to the color classification and clustering method of the RED, GREE and BLUE is the range the values of LOW MEDIAM and HIGH. The fuzzy logic method has been integrate with input fuzzy membership sets and the output fuzzy membership value. The more number of rules to create the color pixel classification on the color image processing.

The RGB color values is to change and then they to be produced the new colors from the RGB. The defuzzification is to crisp of the output where the output is generated based on the input values of RGB color values oriented then the output is the color indicator of itself (ie:- RED GREEN and BLUE). The fuzzification parameter is adjusted so that the color image and image data set are capturing the set of color values contained in the fuzzy input variables. The fuzzy rule may be adjusted or to be modified itself. The defuzzification parameter is to process correct and consistent crisp output.

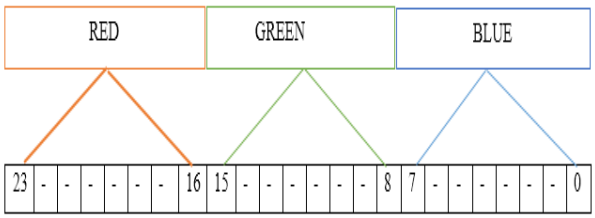

Figure 2: 24 bits for RGB color codes

Figure 2 is indicated by the RGB colors on 24 bits codes and each color has been 8bits codes on every individual colors in the RGB. The range between 0 to 7 for BLUE and 8 to 15 is GREEN and 16 to 23 is the RED value to be assigned. Thus the figure is followed by the three

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dimensional array vector space to be calculated on RGB color values to process the combination of these three colors is mixed with new color has to generate. Every single bit value indicates with single color.

#9400D3	RGB 148, 0, 211
#4B0082	RGB 75, 0, 130
#0000FF	RGB 0, 0, 255
#00FF00	RGB 0, 255, 0
#FFFF00	RGB 255, 255, 0
#FF7F00	RGB 255, 127, 0
#FF0000	RGB 255, 0 , 0

Figure 3: sample color codes and the range of RGB values

Figure 3 is described for sample color codes and the range of RGB values in the hex-decimal code values which are allocated from the three- dimensional array spaces to locate the RGB values.

Overall the system is able to classify the color with certain brightness level. But, when the color is too dark or bright and the following algorithms are not able to produce a correct output from the RGB colors. In order to detect those problems of result will be applied on fuzzy logic process and integrated with the same algorithms for fuzzy clustering process. They followed by the given algorithms are:

IV. K-MEANS ALGORITHM

K-means is one of the simplest and most effective unsupervised learning algorithms to solve well known clustering problems. In general, we have n data points x_i,i=1...n that needs to be partitioned in k clusters. The aim is to assign a cluster to each data point. K-means is a clustering method that aims to find the positions μ_i,i=1...k of the clusters that minimize the distance from the data points to the cluster. K-means clustering solves

$$\underset{c}{\operatorname{argmin}} \sum_{i=1}^{k} \sum_{x \in ci} d(x, \mu i) = \arg\min_{c} \sum_{i=1}^{k} \sum_{x \in ci} \|x - \mu i\|_2^2$$

Where c_i is the set of points that belong to cluster i. The K-means clustering uses the square of the Euclidean distance d(x,μi)=‖x−μi‖22. This problem is not trivial (in fact it is NP-hard), so the K-means algorithm only hopes to find the global minimum, possibly getting stuck in a different solution.

Algorithmic steps:

Let X = {x_1,x_2,x_3,……..,x_n} be the set of data points and V = {v_1,v_2,…….,v_c} be the set of centers.

1) Randomly select *'c'* cluster centers.

2) Calculate the distance between each data point and cluster centers.

3) Assign the data point to the cluster center whose distance from the cluster center is minimum of all the cluster centers.

4) Recalculate the new cluster center using:

$$v_i = \left(1/c_i\right) \sum_{j=1}^{c_i} x_i$$

Where, 'c_i' represents the number of data points in i^{th} cluster.

5) Recalculate the distance between each data point and new obtained cluster centers.

6) If no data point was reassigned then stop, otherwise repeat from step 3).

V. MODIFIED K-MEANS ALGORITHM

This algorithm partitions the entire space into unique segments and calculates the frequency of data point in every segment. The segment which has maximum frequency of data point can have the maximum probability to contain the centroid of cluster. Similar like the traditional K-mean algorithm the number of cluster's centroid (k) will be provided by the user and the number of divisions will be k*k ('k' vertically as well as 'k' horizontally).A simple data structure is required to store some information in every iteration, which is to be used in next iteration. This method avoids calculating the distance of each data object to the cluster centers repeatedly and thus the running time is saved. This method can effectively improve the speed of clustering and accuracy, reducing the computational complexity of the K-means.

Algorithmic steps:

Let D = {d1, d2...dn} be the set of n data items and k be the number of desired clusters.

1. For each column of the data set, determine the range as the difference between the maximum and the minimum element.

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2. Identify the column having the maximum range.
3. Sort the entire data set in non-decreasing order based on the column having the maximum range.
4. Partition the sorted data set into 'k' equal parts
5. Determine the arithmetic mean of each part obtained in Step 4 as c1, c2,….ck;
6. Take these mean values as the initial centroids.
7. Repeat.
8. Assign each data item di to the cluster which has the closest centroid;
9. Calculate new mean of each cluster; until convergence criterion is met.

VI. FUZZY ISO-DATA ALGORITHM

ISODATA is abbreviated as Iterative Self-Organizing Data Analysis Technique. ISODATA is a method of unsupervised classification. Don't need to know the number of clusters. Algorithm splits and merges clusters. User defines threshold values for parameters. The algorithm runs through much iteration until value is reached. ISODATA Algorithm, which allows the number of clusters to be adjusted automatically during the iteration by merging similar clusters and splitting clusters with large standard deviations.

Algorithmic steps:

Randomly place the cluster center sand the pixels are assigned based on the minimum distance to the center method.

1. The standard deviation within each cluster, and the distance between cluster centers is calculated
2. Clusters are split if one or more standard deviation is greater than the user-defined threshold.
3. Clusters are merged if the distance between them is less than the user-defined threshold.
4. A second iteration is performed with the new cluster centers.
5. Further iterations are performed until:
6. The average inter-center distance falls below the user-defined threshold
7. The average change in the inter-center distance between iterations is less than a threshold.
8. The maximum number of iterations is reached.

VII. RESULTS AND DISCUSSIONS

In order to check the performance of our color image segmentation approach, the benchmark image data sets has been used. The data sets are collected from various resources on the web page and store the data are spread in the image database and the different types of size of images and different images are collected from the color based image where all the images are in a different format as .gif, .jpg, .png, .trf.

Implementation Process

Image segmentation process is carried out and demonstrated using matlab tool is then implemented. The version of Matlab tool is 8.6(2015b) and corei3 processor, graphics card on nvidia and support for other system facilities as to use.

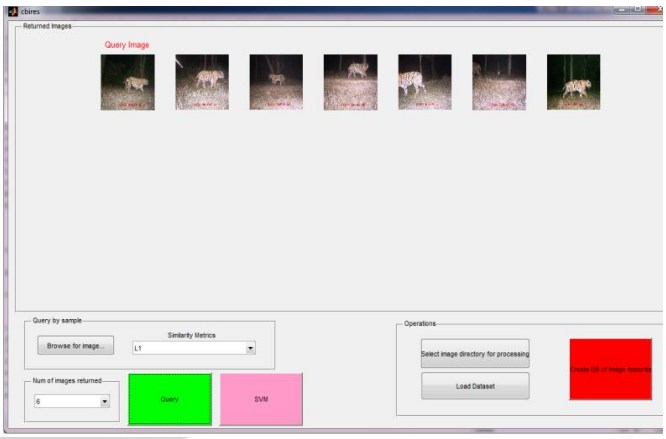

Figure 4: Age wise retrieved tiger image database on single window using query processing

Figure 4 is represents the retrieval of an image from the image database, which helps on the query image processing (CBIR), the color classification using N1 rule will be applied for color image. To retrieve the same age group in the image databases it helps of query processing techniques to be applied. To retrieve the same age of image is based on the pixel colors and pixel values.

Table 1: data clustering for 10 iteration compared with accuracy for existing and proposed methods

S.NO	algorithm	Time period	Accuracy
1	K means	0.56	87.6
2	M k-means	0.48	91.4
3	MFISODATA	0.43	93.4

The above table 1 shows that the data clustering for 10 iteration and compares the accuracy for existing and proposed methods (M K-Means, K-Means, FBISODATA). These algorithms are compared taking is to account both accuracy level and time period, where the FBISODATA algorithm accuracy level is higher than the algorithms. When compared with the accuracy level FBISODATA is 93.4% and time period is 0.43sec and other algorithm accuracy level is 91.4% and 0.48sec and 87.6% and 0.56sec. The level of accuracy is to increase with both algorithms as FBISODATA to K-Means and M-K- Means is 5.8% is higher with FBISODATA to M-K-MEANS is 2.0% and 3.8% is higher with M-K-Means to K-Means. The results significantly shows that FBISODATA is highly efficient.

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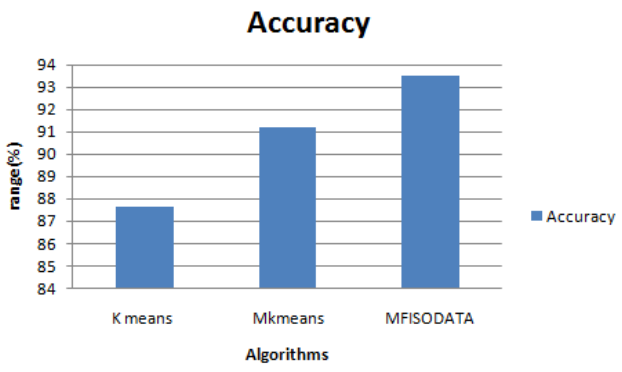

Figure 5 : accuracy chart on the data clustering for 10 iteration its compared with exist and proposed methods

The above figure 5 shows that the data clustering for 10 iteration compared the accuracy of existing and proposed methods for (M-K-Means, K-Means, FBISODATA). The accuracy chart is figurate on table 1.

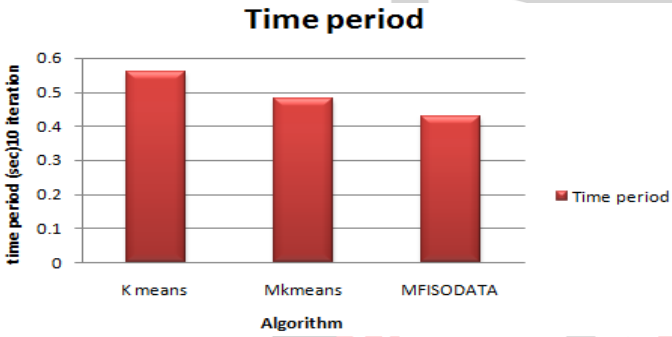

Figure 6: time period calculation to the data clustering for 10 iteration its compared with exist and proposed methods

The above figure 6 shows that the data clustering for 10 iterations compares the Time Period of existing methods with the proposed methods M-K-Means, K-Means, FBISODATA. The overall time period calculation is based on table 1.

VIII. CONCLUSION

This paper describes with the fuzzy based clustering techniques applying on color pixel based classification of RGB color images and then more complicated task to perform with the fuzzy logic process. They are several researchers have been implementing with the real world application for wildlife sanctuary in the tiger images on the forest department. This research work is mainly focusing on their color classification of the images which is most important to identify the age of tiger is based upon color features. This paper have been applying the real time data set for the tiger images datasets, in the research work is highly important and useful for the society. The aim of this application was too developed with calculate the tiger age and then parameter values are used in the skin color and strips as to calculate the tiger age. As to compare with real data set on training and testing data set the image. It's not only an easy task of process but it is very complicated task to be perform the age calculation for the tiger. It's useful for the Fuzzy logic algorithms are highly support for identify the age of tiger using colors and strips and they have retrieve the accurate age group on tiger.

REFERENCE

[1]. Qixiang Ye et al "Color Image Segmentation Using Density-Based Clustering" ICASSP IEEE 2003

[2]. K. Eranna et al "2-Dimentional Object Extraction by using Color feature and KNN Classification" International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Vol. 3 Issue 10, October- 2014.

[3]. Angela Ribeiro et al "An Image Segmentation Based on a Genetic Algorithm for Determining Soil Coverage by Crop Residues" Sensors 2011 ISSN 1424-8220.

[4]. Mantas Paulinas et al "A Survey Of Genetic Algorithms Applications for Image enhancement And Segmentation" ISSN 1392 – 124x Information Technology And Control, 2007, Vol.36, No.3

[5]. Ms.Chinki Chandhok et al " An Approach to Image Segmentation using K-means Clustering Algorithm" IJIT, Volume – 1, Issue – 1, August 2012 ISSN 2279 – 008X.

[6]. Jitendra Malik et al "Contour and Texture Analysis for Image Segmentation" International Journal of Computer Vision 43(1), 7–27, 2001.

[7]. Lucia Ballerini et al "A color and texture based hierarchical K-NN approach to the classi_cation of non-melanoma skin lesions" Springer-Verlag Berlin Heidelberg (2010).

[8]. Jinping Fan et al " Color Cell Image Segmentation Based on Chan-Vese Model for Vector-Valued Images" Journal of Software Engineering and Applications, 2013, 6, 554-558.

[9]. Nguyen Tran Lan Anh et al "color image segmentation using a morphological gradient-based active contour model" ICIC ISSN 1349-4198 PP 4471-4481 vol 9 No 11 Nov 2013.

[10]. Rajivkumar Mente et al "Color Image Segmentation and Recognition based on Shape and Color Features" nternational Journal of Computer Science Engineering (IJCSE) 2012.

[11]. Kumary R Soumya et al "License Plate Detection and Character Recognition Using Contour Analysis" International Journal of Advanced Trends in Computer Science and Engineering ISSN 2278-3091 Volume 3, No.1, January – February 2014.

[12]. Vijay Jumb et al "Color Image Segmentation Using K-Means Clustering and Otsu's Adaptive Thresholding" International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-3, Issue-9, February 2014.

[13]. Poonam Panwar et al "Genetic Algorithms For Image Segmentation Using Active Contours" JGRCS Volume 4, No. 1, January 2013.

[14]. Mrs. Namrata et al "Augmented Reality Using Contour Analysis In E-Learning" International Journal of Innovative Research in Science, Engineering and Technology ISSN: 2319-8753*Vol. 2, Issue 5, May 2013*

[15]. Amanpreet Kaur Bhogal et al "Color image segmentation using k-means clustering algorithm" International Journal on Emerging Technologies 1(2): 18-20(2010) ISSN 0975-8364.

 DOI : 10.18231/2454-9150.2018.0485