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A Modified Method For Road Sign Detection & Recognition

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ABSTRACT

Road sign detection is an important for regulating the traffic. In this paper oversegmentation technique is used for the detection and recognition of a road sign with the integration of shape analysis. The main focus is on the implementation and efficiency aspect of this technique. There is a detailed analysis of oversegmentation has been shown. This proposed algorithm can be used as a part of driver assistant system. The proposed algorithm can detect road signs with any color and any of the shapes (circle, triangle, rectangle, diamond, pentagon, or octagon). The key feature of oversegmention is to make much of segmentation of the image so that the object and background can be distinguished easily .There is also a creation of predefined database of shapes based on various features which is explained in details in following paper .The accuracy also measures for the detection of road sign. Therefore the proposed technique will address to a wide range of problem for detection of the road sign when the sign is partially occluded, rotated, scaled and tilted.

Keywords -K means clustering ,Oversegmentation, Morphological operations, Shape recognition.

I. INTRODUCTION

Road sign detection has been an important issue for research recently. Road sign detection is a technology by which a vehicle is able to recognize the different signs put on the road e.g. "speed limit" or “stop sign” or "children" or "turn ahead” etc. Traffic signs are used to regulate the traffic. Traffic signs are used for guiding the driver. Automatic detection and recognition of road traffic signs is an essential task of regulating the traffic and guiding and warning drivers and pedestrians [1]. It is also possible to design specific signs, for example mobile robots with a format similar to traffic signs that would indicate some kind of information about tasks, prohibitions or warnings in the environment [2]. Sometimes very serious accidents happened takes place due to the factors such as when the stop sign is not noticed by the driver or the psychological state of the driver. The causes of accidents are also related to the partial occlusion of a traffic sign, deterioration of the sign or possible distraction of the driver [3]. It is necessary to solve the problems that are involved in traffic detection. The test setof these problems reported in [4] [5].Road sign detection is most important forDriver Assistance System, autonomous vehicles, and inventory purposes. Driver Assistance System is used to increase the driver safety. Road signs carry much useful information such as to drive the vehicle in the correct lane and at the right speed; to avoid obstacles. It gives information to the driver about the presence of any specific sign. The road signs are used to indicate the state of the road. The sign may have numerous numbers of different sizes and colors [1].

II. WORK METHODOLOGY

2.1 Flow Chart

The flow chart for the road sign detection and recognition is shown in fig 2.1. Take a signal from the data acquisition tool box .Now apply k means based color quantization. Color image quantization is a process that reduces the number of distinct colors used in an image, usually with the intention that the new image should be as visually similar as possible to the original image. Now apply histogram equalization for quantized image, Histogram equalization enhances the contrast of images. The features of the signals are extracted by using morphological operations. Calculate features from the original RGB signal. These features are also calculated for extracted binary signal. Now calculate the Euclidean distance for detecting the shape of the signal. The signal can be circular, triangular, rectangular, square, polygon and diamond shape. Detection of the various road signs is accomplished using geometric dimensions of symmetrical sign shapes outlines. For the shape recognition of the circle, triangle, square, rectangle and polygon use the set of rules in which parameters dimensions (length, breadth) and corners are defined. For detecting the corners of each object sensitivity factor must be used, it will be different for each shape of the signal. The shape of various signals also depending on tolerance of each signal. If all the criteria are matched with database then the signal is detected and it is shown on the screen. But if the Euclidean distance and the other criteria don’t match with the database then no signal matched is displayed on the screen.

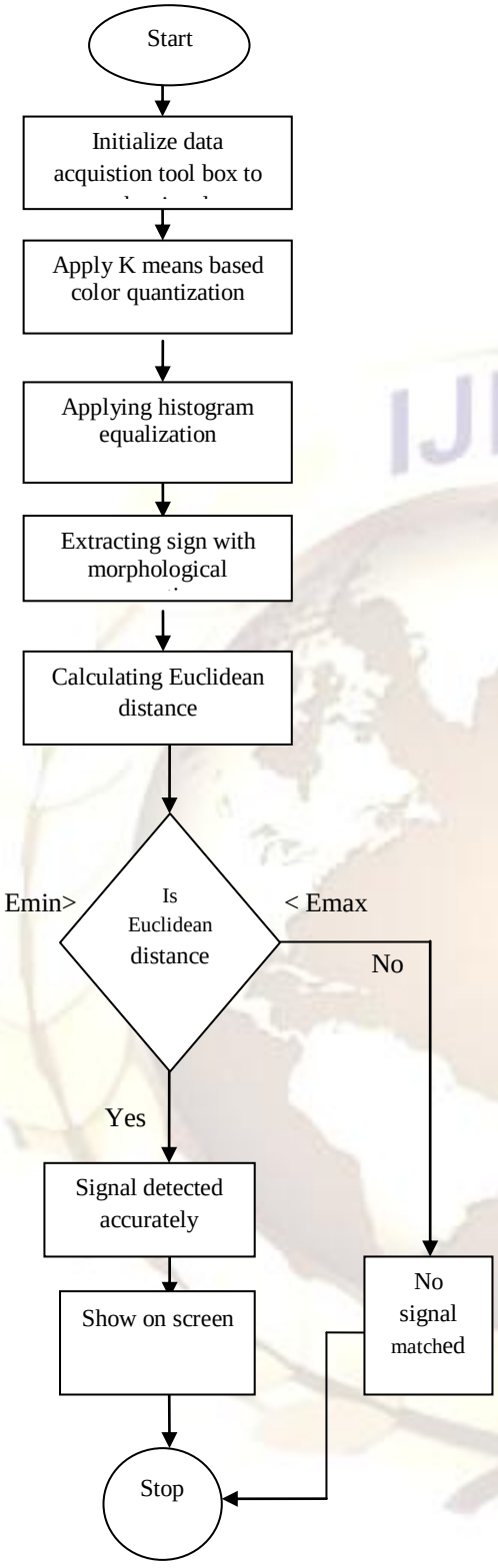

Fig 2.1: Flow chart for the road sign detection and recognition

III. Algorithm Implementation

Shape is an important character of an image, the shape information of an image doesn't change when image color is changed. The automatic analysis of geometric shapes is shape analysis. The shape of the different road signs can be determined by a finite number of coordinate points. In this process first the edges of the images are detected. The edges are those points where the boundary is existed between two regions of images .Edges may include of junctions.

3.1 K means clustering

Clustering in image segmentation as the process of identifying groups of similar image primitive [9].Clustering technique can be classified into supervised and unsupervised. The unsupervised clustering technique is used in super pixel formation [10].

The K-means algorithm is an iterative technique that is used to partition an image into *K* clusters. The basic algorithm is

1. Pick *K* cluster centers, either randomly or based on some heuristic.
2. Assign each pixel in the image to the cluster that minimizes the distance between the pixel and the cluster center
3. Re-compute the cluster centers by averaging all of the pixels in the cluster
4. Repeat steps 2 and 3 until convergence is attained (e.g. no pixels change clusters)

In this case, distance is the squared or absolute difference between a pixel and a cluster center. The difference is typically based on pixel color, intensity, texture, and location, or a weighted combination of these factors. K can be selected manually, randomly, or by a heuristic.The quality of the solution depends on the initial set of clusters and the value of K.

In statistics and machine learning, the k-means algorithm is a clustering algorithm to partition n objects into k clusters, where k < n.

3.2Oversegmentation

Oversegmentation is the technique by which the objects being segmented from the background are themselves segmented or fractured into subcomponents [7]. Feature detection process is applied to the images. Feature detection is used on the image to examine every pixel to see if there is a feature present at that pixel. The significance of this technique in the algorithm is to predict the features of the objects of interest .The main property for feature detection is repeatability, It checks whether or not the same feature will be detected in two or more different images of the same scene. Then feature extraction process is used by which features of the objects are extracted using morphological operations.

Thresholding technique is used for converting the rgb images to binary image based on the threshold. During the thresholding process,

individual pixels in an image are marked as "object" pixels if their value is greater than some threshold value and as "background" pixels if their value is less than some threshold value. Typically, an object pixel is given a value of "1" while a background pixel is given a value of "0." Finally, a binary image is created by colouring each pixel white or black, depending on a pixel's label.

In morphological image processing,two fundamental operations erosion and dilation are used. Morphological operations are used for identifications of the objects or boundaries in an image. Morphological operations are usually performed on binary images because the pixel values in the binary image are either 0 or 1. A pixel value of 1 is taken as white and a pixel value of 0 is taken as black.

Dilation is typically applied to binary images.The basic effect of the operator on a binary image is to gradually enlarge the boundaries of regions of foreground pixels . Thus areas of foreground pixels grow in size while holes within those regions become smaller. With binary images, dilation connects areas that are separated by spaces smaller than the structuring element and adds pixels to the perimeter of each image object. It is translation invariant, It is commutative, associative and it is distributive over set union.

The dilation operator takes two pieces of data as inputs. The first is the image which is to be dilated. The second is a small set of coordinate points known as a structuring element .Structuring element that determines the precise effect of the dilation on the input image.

For shrinking the object's erosion operation is used. Shrinking can be used to reduce objects to a single point located at the geometric center of the object in the image . Shrinking can used as a finding the center of mass of an object.

Erosion is the operator that is used in morphology. Erosion is applied to binary images to erode away the boundaries of regions of foreground pixels. Thus areas of foreground pixels shrink in size, and holes within those areas become larger. The erosion is translation invariant. It is distributive over set intersection. The imerode function accepts two primary arguments and is used to eroding an image.

• The input image to be processed (binary image).
• A structuring element object, returned by the strel function.

For performing the morphological erosion operation take the structuring element. Disk shaped structuring element used in it. For example 'disk', 1 means the diameter of objects will be changed according to this value. The shape of the region has been quite well preserved just because of disk shaped structuring element.

After the feature extraction process, it matches the features of the object with the predefined table to predict the shape of a particular sign shape. The shape of the sign is recognized using the process of sign recognition for a given image. Humans recognize a large number of objects in an image, despite of the fact that the objects variation in different viewpoints, sizes, scales, translation or rotation. The proposed algorithm can detect the road sign when they are partially obstructed from view. Labeling of the objects is necessary for detecting the shapes of different road sign. Each sign is labeled with the different number.

For the shape recognition of the different sign like circular, triangular, square, rectangular, diamond and polygon, use the prediction table in which parameters dimensions (length, breadth) and corners are defined. For detecting the corners of each object sensitivity factor must be used, it will be different for each object.

The road sign detection is also depending on tolerance of each geometric object. By choosing different tolerance for each object, circular, triangular, square, rectangular, pentagon and hexagon shapes of the sign are recognized.

IV RESULTS

Road signs are normally classified according to their color and shape. It should be designed and positioned in such a way that they can be noticed while driving. Firstly take a signal from the data acquisition toolbox in MATLAB. Draw the histogram of the original image. The original image and histogram of the original image is shown in fig 4.1.

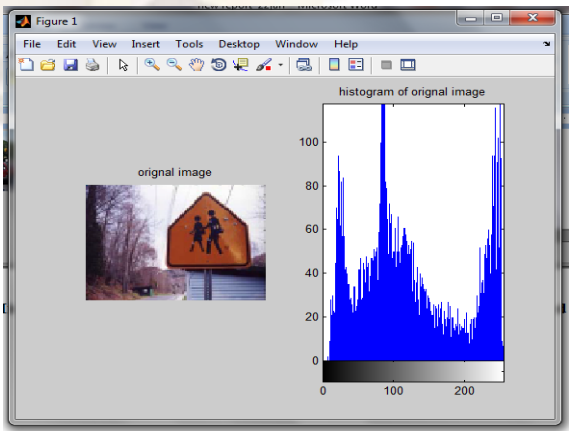

Fig 4.1: Histogram of original image

Use quantization process on the image. Color image quantization is a process that reduces the number of distinct colors used in an image, usually with the intention that the new image should be as visually similar as possible to the original image.

Draw the histogram of quantized image. The histogram of quantized image is shown in fig 4.2.

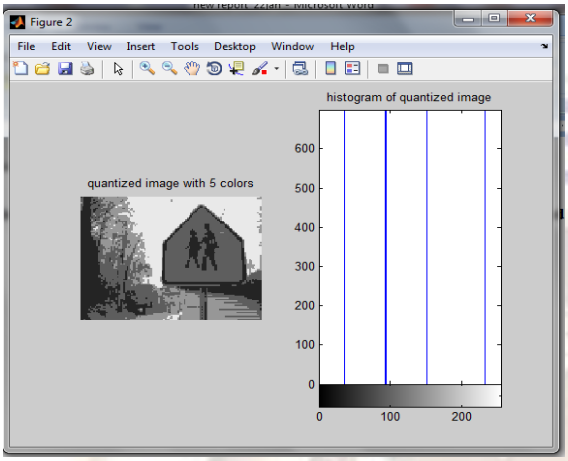

Fig 4.2 : Histogram of quantized image

Apply histogram equalization on the quantized image. Histogram equalization enhances the contrast of images. The histogram equalization of quantized image is shown in fig 4.3.

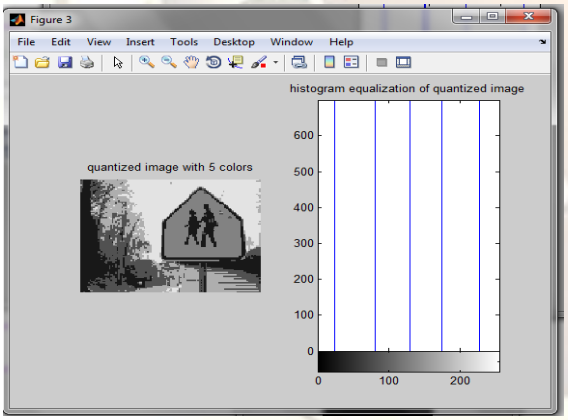

Fig 4.3: Histogram equalization of quantized image

Road sign is extracted from the background by using the proposed algorithm. The extracted sign is shown in fig 4.4.

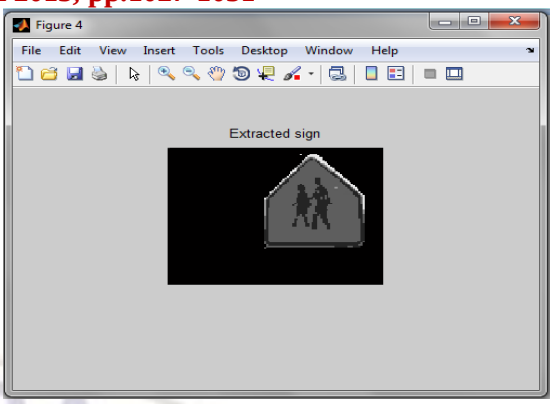

Fig4.4: Extracted sign

Colored sign is extracted from the background by using the proposed algorithm. The extracted sign is shown in fig 4.5.

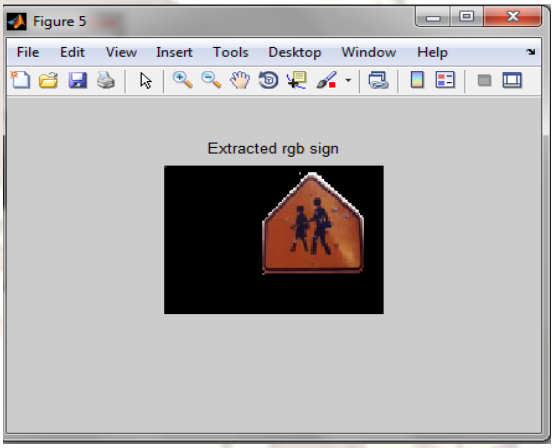

Fig 4.5 : Extracted RGB sign

V. SUMMARY OF RESULTS

The following table shows the results for road sign detection and recognition

TABLE

a) Total number of images	50
b) Total number of signs	59
c) No of different traffic signs	16
d) Detection of traffic signs	58
e) False detection	1
f) No of misses	0

The proposed algorithm has the accuracy for detecting the road sign is 98.30%.

VI. CONCLUSION

In this study, this proposed work has a significant role in the road signs detection. This

research work would help to detect the shape recognition of road sign under bad weather conditions or under illumination. By using histogram equalization, the contrast of the images has been enhanced. Detection of the various road signs is accomplished using geometric dimensions of symmetrical sign shapes outlines. The proposed algorithm is invariant to transformations like translation, scaling and rotation. The proposed algorithm can detect road signs with any color and any of the existed shapes in the image for example - circular, triangular, rectangular, diamond, pentagonal, or octagonal. This proposed work would detect the road sign when the sign is partially occluded, rotated or tilted. The proposed algorithm improves the efficiency ,by detection of small scaled road signs.With this proposed algorithm, the accuracy for detection of road sign is 98.30%.

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