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DETECTION AND RECOGNITION OF TRAFFIC SIGN FOR VISUALLY IMPAIRED PEOPLE

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ABSTRACT This paper introduces the different methods of detection and recognition of road traffic sign for visually impaired people. Traffic sign plays an important role in finding way and navigation to assist blind people accessing unfamiliar environment. Traffic sign gives the information about road condition, Traffic rules and assists the driver for better and safe driving. There is various method are used for detection and recognition of traffic sign based on accuracy. In this paper, various techniques for detection and recognition of traffic sign are explained and their comparative study is also explained based on their performance.

Key Words: Detection, Recognition, Maximally stable external region (MSER), speeded up robust feature (SURF), support vector machine (SVM), optical character recognition (OCR), Artificial Neural Network (ANN)

1. INTRODUCTION

Traffic signs are signed which are placed on the side or above the rods to give necessary information to road user or driver for safe driving and navigation. Sometimes because of weather condition, heavy traffic or miss attention of drivers, there is the chance of missing traffic sign it might lead to an accident. So, it is very important to detect and recognize the traffic signs automatically and alert the driver about the situation. There are three types of traffic signs are used in India namely mandatory signs are road sign which is used to set the bond of all traffic which uses a specific area of road. Most mandatory sign are circular, may use the white symbol on white background with a red border.

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The second is the cautionary sign is also a type of traffic sign that is used to indicate that there is hazard ahead on the road that may not be visible to the driver. they usually, take the shape of the equilateral triangle with white background and thick red border. And the last is nothing but information sign which is generally used for indication, destination name, route direction, distances and help driver for safe driving. these signs usually rectangular in shape. For visually impaired people the detection and recognition of traffic sign are not easy. They use different methods and way to make their life easier.the most common way used by visually impaired people to navigate around is by using a white cane. they also use guide dogs have been trained to help visually impaired people to guide them but the problem is that dog can only go to places that they already being trained. The visually impaired people are not fully independent due to vision weaknesses. They had to depend on their caretaker or other people to help them to go to places, etc. Because of this problem they cannot live their life independently.

2. LITERATURE REVIEW

There are various methods used for detection and recognition of traffic sign for visually impaired people many of the researchers proposed many methods. Swathi M, K.V. Suresh [1], Po-Cheng Shih, Chi-Yi Tsai and Chun-Fei Hsu [3] They present the novel technique for detection and recognition of traffic based on Advance Driver Assistance system (ADAS).The main purpose of ADAS is to collect the significant information for the driver in order to reduce their effort in safe driving .there are the various application of ADAS are in blind spot detection, speed limit recognition, emergency brake assist etc.

Sumi K.M., Arun Kumar M.N., Ph.D. [2], Po-Cheng Shih, Chi-Yi Tsai and Chun-Fei Hsu [3] they explain other methods for detection and recognition of traffic sign such as maximally stable external region (MSER) are used as blob detection in an image. This algorithm is used to accurately detect traffic signs and feature vector for each traffic sign is extracted via the histogram of oriented gradient algorithm.

Md. Zainal Abedin, Prashengit Dhar, Kaushik Deb [4], Mugdha Surve, Priyanka Tambe, Sayali Walke, Pranoti Mane [5], Shuihua Wang and Yingli Tian [6], Yan Han, Kushal Virupakshappa, and Erdal Oruklu They explain about the speeded up robust feature descriptor (SURF) it is mainly used in object recognition, image registration etc .it uses scale-invariant

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feature transform (SIFT) to extract the local feature in the detected area. SIFT feature widely used for

object detection and recognition due to strength to a variation of scale, translation, rotation, illumination etc. SIFT feature extraction and representation contain two part 1) first is to detect interest feature points 2) and the second one is the feature point descriptor the feature points are detected by using a difference of Gaussian (DOG).A DOG is a close approximation to the scale –normalized to the scale normalized Laplacian –of- Gaussian to find the most stable image. SURF is relatively efficient compared to other algorithm but one problem with SURF is that is high dimensionality and it is very difficult to find the suitable database. Feng Lin, Yan Lai, Lan Lin, and Yuxin Yuan [9], Ayoub Ellahyani, Mohamed El Ansari [12] they explain another important method for detection and recognition of traffic sign which is nothing but support vector machine (SVM) mainly SVM is designed to solve the binary classification problem. SVM are supervised learning algorithm which produces reliable performance in pattern recognition. The goal of SVM is to find the optimal hyperplane that separates the data sets in such a way that the margin between the data set is maximized. The main advantages of SVM are that it can be analyzed theoretically using concepts from computational learning theory and at the same time it gives the good result when it is applied to the real problem. But the disadvantages of SVM is that the time required is more and its high dimensionality. Ayoub Ellahyani, Mohamed El Ansari [12], Supreeth H.S.G, Chandrashekar M Patil [13], Amol Jayant Kale, Prof.R.C.Mahajan [14] they explain about the colour segmentation based detection and recognition of traffic sign. there is a various problem are occurs for detection of traffic sign because some of the traffic sign is faded in color because of weather condition, daytime, contact of object continuous to the sun, many other objects in the street are same in color as that of traffic sign etc.In order to overcome this difficulty HSI color space is used. Colour segmentation is a procedure in which the desired color is included and the unwanted part is removed from an original image in order to obtain the binary image .mainly in RGB color space R corresponds to amount of red color, G corresponds to the amount of green color and B corresponds to amount of blue color. Pravin A. Dhulekar, Niharika Prajapati, Tejal A. Tribhuvan, and Karishma S. Godse [11] they explain about the traffic sign recognition by using optical character

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recognition (OCR). Sign detection takes place in an additional dynamic environment. OCR is used for character extraction and symbol matching.OCR is widely used as a form of information entry from the printed paper data record,whether passport document, business card, mail, or any suitable document.OCR is quick and accurate and it mainly increases the efficiency and effectiveness of official work. Supreeth H.S.G, Chandrashekar M Patil [13], Amol Jayant Kale Prof.R.C.Mahajan [14] they give detail information about the traffic sign detection and recognition using an Artificial neural network (ANN). The ANN consists of an interconnected group of artificial neurons and processes information using a connectionists approach to computation. For traffic sign detection and recognition, ANN is very important it contains an input layer, hidden layer, and output layer. The main advantage of ANN is it can handle a large amount of data. ANN has the ability to detect complex nonlinear relationships between dependent and independent variable. One of the disadvantages of ANN is it has slow convergence speed, less generalizing performance.

3. DETECTION AND RECOGNITION METHODS

Traffic sign detection and recognition is used to detect and recognize the traffic sign that is put on the road or above the road. The detection and recognition of Traffic sign are mainly based on the shape, color, and motion of traffic sign.

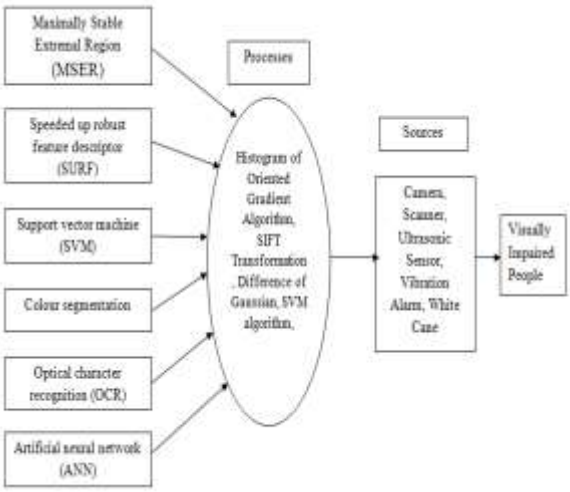

Fig: - Different methods of traffic sign detection and recognition for visually impaired people

3.1 Maximally Stable Extremal Region (MSER)

MSER is used as the method of blob detection in an image. The MSER algorithm extracts from an image a number of covariant regions called MSER. The word extremal refers to a property that the entire pixel inside the MSER has either higher intensity than all the pixels on its outer boundary. This algorithm is used to accurately detect traffic signs and feature vector for each traffic sign is extracted via the histogram of oriented gradient algorithm (HOG).Is a feature descriptor

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used in computer vision and image processing for the purpose of object detection? The histogram of oriented gradient descriptor is the local object appearance and shape within an image can be described by the distribution of the intensity gradient or edge direction. Generally, the traffic sign image is divided into the small number of connected regions called cells, and for finding out the pixels within each cell, a histogram of gradient direction is compiled. The HOG is very high dimensional typically ~4000 dimensions. The basic properties of MSER are that it performs well on the image containing a homogenous region with distinctive boundaries. MSER works well for small regions. MSER doesn't work well with an image with any motion blur. It has good repeatability.

3.2 Speeded Up Robust Feature Descriptor (SURF)

SURF is the best feature-based algorithms have been widely used in computer vision purposes. SURF algorithm is based on the matching principles, but utilizes a different scheme and it should provide better and faster result. It is mainly used in object recognition, image registration etc. The main interest of SURF approach lies in its fast computation of operator using box filters. It is used in real time application for tracking and object recognition. It uses scale-invariant feature transform (SIFT) to extract the local feature in the image. SIFT consist of several steps in that first determine approximate location and scale of salient feature points. Then refine their location. Determine orientation for the key point. Then last is determining descriptors for each key point. In feature point the feature points are detected by using difference of Gaussian (DOG). The Difference of Gaussian is used as a feature enhancement algorithm. This algorithm performs the subtraction operation of one blurred version image from another and less blurred version of the image. In order to find out any case of a grayscale image that is blurred image can be obtained by convolving the original grayscale image with Gaussian kernels having differing standard deviation. The advantages of SURF are that it is more accurate and relatively efficient compared to other algorithm. But there are some disadvantages of using SURF that is it has high dimensionality and it is mathematically complicated, computationally heavy.

3.3 Support Vector Machine (SVM)

SVM is designed to solve the binary classification problem. SVM are supervised learning algorithm which produces reliable performance in pattern

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recognition. Supervised learning is a machine learning technique for the function from training data. The training data consist of pairs of the input object and desired outputs. The output of the function can be used for classification, regression etc. It consists of SVM algorithm which is generally based on two key elements that are a general learning algorithm and a problem specific kernel that computes the inner product of input data points in a feature space. Basically, SVM performs the classification of output by constructing an N-dimensional hyper plane that ideally separates the data into two categories. The goal of SVM is to find the optimal hyper plane that separates the data sets in such a way that the margin between the data set is maximized. The simplest way to divide two categories is with the straight line, flat plane or N-dimensional hyper plane .but it is not possible in order to overcome this problem, the SVM uses a kernel function to map the data in different space. The kernel function transforms the data into higher dimensional space to make it possible to perform the separation. The advantages of SVM is that it can be analyzed

theoretically using concepts from computational learning theory and at the same time it gives the good result when it is applied to a real problem. But the disadvantages of SVM is that the time required is more and its high dimensionality.

3.4 Colour Segmentation

There is a various problem are occurs for detection of traffic sign because some of the traffic sign is faded in color because of weather condition, daytime, contact of object continuous to the sun, many other objects in the street are same in color as that of traffic sign etc. In order to overcome this difficulty HSI color space is used. Colour segmentation is a procedure in which the desired color is included and the unwanted part is removed from an original image in order to obtain the binary image .mainly in RGB color space R corresponds to amount of red color, G corresponds to the amount of green color and B corresponds to amount of blue color. The advantages of using color segmentation is that eliminate unwanted colors, thus the number of edge pixels which are present in the edge detection process get decreases, The complexity of traffic sign decreases since only edge pixels are processed, color segmentation mainly gives information about the border color and the inner color of the sign.

3.5 Optical Character Recognition (OCR)

Optical character recognition is generally considered as a system that provides a

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character that is either a letter or a number for recognition of printed or handwritten characters at electronic speed by simply scanning of character. OCR involve the scanning of photo and the text present in the photo character-by-character, after scanning the analysis of the scanned image is done and then finally conversion of the character image into character codes, such as ASCII is performed. It is widely used as a form of information entry from printed paper records, passport document, bank statement mail etc. OCR can be used for data entry, Automatic number plate recognition, Automatic insurance document key information extraction, extracting business card information into a contact list etc. The advantages of OCR is printed document can be converted into text files, It is extremely fast and accurate because the shaded region is simple to detect, advance OCR can recognize handwritten text and convert them into computer readable text files. But there are some disadvantages OCR cannot recognize all types of fonts, documents that are poorly types or have strikeover cannot be recognized, when a very old document is passed through OCR may not have an exact copy of the text files.OCR is unreliable.

3.6 Artificial Neural Network (ANN)

An ANN is based on a collection of connected units or nodes called artificial neurons. Each connection between artificial neurons can transmit a signal from one node to another. The artificial neurons that receive the signal can process it and then signal artificial neurons connected to it .for implementation of ANN, the signals which are present at the connection between artificial neurons is generally a real number, and the output of each artificial neuron is calculated by a non-linear function of the sum of its inputs. For traffic sign detection ANN is very important it contains an input layer, hidden layer, and output layer. ANN is supervised learning task aims at minimizing the error, thus the difference between the real output generated by the network .for this it compute the output and compares with the desired output. The advantages of neural network is it can learn and does not need to be reprogrammed, it can be implemented in any application, accuracy of ANN is generally high , it works even in the presence of noise with good quality output, when element of neural network fails, it can continue to operate without any problem to their parallel nature. The disadvantages of ANN are requiring training to operate, it requires high processing time for the large neural

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network, large complexity for network structured table.

4. CONCLUSION

This paper gives a brief overview of the different methods used for detection and recognition of traffic signs for visually impaired people and their comparative study based on their performance .mostly MSER and OCR are the most popular method used for detection of traffic sign because MSER and OCR both the methods are simple for implementation point of view. The future scope is introducing a more efficient technique for text detection and recognition from a traffic sign.

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