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REAL TIME INDIAN TRAFFIC SIGNBOARD RECOGNITION USING CONVOLUTION NEURAL NETWORK

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ABSTRACT

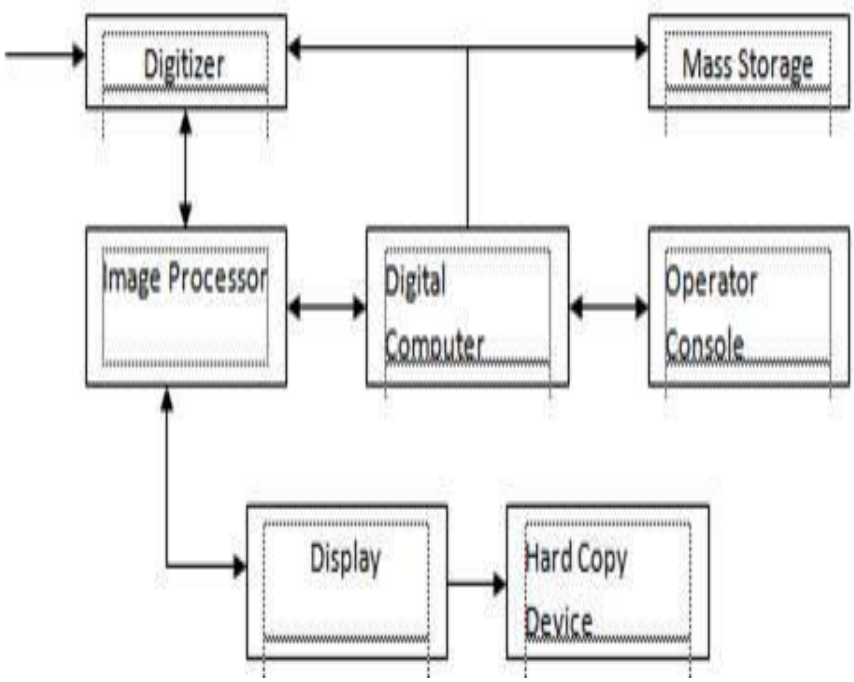
Traffic signs recognition (TSR) is an important part of some advanced driver-assistance systems (ADAS) and auto driving systems (ADS). This System uses variety of image processing techniques to enhance the image quality and to remove non-informational pixel, and detecting edges. This method has a novel-graph based ranking and segmentation approach to detect salient regions, with specified colors, as traffic sign candidate regions. The proposed approach combines information pertaining to the color, saliency, spatial and contextual relationship of modes for traffic sign detection, making it more discriminative and robust than other methods. This has major applications in advance driver assistant systems and auto driving systems (DAS) to help drivers and pedestrian to recognize and be alert which help them to keep safe from road accident and it can also be used in driverless automatic design.

Keywords- Traffic Sign Detection and Recognition, Convolutional Neural Network.

1. INTRODUCTION

The term digital image refers to processing of a two-dimensional picture by a digital computer. In a broader context, it implies digital processing of any two-dimensional data. A digital image is an array of real or complex numbers represented by a finite number of bits. An image given in the form of a transparency, slide, photograph or an X-ray is first digitized and stored as a matrix of binary digits in computer memory. This digitized image can then be processed and/or displayed on a high-resolution television monitor. For display, the image is stored in a rapid-access buffer memory, which refreshes the monitor at a rate of 25 frames per second to produce a visually continuous display.

Figure 1 Block diagram of image processing system



An image processor does the functions of image acquisition, storage, preprocessing, segmentation, representation, recognition and interpretation and finally displays or records the resulting image as in figure 1.1. Image enhancement operations improve the qualities of an image like improving the image's contrast and brightness characteristics, reducing its noise content, or sharpen the details. This just enhances the image and reveals the same information in more understandable image. It does not add any information to it.

Image restoration like enhancement improves the qualities of image but all the operations are mainly based on known, measured, or degradations of the original image. Image restorations are used to restore images with problems such as geometric distortion, improper focus, repetitive noise, and camera motion.

2. LITERATURE REVIEW

This paper introduced a threshold-based method using First-fixation distance. It was linearly related to speed and fixation duration. Road signs were gazed at a much closer distance than their visibility distance. In a second study a staircase procedure was used to test the presentation-time threshold that led to a 75% accuracy in road sign identification. The threshold was 35ms, showing that short fixations to a road signs could lead to a correct identification. The distance of first-fixation to vertical road signs was assessed in 22 participants while driving a route of 8.34km. Fixations to road signs were recorded by a mobile eye-movement-tracking device synchronized to GPS and kinematic data. The route included 75 road signs. First-fixation distance and fixation duration distributions were positively skewed. Median distance of first-fixation was 51m. Median fixation duration was 137ms with a modal value of 66ms.[1].

This paper introduced an overview of some recent and efficient methods in the traffic s T ign detection and classification. Indeed, the main goal of detection methods is localizing regions of interest containing traffic sign, and the detection methods were divided into three main categories: color-based (classified according to the color space), shape-based, and learning-based methods (including deep learning). In addition, classification methods were divided into two categories: learning methods based on hand-crafted features (HOG, LBP, SIFT, SURF, BRISK) and deep learning methods. For easy reference, the different detection and classification methods were summarized in tables along with the different datasets.[2]

In this paper, a fast traffic sign detection method based on a cascade method with saliency test and neighboring scale awareness. In the cascade method, feature maps of several channels were extracted efficiently using approximation techniques. Sliding windows were pruned hierarchically using coarse-to-fine classifiers and the correlation between neighboring scales. The cascade system had only one free parameter, while the multiple thresholds were selected by a data-driven approach. To further increase speed, it used a novel saliency test based on mid-level features to pre-prune background windows. Experiments on two public traffic sign data sets show that the proposed method achieved competing performance and runs 2~7 times as fast as most of the state-of-the-art methods.[5].

Traffic scene perception (TSP) aimed to extract accurate real-time on-road environment information, which involves three phases: detection of objects of interest, recognition of detected objects, and tracking of objects in motion. Since recognition and tracking often rely on the results from detection, the ability to detect objects of interest effectively plays a crucial role in TSP. This paper focused on three important classes of objects: traffic signs, cars, and cyclists. The proposed method detects all the three important objects in a single learning-based detection framework.[7].

3.TRAFFIC SIGN RECOGNITION USING CONVOLUTIONAL NEURAL NETWORK

The proposed method is broadly divided into, data processing, data classification, and training and testing. System uses variety of image processing techniques to enhance the image quality and to remove non-informational pixel, and detecting edges. Feature extractors are used to find the features of image. Deep learning algorithm Convolutional Neural Networks (CNN) is used to classify the different traffic sign images based on their features by using the real time camera. The Convolution Neural Network techn ique used here reduces the processing time and helps us in getting the desired output. Since processing time is reduced, the detection speed becomes high which make this technique more preferable in advanced driving systems. Variety of traffic sign detection algorithms can be added so as to give wider range of options to detect signs more accurately.

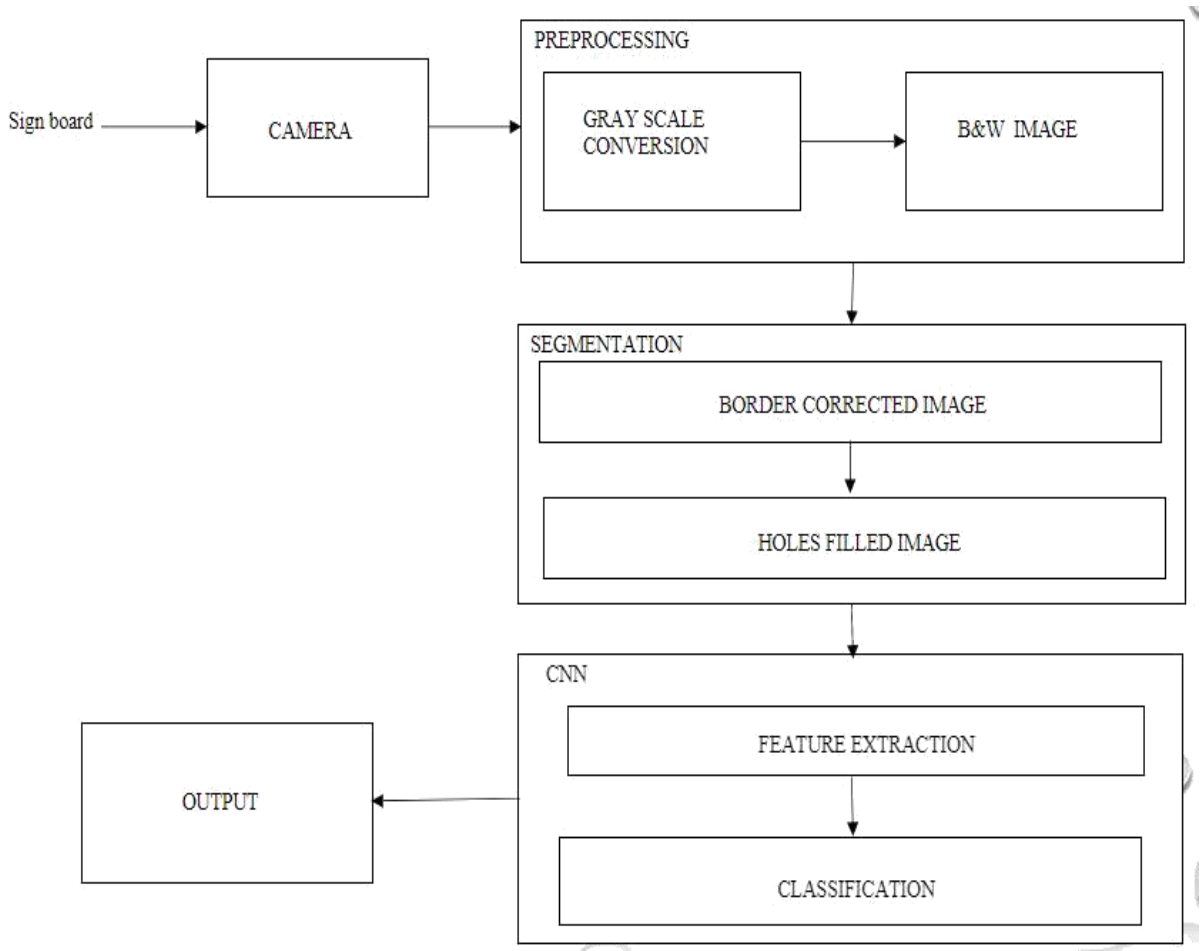


Figure 2 Block Diagram of the Traffic sign recognition using Convolutional Neural Network

In figure 2, all the blocks such as Preprocessing, Segmentation, Convolutional Neural Network from the image are explained in detail.

1)PREPROCESSING

Preprocessing is a common name for operation with images at the lowest level of abstraction both input and output are intensity images. The aim of pre-processing is an improvement of the image data that suppresses unwanted distortions or enhances some image features important for further processing. Image pre-processing methods use the considerable redundancy in images. Neighbouring pixels corresponding to one object in real images have essentially the same or similar brightness value. Thus, the distorted pixel can often be restored as an average value of neighbouring pixels. All the input images are resized into same dimensions. All the input images are resized into same dimensions. If the specified size does not produce the same aspect ratio as the input image, the output image will be distorted. For many applications of image processing, color information doesn't help us. If you get into the business of attempting to distinguish colors from one another, then one reason for converting RGB image to BLACK AND WHITE or GRAYSCALE formats in image.

2)SEGMENTATION

Image Segmentation is a commonly used technique in digital image processing and analysis to partition an image into multiple parts or regions, often based on the characteristics of the pixels in the image. In computer vision, Image Segmentation is the process of subdividing a digital image into multiple segments (sets of pixels, also known as super pixels . Segmentation is a process of grouping together pixels that have similar attributes. Image Segmentation is the process of partitioning an image into non-intersecting regions such that each region is homogeneous and the union of no two adjacent regions is homogeneous Pixels in a region are similar according to some homogeneity criteria such as color, intensity or texture so as to locate and identify objects and boundaries (lines, curves, etc.) in an image. Segmentation accuracy determin es the eventual success or failure of computerized analysis procedure.

Color space conversion is the translation of the representation of a color from one basis to another. This typically occurs in the context of converting an image that is represented in one color space to another color space, the goal being to make the translated image look as similar as possible to the original. Morphological image processing is a collection of non-linear operations related to the shape or morphology of features in an image. Morphology is a broad set of image processing operations that process images based on shapes. Morphological operations apply a structuring element to an input image, creating an output image of the same size.

3)CONVOLUTION

CNN stands for Convolutional Neural Network which is a specialized neural network for processing data that has an input shape like a 2D matrix like images. CNN is typically used for image detection and classification**.** Images are 2D matrix of pixels on which we run CNN to either recognize the image or to classify the image. Identify if an image is of a human being, or car or just digits on an address. In general, the CNN architecture contains three types of layers, which are convolutional layers, pooling layers, and fully connected layers. The CNN algorithm receives an input image that passes through the layers to identify features and recognize the image, and then it produces the classification result. The architecture of the CNN contains alternating convolutional layers and pooling layers, followed by a set of fully connected layers. The output of each layer in the CNN is the input of the next layer.

4.RESULTS AND DISCUSSION

The input traffic sign image of size 480x640 undergoes convolution algorithm and gives a resized output image of size 28x28.The convolutional layer extracts the features of the image and identify which sign it belongs too and gives an alert message to the drivers. For saving the storage capacity and reducing the computational complexity, the original images of size 480x640 pixels are scaled down into 256 × 256 pixels. It goes through a preprocessing block where the input image is converted to black and white by grey scale conversion and the image is complemented. If the extracted input image is blurred or unclear, the segmentation block performs holes filling process where the blank space is filled. The resized image of size 28x28 pixels is given as the output. Then it is given to the convolutional block, here the features of the image are extracted by using the convolution layer and the pooling layer and it is resized. The fully connected layer determines the type of the traffic sign and the output is displayed.

Figure 3 Output obtained from the Convolutional Neural Network

In the figure 3, the input traffic sign image of size 480x640 undergoes convolution algorithm and gives a resized output image of size 28x28.The convolutional layer extracts the features of the image and identify which sign it belongs too and gives an alert message to the drivers.

In Table 1, environment, various weather conditions such as Rainy, cloudy, sunny, camera specification in real time is 30Fps. The image size is 480x640, traffic sign sizes, traffic sign condition such as faded, blurred, clear and traffic sign types such as forward, backward, stop, school zone, pedestrian crossing, left bend ahead and speed limit 60 are mentioned respectively.

1.	Environment	Real time
2.	Weather	Rainy, Sunny, Cloudy
3.	Camera specification	30 Fps
4.	Input Image size	480x640
5.	Traffic sign condition	Faded, Blurred, Clear

Table 1 Environmental condition for Image Processing

5. CONCLUSION

In this proposed paper, a comprehensive review of the literature on TSD is presented. We divide the reviewed detection methods into two main categories: colour-based methods, shape-based methods. The proposed method is broadly divided in five parts. They are data collection, data processing, data classification, training and testing. System uses variety of image processing techniques to enhance the image quality and to remove non - informational pixel, and detecting edges. Deep learning algorithm Convolutional Neural Network (CNN) is used to classify the images based on their features. First, the image is converted to black and white image by grayscale conversion process in preprocessing. Then, it is given to the segmentation block where the image gets partitioned into pixels and the size gets reduced. Now, the image passes through several layers such as maxpool layer, convolution layer, softmax layer and fully connected layer to extract the features and classify the type of traffic or board sign present in it. We also propose a novel graph-based ranking and segmentation approach to detect salient regions, with specified colours, as traffic sign candidate regions. The proposed approach combines information pertaining to the colour, saliency, spatial, and contextual relationship of nodes for traffic sign detection, making it more discriminative and robust than other methods in addressing various illumination conditions, shape rotations, and scale changes of traffic sign images. This system produces very low false positive rate. It works based on real time. When compared to existing system this is advanced technique as it is easy to process. The proposed technique is invariant to scaling, rotation and skewing. In future, it can be used in Advance Driver Assistant System (DAS) to help the drivers and pedestrians to recognize and be alert and can also be used in driverless automation design.

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