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Deep Learning For Traffic-Sign Detection and Recognition-ANN

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ABSTRACT

Traffic Sign Recognition (TSR) system is a significant component of Intelligent Transport System (ITS) as traffic signs assist the drivers to drive more safely and efficiently. This paper represents a new approach for TSR system wheredetection of traffic sign is carried out using fuzzy rules based color segmentation method and recognition is accomplished using Speeded Up Robust Features(SURF) descriptor ,trained by artificial neural network (ANN) classifier . In the detection step, the region of interest (sign area) is segmented using a set of fuzzy rules depending on the hue and saturation values of each pixel in the HSV color space, post processed to filter unwanted region. Finally the recognition of the traffic sign is implemented using ANN classifier upon the training of SURF features descriptor. The proposed system simulated on offline road scene images captured under different illumination conditions. The detection algorithm shows a high robustness and the recognition rate is quite satisfactory. The performance of the ANN model is illustrated in terms of cross entropy, confusion matrix and receiver operating characteristic (ROC) curves.

Keywords: ANN,tsr,surf,its,roc,accuracy

1.INTRODUCTION:

Traffic sign detection and recognition is an important research topic that continuously keeps wider interest to the research in the field of ITS. Because traffic signs illustrate the traffic environment of the road, indicate dangers and complications drivers may encounter, give warnings to them, and guide them in navigation by providing useful informationwhich makes driving safe and convenient. Due to the tremendous increase of road vehicles all over the world, the number of road accidents has also increased significantly. Among different causes of accidents, some major causes are ignorance of the road sign, occlusion of the road sign and distraction of the drivers. A Driver Assistant System (DAS) like TSR helps the drivers and pedestrians to recognize and be alert which help them to keep safe from road accidents. Traffic signs do not look same all over the world. Hence it is not possible to develop a universal TSR system. For Bangladeshi traffic signs no significant research works has been done. Hence we are strongly motivated to do some research in this regard in order to give a new dimension in the research of TSR regarding Bangladesh context. These sign can be classified according to their color and shape and both of these determine the meaning of traffic signs.

2.LITERATURE SURVEY

[1]BithiBanik, and FahimIrfanAlam,Road sign recognition is considered to be one of themost fascinating and interesting field of research in intelligentvehicle and machine learning. Road signs are typically placedeither by the roadside or above roads. They provide importantinformation in order to make driving safer and easier. This paperproposes an algorithm that recognizes Bangla road sign witha better percentage. The algorithm starts with capture imagefrom real video scene, text detection from images, charactersegmentation and recognition of characters through shape matrix.The constructed feature vectors for each individual Bangla roadsign are learned into a neural network which later classifies new instance of Bangla road sign. The promising preliminaryexperimental results indicate a positive potential of our algorithm.

[2]**Xilin Chen, and JieYang**,This paper presents a framework for incremental detection of text from road signs. The approach efficiently incorporates tracking and detection mechanisms into the same framework. The proposed approach first finds a set of discriminative feature points and clusters them into different regions. We then select candidate sign planes by a combination of color and vertical plane models. Within detected road sign planes, theframework selects candidate text regions again base on feature points. The feature points serve a dual purpose: correspondence for tracking if text has been detected in the region and cues of candidate regions for text detection. The framework further verifies candidate text regions using more sophisticated features. Once a text region is confirmed, the tracking algorithm will continuously track

the region. The text region grows as more text around it is detected from frame to frame. Experimental results have demonstrated the feasibility of the proposed framework in incrementally detecting text on road signs over the time from video sequences captured from a moving vehicle

[3]**Yan Han** ,In this paper, a robust traffic sign recognitionsystem is introduced for driver assistance applications and/orautonomous cars. The system incorporates two major operations,traffic sign detection and classification. The sign detection isbased on color segmentation and incorporates hue detection,morphological filter and labeling. A nearest neighbor classifier isintroduced for sign classification. The training features areextracted by SURF algorithm. Three feature extraction strategiesare compared to find an optimal feature database for training.The proposed system benefits from the SURF algorithm, whichachieves invariance to the rotated, skewed and occluded signs.Extensive experimental results show detection accuracy reachingup to 97.54%.

[4]**Zumra Malik, and Imran Siddiqi** Automatic detection and recognition of road signs is an important component of automated driver assistance systems contributing to the safety of the drivers, pedestrians and vehicles. Despite significant research, the problem of detecting and recognizing road signs still remains challenging due to varying lighting conditions, complex backgrounds and different viewing angles. We present an effective and efficient method fordetection and recognition of traffic signs from images. Detection is carried out by performing color based segmentation followedby application of Hough transform to find circles, triangles or rectangles. Recognition is carried out using three state-of-the-artfeature matching techniques, SIFT, SURF and BRISK. Theproposed system evaluated on a custom developed dataset reported promising detection and recognition results. A comparative analysis of the three descriptors reveal that whileSIFT achieves the best recognition rates, BRISK is the most efficient of the three descriptors in terms of computation time.

[5]**Chunsheng Liu, Faliang Chang, Zhenxue Chen,**In this paper, we propose a high-performance traffic sign recognition (TSR) framework to rapidly detect and recognize multiclass traffic signs in high-resolution images. This framework includes three parts: a novel region-of-interest (ROI) extraction method called the high-contrast region extraction (HCRE), the split-flow cascade tree detector (SFC-tree detector), and a rapid occlusion-robust traffic sign classification method based on the extended sparse representation classification (ESRC). Unlike the color-thresholding or extreme region extraction methods used by previous ROI methods, the ROI extraction method of the HCRE is designed to extract ROI with high local contrast, which can keep a good balance of the detection rate and the extraction rate. The SFC-tree detector can detect a large number of different types of traffic signs in high-resolution images quickly.

The traffic sign classification method based on the ESRC is designed to classify traffic signs with partial occlusion.

Instead of solving the sparse representation problem using an overcomplete dictionary, the classification method based on the ESRC utilizes a content dictionary and an occlusion dictionary to sparsely represent traffic signs, which can largely reduce the dictionary size in the occlusionrobust dictionaries and achieve high accuracy.

The experiments demonstrate the advantage of the proposed approach, and our TSR framework can rapidly detect and recognize multiclass traffic signs with high accuracy.

3.PROPOSED SYSTEM:

In this paper we propose a traffic sign recognition system (TSR) for the road signs of Bangladeshi traffic environment.

The system consists of two main components: segmentation and recognition. For segmentation the RGB image is converted to HSV color spaces. Then, the image is segmented using generic fuzzy rules based image processing approach. The hue and saturation values of pixel are used as input parameters for Fuzzy Inference System (FIS) and the boundary color (red, green, blue, yellow) of the sign as output. After this, morphological filtering is applied to reduce noise from the binary image.

To remove the unwanted region, areas and aspect ratio parameters are used to filter the binary image.

Then the region of interest is extracted using bounding box parameters of the segmented area. In the final stage, the recognition of the traffic sign is implemented upon creation of SURF features descriptor and training of the ANN classifier with scaled conjugate gradient back propagation learning algorithm.

BLOCK DIAGRAM

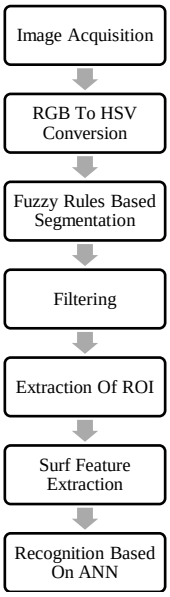

Fig 1: Block Diagram of the proposed system

4.METHODOLOGY:

4.1COLOR CONVERTION

The system consists of two maincomponents: segmentation and recognition. For segmentationthe RGB image is converted to HSV color spaces.

As hue varies from 0 to 1.0, the corresponding colors vary from red through yellow, green, cyan, blue, magenta, and back to red, so that there are actually red values both at 0 and 1.0. As saturation varies from 0 to 1.0, the corresponding colors (hues) vary from unsaturated (shades of gray) to fully saturated (no white component).

As value, or brightness, varies from 0 to 1.0, the corresponding colors become increasingly brighter.

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4.2FUZZY RULES BASED SEGMENTATION

Fuzzy set theory is useful in handling various uncertainties in computer vision and image processing applications. Fuzzy image processing undergoes three steps: image fuzzification, inferences and defuzzification. The crisp inputs to the FIS systems are normalized hue and saturation values of each pixel. In fuzzification the crisp inputs ar mapped into fuzzy linguistic variables to process within the FLS .The linguistic variables that are used for the inputs are: red, green, blue, yellow and noise. The inference system has one output (result). The linguistic values that are used for the output are: red, green, blue, yellow and black. With respective membership functions of the fuzzy inputs, the Mamdani Inference method is performed.

4.3FILTERING AND EXTRACT ROI

Morphological filtering is applied to reduce noise from the binary image. To remove the unwanted region, areas and aspect ratio parameters are used to filter the binaryimage. Then the region of interest is extracted using bounding box parameters of the segmented area.

4.4 SURF Feature Extraction

A speeded-up variant of SIFT which was termed as SURF (Speeded up Robust Features). SIFT computes a 128 dimensional features descriptor of neighbors of each key point based on histogram of local gradients On the other hand. SURF depends on sums of Haar wavelet components.

Instead of difference of Gaussian, SURF is approximated by laplacian of Gaussian with a box filter. Because of using integral images which allow a very fast computation of box type filters, the computation time has reduced significantly in SURF. The detection of interest point is based on the determinant of Hessian matrix.

4.5ANN Classification:

ANN is soft computing tool used for classification, data mining (prediction), pattern recognition, functionapproximation and control system. A neural network is amassively parallel distributed processor made up of simple processing units that has a natural propensity for storingexperiential knowledge and making it available for use. Thebasic component of ANN is neuron which is simple linersumming junction interconnected and layered. Eachconnection is weighted by synaptic values. The output of aneuron depends on the synaptic weight. To training an ANNmeans the adjustment of synaptic weights until desireperformances is met. An activation function allowsdetermining the neurons outputs as a result of weighted sumsof the inputs. The ANN realization requires defining inputs,types of network architecture, training algorithm and transferfunction.

5CONCLUSION

This paper illustrates a new detection and recognition algorithm in the context of Bangladesh road signs using fuzzy rules based segmentation approach in the illumination invariant colour space (HSV) and artificial neural network classifier trained by robust SURF descriptor. The segmentation results illustrate that it is robust in different illumination conditions. This feature vector is invariant to scaling, rotation and skewing of the sign due to robust SURF descriptor. The detection is developed for any traffic sign and recognition is simulated for four types of signs. Here hue and saturation are used as input parameter for fuzzy logic system.After the segmentation, filtering such as morphological analysis and geometrical properties are applied. A precise road sign recognition system with low false positive rate is very crucial to contribute more safety and efficiency. In this regard,the experimental results represent that this system carries significant classification rate. From the confusion matrix it isevident that the overall correct classification rate of the ANN classifier using SURF descriptor is 97 %. In addition, a comparison is drawn among the state of the art classifier where the ANN

6. RESULTS

6.1 Segmentation output

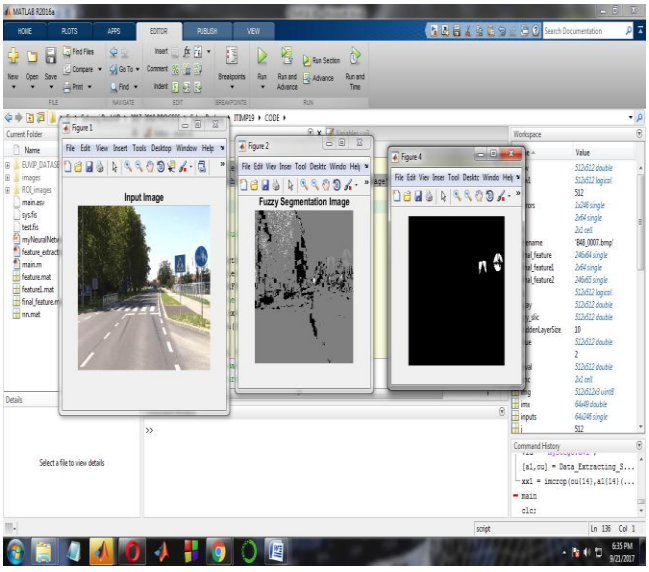

FIGURE 1:Input image

6.2.OUTPUTS

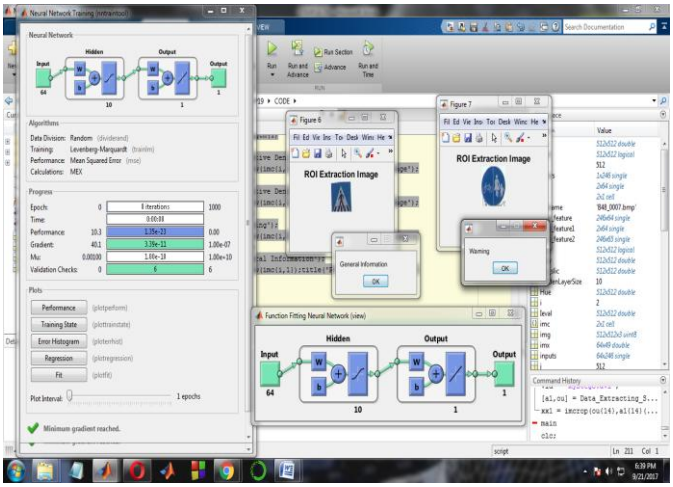

FIGURE 2: Traffic Sign Output detection

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