



## Vehicle Colour Recognition System using CCTV Cameras

Pratishtha Gupta\*, G N Purohit

Computer Science  
Banasthali University, Jaipur, India

Saroj Kumari

Information Technology  
Banasthali University, Jaipur, India

**Abstract**— *Vehicle Color Recognition System is the implementation of automatic detection of predominant color of vehicles from the traffic images captured through CCTV cameras installed at crossings. This document presents a new effective method for extracting color of vehicle using MATLAB, Firstly vehicle is cropped automatically from the traffic image and then color of individual vehicle is picked according to the probability of frequency of RGB intensity of each pixel. The dominant color is presented as vehicle color in the output.*

**Keywords**— *MATLAB, Vehicle Color Recognition, CCTV, Intensity*

### I. INTRODUCTION

Vehicle Color Recognition, a new application and is important especially for Intelligent Transportation System. Vehicle color is the most important factor to determine exterior of vehicle. Color is the significant attribute of the individual to get identified in the traffic images. Vehicle color can efficiently identify the vehicle candidate that can be useful for police force to improve serving performance. In this document, the system to recognize color of an automobile captured in traffic images at the crossings by the CCTV cameras is presented. This can be performed with the help of MATLAB Environment.

For detecting vehicle color, two source images have to be given as input to the system, one is blank road image and other is corresponding road image with vehicles. The two images is subtracted, so that area where vehicles are present can be determined accurately. Individual vehicles at particular coordinates are cropped. Intensity value of individual pixels of cropped vehicle is computed and compared with each other, the RGB intensity having maximum frequency of occurrence is resulted as color of the vehicle. This experiment is done in MATLAB Environment. The paper is organized as follows: Section II presents literature survey of Vehicle color detection. Section III briefly describes about the MATLAB, the image processing environment. Section IV presents the proposed methodology for vehicle color detection. Section V presents the experimental results. Section VI draws conclusion.

### II. LITERATURE SURVEY

#### A. Vehicle Color Detection

Wu Y. T. et al. [1] have proposed a VCC (Video Color Classification) algorithm which was based on refining the foreground mask for removing the undesired regions which was done after obtaining the MDFM (Model-Derived Fore-ground Mask). The Support vector Machine (SVM) based classifier with two layer structure was used for color recognition. Baek N. et al. [2] have also used SVM method to classify feature vectors into five vehicle color classes i.e. black, white, red, yellow and blue. Firstly, converted the vehicle images into an HSV color model-based image, to eliminate distortions, then feature vector is constructed. The color feature of vehicle was detected by Kim K. J. et al. [3] through color histogram, the appropriate number of color histogram bins, which mainly affects the successful recognition rate. Template matching was used to determine vehicle color after generating histogram. After that Buluswar S. D. et al. [4] worked to analyze the variation of object color in outdoor images. For that two approaches were proposed i.e. context- based model of daylight illumination and object color can be non-parametrically learned through classification methods. Forsyth. et al. [5] and Dule E. et al. [6] worked on car color recognition where color samples are picked according to the probability of presence of each color, using Region of interest and feature vector construction methods or Otsu N. et al. [7] used infrared sensors (IR) a traditional method for Automatic Target Recognition (ATR).

Butzke M. et al. [8], Christeet et al. [9] and Mahalanobis A. et al. [10] have focused on processing an image, pixel by pixel and modification of pixel neighborhoods. Transformation can be applied to a partial region or to the whole image. An algorithm was proposed for automatic detection of logo and predominant color of vehicle. Where logo segmentation was done using morphological operators and color was obtained using fuzzy sets and pertinence rules of pixels. A system that able to handle both stationary and moving objects was developed. System must be able to detect, track and handed over moving objects between cameras in real-time. It shows advantages of multiple cameras in order to monitor activities over large areas. The important issues related to tracking including the use of appropriate image attributes, selection of motion models, color and detection of objects was discussed by Yilmaz A. et al. [11]. Moreover, discussed tracking methods based on the object and motion representations.

Pandey S. et al. [12] worked on traffic load computation for real time traffic signal control system to count the traffic load using edge detection, histogram equalization, labeling and removing the noise with the help of median filter.

Whereas Tsin Y. et al. [13] worked to identify and quantify the more significant, heavier vehicle loads to which the city's streets are subjected. Visual sensor networks (VSNs) is discussed by Goyal et al. [14] for identifying moving objects from a video sequence is a fundamental and critical task in computer-vision applications.

### III. PROPOSED METHODOLOGY

The complete procedure is shown in the flowchart:

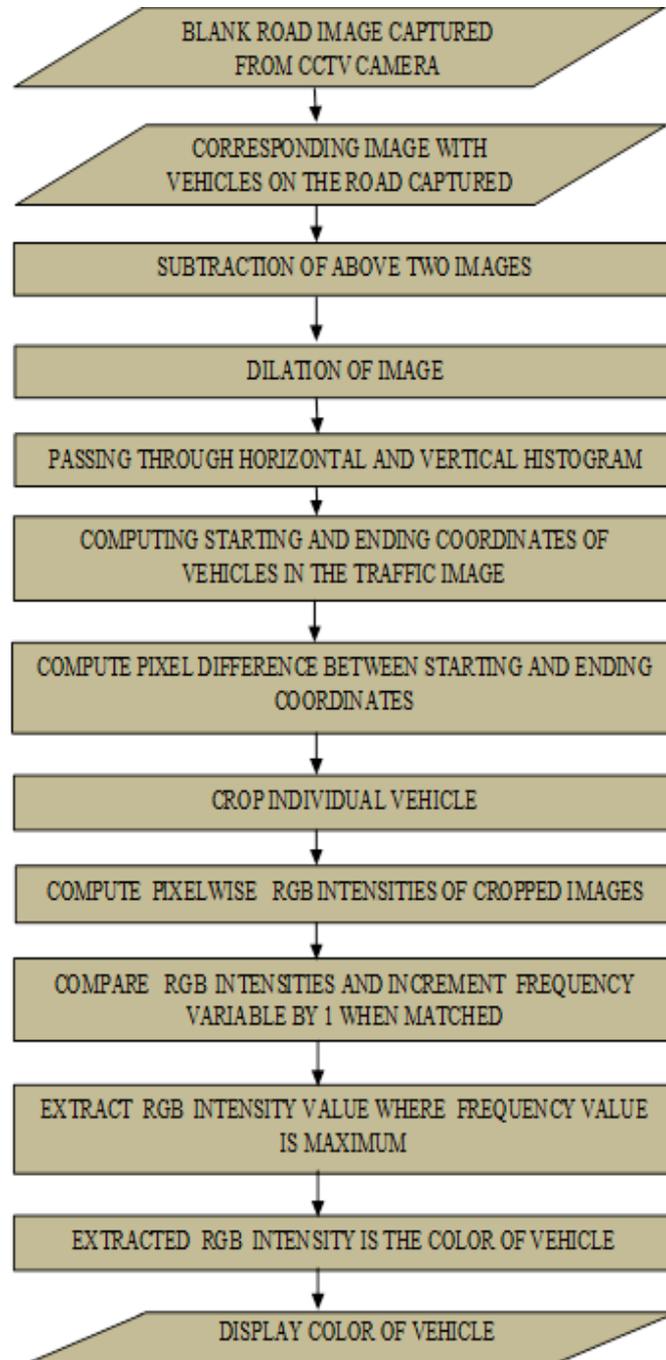


Fig. 1 Vehicle color detection

### IV. EXPERIMENT

MATLAB is most commonly used tool while dealing with problems related to video and image processing. So, MATLAB is used to acquire unique and good solution to the selected problem i.e. "Vehicle color recognition". This experiment can be performed using any version of MATLAB. Output would be obtained either on the command window or on the figure window.

Following steps are used for Vehicle color detection:

#### Step 1: Image Capture

- a) Blank Road Image Capturing

Initially, image is captured at the junction of the road when there is no traffic on the road (Fig. 2).



Fig. 2 Blank road image

b) Image with Vehicles

Now, capture corresponding image with vehicles on road from CCTV Camera (Fig. 3).



Fig. 3 Image with Vehicles on the Road

### Step 2: Subtraction of Images

After capturing the static objects the background image is subtracted from the second image i.e. image with vehicles to obtain the foreground dynamic objects.

Remaining processing is performed on the image that is obtained after applying subtraction (Fig. 4).



Fig. 4 Subtracted image

### Step 3: Dilation

Dilation is performed on image obtained through subtraction (Fig. 5). In this process pixels are added to the boundaries of objects in an image.



Fig. 5 Dilated image

#### Step 4: Horizontal and Vertical Histogram

Horizontal and Vertical edge processing is performed on dilated image by passing dilated image through horizontal histogram (Fig. 6) and vertical histogram (Fig. 7).

It finds all the regions in an image that has high probability of containing vehicles. These histograms represent the differences of gray values between neighboring pixels of an image either column-wise or row-wise. Firstly the horizontal correction is calculated, for this algorithm traverses through each column of an image. In each column, the algorithm starts with the second pixel from the top. The difference between second and first pixel is calculated. If the difference exceeds certain threshold, it is added to total sum of differences. Algorithm will move downwards to calculate the difference between the third and second pixels. So on, it moves until the end of a column and calculate the total sum of differences between neighboring pixels. In end, an array containing the column-wise sum is created. The same process is carried out to find the vertical correction. In this, rows are processed instead of columns. Out of these regions, the one with the maximum histogram value is considered as the most probable candidate.

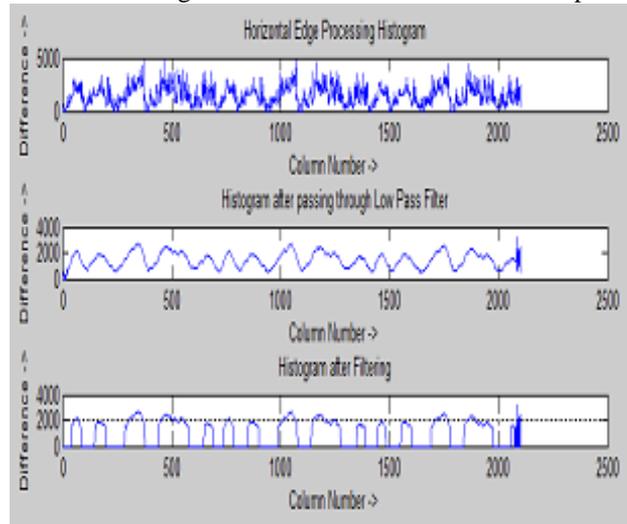


Fig. 6 Horizontal edge processing

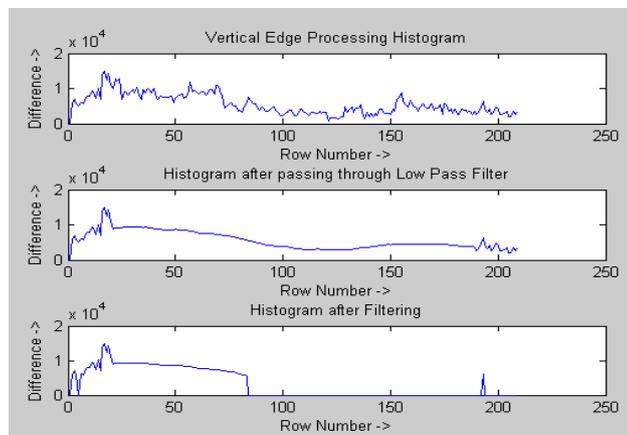


Fig. 7 Vertical edge processing

After applying horizontal and vertical edge processing new image is obtained, as shown is in Fig. 8.



Fig. 8 After passing through horizontal and vertical histogram

**Step 5: Coordinate Detection**

Compute starting and ending coordinates of individual vehicles with respect to row and column in the traffic image obtained after applying Histogram. Coordinate value is reflected when there is sudden change in RGB intensity means positive value of RGB is obtained.

Now, find minimum coordinate value with respect to row and column from where object starts in the traffic image.

**Step 6: Difference Computation**

Now, compute the pixel difference between the coordinates by subtracting Starting and ending coordinates of vehicle.

**Step 7: Cropping**

Automatic cropping of vehicles is performed with the help of inbuilt function “`imcrop(min_column, min_row, difference_column, difference_row)`”, from the image obtained after applying horizontal and vertical edge processing (Fig. 8).

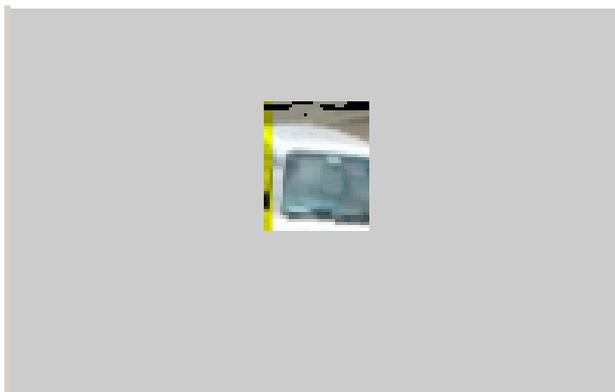


Fig. 9 Image of first vehicle



Fig. 10 Image of second vehicle



Fig. 11 Image of third vehicle

**Step 8: Color Detection**

Each cropped image of vehicle is handled individually and scanned from top to bottom.

- a) Compute pixelwise RGB intensity of cropped vehicle image.
- b) Comparison

RGB intensity of each pixel is compared with each other, a variable i.e. frequency is maintained which is updated when intensity matches with previous intensity. RGB intensity having maximum frequency of occurrence is reflected as the color of vehicle (Fig. 12, Fig. 13 and Fig. 14).

- Color of first vehicle is White as shown in Fig. 12.

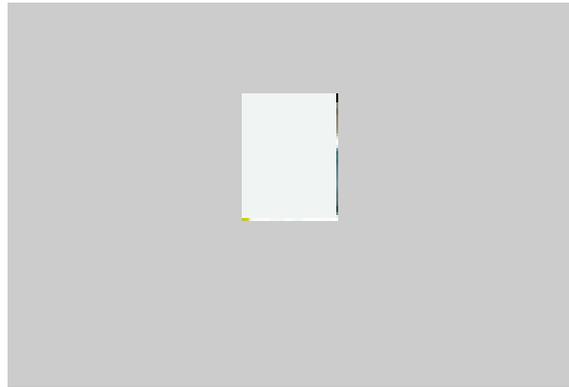


Fig. 12 Color of first vehicle

- Color of second vehicle is Gray as shown in Fig. 13.

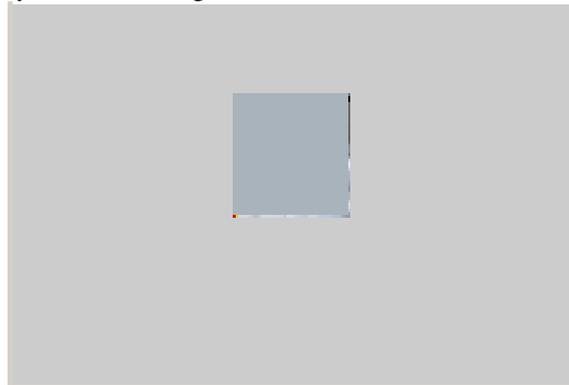


Fig. 13 Color of second vehicle

- Color of third vehicle is dark blue as shown in Fig. 14.

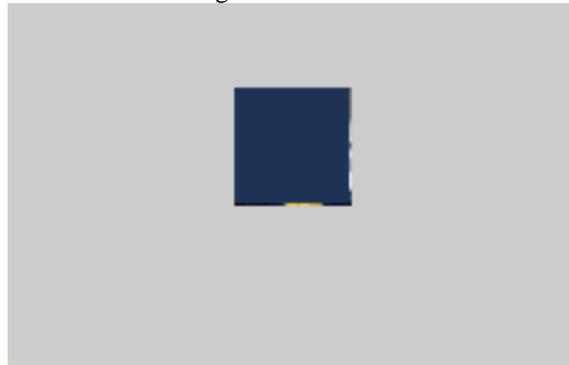


Fig. 14 Color of third vehicle

## V. RESULT

Result of experiment shows, color of vehicles were recognized properly. Experimental result is shown in Table 1.

TABLE I. TABLE FOR RESULT

Technique	Real Time Images	Number of vehicles (4 wheelers)	Color of vehicles correctly recognized	Result accuracy
MATLAB	1	3	3	100%

## VI. CONCLUSIONS

An efficient approach is proposed for the extraction of color from traffic images captured through CCTV cameras at junctions or crossings. This is an important application in Intelligent Transportation system. Experiment shows that color of vehicles (Four wheelers) was properly recognized with 100% accuracy. Experiment was performed using MATLAB environment.

**REFERENCES**

- [1] Y. T. Wu, J. H. Kao and M. Y. Shih, "A Vehicle color classification method for video surveillance system concerning model-based background subtraction", *Advances in Multimedia Information Processing - PCM*, Springer- Verlag Berlin Heidelberg, Vol. 6297, pp. 369-380, 2010
- [2] N. Baek, S. M. Park, K. J. Kim, S. B. Park, " Vehicle color classification based on the support vector machine method", *Advanced Intelligent Computing Theories and Applications. With Aspects of Contemporary Intelligent Computing Techniques*, Vol. 2, pp. 1133-1139, 2007
- [3] K. J. Kim, S. M. Park, Y. J. Choi," Deciding the number of color histogram bins for vehicle color recognition", *Asia-Pacific Services Computing Conference, IEEE*, 2008, pp. 134 – 138
- [4] S. D. Buluswar , B. A. Draper, "Color recognition in outdoor images", *Computer Vision*, 1998. Sixth International Conference, Bombay, Jan 1998, vol.6, pp. 171 - 177
- [5] D. Forsyth. "A Novel Approach for Color Constancy", *International Journal of Computer Vision*, vol. 5, pp 5-36, 1990
- [6] E. Dule, M. Gokmen M. S. Beratoglu, "A Convenient Feature Vector Construction for Vehicle Color Recognition", *recent advances in neural networks, fuzzy systems & evolutionary computing*, ISSN: 1790-5109, pp. 250-255, 2010
- [7] N..Otsu. "A threshold selection method from graylevel histograms", *IEEE Transactiond on Systems, Man and Cybernetics*. Vol 9, pp. 62-66, January 1979.
- [8] M. Butzke, A. G. Silva, M. S. Hounsell, M. A. Pillon," Automatic Recognition of Vehicle Attributes –Color Classification and Logo Segmentation",*Hifen, Uruguaiana*, Vol.-32, pp. 293-300, 2008
- [9] S. A. Christe, M. Vignesh, A. Kandaswamy, "An efficient FPGA implementation of MRI image filtering and tumour characterization using Xilinx system generator", *International Journal of VLSI design & Communication Systems (VLSICS)*, Vol. 2, No. 4, pp. 95-109, December, 2011
- [10] M. Y. Siyal, M. Fathi, M. Atiquzama, "A Parallel Pipeline Based Multiprocessor System for Real- Time Measurement of Road Traffic Parameters", *Elsevier*, Vol. 6, No. 3, pp. 241-249, June 2000
- [11] A. Yilmaz, A. Javed, M. Shah," Object Tracking: A Survey", *CSUR Journal (ACM Computing Surveys)*, vol. 38, issue. 4, Article no.13, pp. 1-45, 2006
- [12] P. Gupta, G. N. Purohit, S. Pandey," Traffic Load Computation for Real Time Traffic Signal Control", *International Journal of Engineering and Advanced Technology*, ISSN: 2249 – 8958,Vol. 2, Issue-4, pp. 891-895, April 2013
- [13] Y. Tsin, R..T. Collins, T. Kanade, and V. Ramesh. Bayesian color constancy for outdoor object recognition. In 2001 IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR-01)-Volume 1, p.1132, 2001
- [14] H. Goyal, "Frame Differencing with Simulink model for Moving Object Detection", *International Journal of Advanced Research in Computer Engineering & Technology*, Vol-2, Issue-1, pp.263-266, January 2013