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Vehicular Classification and Analytics Using haar Based Classifier

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Abstract: *Object detection is an important part of computer science. The main focus of the project is to identify different types of vehicles from a video. Types of the vehicle will be car, trucks, motorcycles .There will be a requirement of a significantly large training set for actual differentiation. Training set will consist of photos of various types of vehicles as stated above. A video of traffic will be supplied after the training is completed. The types of vehicles from the video will be identified. A vehicle counter will be applied which will give the number of vehicles of each type.*

Keywords*: Object Detection, Training Set, ADABOOST (Adaptive Boosting), Haar-based classifier.*

1. INTRODUCTION

Vehicular congestion is one of the major concerns in the urban cities. 141866 thousand registered vehicles are currently running on the Indian roads as measured in the year 2011.

According to regional transport office (RTO), every day 500 new non-commercial vehicles in Pune get registered including two wheelers and four wheelers. This shows how severe the problem of traffic congestion is going to be in the near-future.

Vehicular theft is another problem. As many as 84 cases vehicular theft are reported in the national capital everyday with acute shortage of parking space and reluctance of car owners in installing anti-auto equipment being blamed for the rising cases. We could also blame the cost of the security equipment.

The solution to the problem is the real-time analysis of the data in order to effectively redirect traffic to minimize load on certain roads in the cities.

The above mentioned problems can be tackled effectively with the use of computer vision.

By using vehicular detection along with vehicular counter it is possible for us to redirect and analyse traffic at real-time.

The goal of the project is to detect and classify the vehicles into different types using haar classifiers. It has the ability to detect vehicles at faster speed, this detection is achieved by using adaboost or Adaptive Boosting. After the detection of the vehicles, we will perform analysis on the data that is gathered.

If the system is implemented we can get to several solutions on how to treat the problem of traffic management by performing analysis of the collected system.

Suppose there is an accident on some road ahead then we can redirect traffic to alternative routes.

2. LITERATURE SURVEY

1. Reliable Classification of Vehicle Types Based on Cascade Classifier Ensembles

Vehicle-type recognition based on images is a challenging task. This paper comparatively studied two feature extraction methods for image description, i.e., the Gabor wavelet transform and the Pyramid Histogram of Oriented Gradients (PHOG). The Gabor transform has been widely adopted to extract image features for various vision tasks. PHOG has the superiority in its description of more discriminating information. A highly reliable classification scheme was proposed by cascade classifier ensembles with reject option to accommodate the situations where no decision should be made if there exists adequate ambiguity.

2. Traffic sign recognition system for autonomous vehicle using cascade SVM Classifier

Camera provides a lot of information and is low-cost device rather than other sensors. Traffic road sign, as one of the important information from camera, carries a lot of useful information that are required for navigating. Thus, in this work, traffic sign detection and recognition is addressed.

3. Vehicle Detection Method using Haar-like Feature on Real Time System

This paper presents a robust vehicle detection approach using Haar-like feature. It is possible to get a strong edge feature from this Haar-like feature. Therefore it is very effective to remove the shadow of a vehicle on the road. And we can detect the boundary of vehicles accurately.

4. Scalable Traffic Video Analytics using Hadoop Map Reduce

Road traffic video analytics aims at using a number of techniques to achieve better traffic and road safety, control congestion and provide immediate care for accident victims. In this paper, we propose a near real-time traffic analytics system which can automatically detect road accidents from live video streams.

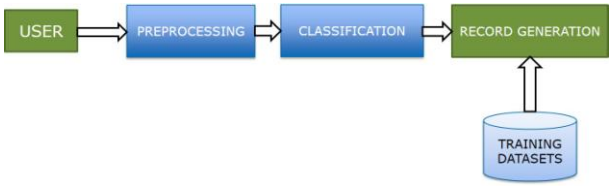
3. SYSTEM ARCHITECTURE

Overview

The system architecture consists of 3 modules namely Pre-processing, Classification and Record generation.

Pre-processing consists of training the classifier using positive and negative samples. In classification phase, we need to classify the vehicles from the video feed in 3 categories: Bikes, Cars and Trucks

On the classified vehicles, we need to perform analysis in order to generate traffic records. The analytics consists of the type of vehicle, the instance for that type of vehicle and related timestamps.



Sub-modules in classification

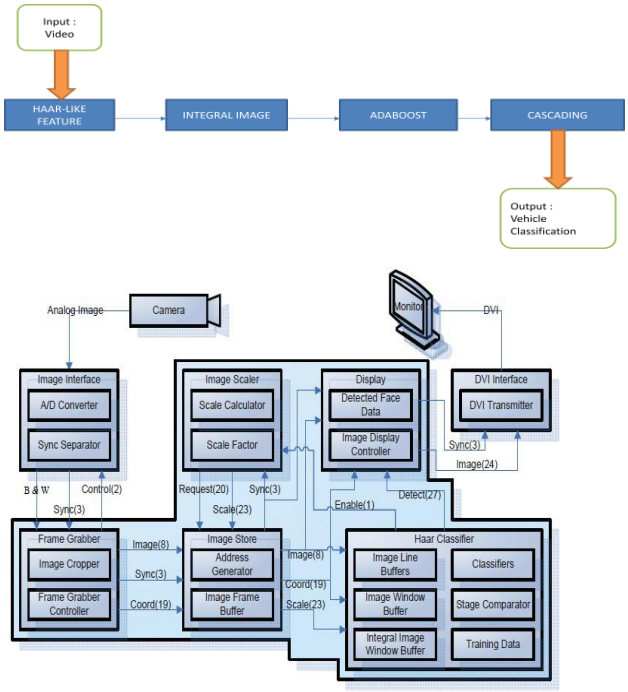


Fig: *Architecture diagram*

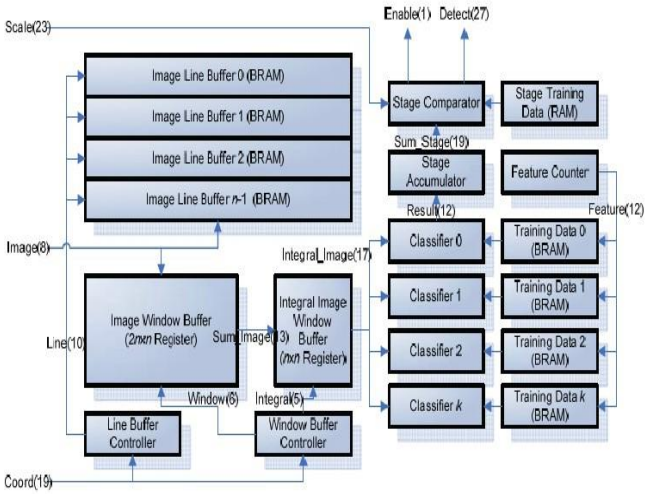


Fig: *Haar classifier*

4. WORKING

1. Capture of live videos feed: cameras monitoring freeways and arterials are captured for video frame processing by a USB frame capture device. The video feeds are captured at various locations at different time of the day. Also, the cameras are sometimes-tilt-zoom cameras with varying camera field of view. Also, the height of the camera mounted is unknown.

2. Pre-processing of video frames: Using a GUI tool developed as part of our vehicle detection system, the user can select the region of interest on the captured video frame. The detection and tracking algorithms are only performed on this cropped image region to reduce the processing time of the system. The user is required to specify detection and speed zones using horizontal virtual reference lines. The detection zones are areas where the interest points are evaluated, vehicles detected and vehicle counts are incremented. The speed zones are adjacent to the detection zones, where the interest points are reevaluated and vehicles are detected.

As a rule of thumb, the detection zone length should be less than the vehicle length as seen in the video feed and the speed zone length should be just greater than the vehicle length as seen in the video feed. The user specifies the virtual vertical lane reference lines that segment the lanes on the video frame. These vertical lines are used to determine vehicle counts by lane. Also, the user specifies the direction of vehicle motion or traffic flow, the calibration reference line and the corresponding distance in physical distance. This reference distance is used to evaluate the speed of the vehicle.

3. Smoothing: Due to low quality of image captured from cameras (24 24 pixels), smoothing of the image to eliminate noise is performed. Gaussian smoothing is usually used for smoothing.

4. Color conversion: This task converts the color image/frame in the Region of Interest (RIO) from color values to gray-scale values. The video frames captured by the frame grabber device are in additive RGB color format.

5. Vehicle detection and counter increment of respective class: From the captured video we need to detect the vehicle using haar classifiers. By giving the input of positive and negative images we will train the classifier for detection .If detected then increment the counter of the respective class.

5. SYSTEM SPECIFICATIONS

Hardware Interfaces

- Keyboard
- Mouse
- Touch Pad
- Network Connections if we are providing live video feed
- Access Point for WLAN in case of LAN connections

Software Interfaces

- Front End - Application or GUI
- Back End – System or Classifier

Hardware and Software Requirements

Hardware requirements:

Sr. No.	Parameter	Minimum Requirement
1	CPU Speed	500 Mhz Pentium 3 processor
2	RAM	256 MB RAM
3	GRAPHICS	3D OpenGL compatible graphics accelerator card

Software requirements**:**

1. Operating System: Windows

2. Programming Language: Python

Advantages

- Can be used for real-time monitoring security applications.
- Maintaining records of number of vehicles passed by.
- When using haar classifiers, adaboost algorithm is very essential as it enhances the speed of detecting the vehicles.
- It provides a flow to traffic system in crowded places.
- Video detection enables freeways on special events on important roads.

Disadvantages

- Most of the time is utilized in training the classifier.
- It is difficult to detect vehicles at night time due to darkness and illusion of light.
- Difficult to differentiate between positive and negative images.

6. FUTURE SCOPE

1. Detection of stolen vehicles: Through CCTV's that are installed in various societies , on roads, college campuses or any other area we can detect stealing of vehicles.

2. Effective traffic management: Due to increase in individual's use of vehicles, on road traffic is increasing day by day and so there is need of proper traffic handling. This can be done by vehicle detection.

3. Number plate Detection: Depending upon the position of the camera number plate can be detected for any crime scene. Even, vehicles who break the law can be detected.

4. Helmet detection: Rider who is not wearing helmet can be detected.

5. Processing: problem is related to symbol extraction from number plate image and further symbol recognition.

This will help in the progress of automatic number plate registration and recognition. Also the same concept can be used for Traffic Light Control wherein the timer of the signal for its corresponding road is automatically increased or decreased depending upon the traffic density on the particular road facing the camera

7. CONCLUSIONS

This paper summarizes the use of Haar-based classifier for vehicular classification. This algorithm allows us to classify the vehicles efficiently, reducing the computations.

This Project is associated with two stages:

1. Training Stage. 2. Detection Stage.

1. Training Stage: In this stage, images are given as input on which we apply various mechanisms to train the classifier. These stages are:

Haar-feature selection, Integral image, Adaboost, Cascading.

2. Detection Stage: In this stage, video feed is given as an input on which the trained classifiers are applied to get the desired output.

After applying above two stages analysis will be performed on gathered data to classify which type of vehicle it is.

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