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Real Time Animal Detection System using HAAR Like Feature

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ABSTRACT : Among the many problems faced by the country,deaths and injuries due to road traffic accidents is extremely common. Collision with an animal is one of the major reasons which lead to these accidents. In this paper, we are discussing a ' Real time animal detection system on highways' which could reduce the animal vehicle collision. Viola and jone algorithm is used for facial feature detection. In this paper, we discuss animal detection using viola and jone algorithm for animal detection.

KEYWORDS: Animal detection, Haar like feature, Classifier, Machine learning, Open CV

I. INTRODUCTION

With over-rising trend Road accident has been a worldwide calamity. Due to road accidents in the world owing to the dangerous driving habit and poor infrastructure in India suffers from the highest number of deaths –around 1,05,000 in absolute terms annually. The increasing number of traffic accidents due to a reduced driver's alertness level has become a serious problem for the society. Statistics show that 20% of all the traffic accidents and up to one-quarter of fatal and serious accidents are due to drivers with reduced alertness level [1].

Highway safety is becoming a major social issue with the number of vehicles increasing day by day, and due to different traffic conditions, crashes can happen with other vehicles, human as well as animals.
The demand for increased safety, ease, and security Modern Vehicle design is pushed. Most of the accidents take place due to the collision with object and motorist. One time a report on the causes of road accident in India, 2011 is shown in fig 1.

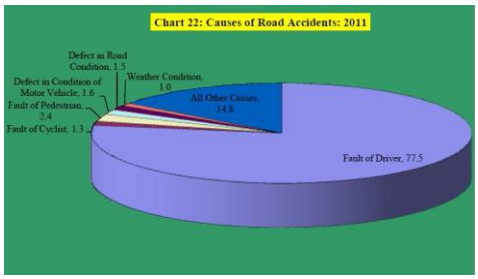

Fig 1: Causes of road accident in India [4]

Fig 1 shows that most of the accident occurs due to the driver fault. This accident can take place with the collision with pedestrian, obstacle, animal and other object. Tons of study has been performed in automatic lane detection, vehicle detection, and pedestrian detection, but research is still failing on the animal detection. Referable to the large number of real life application, animal detection is challenging and an emerging area.

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The animal detection system is mainly divided into two categories: on board and road side systems. Roadside system installed at the road edges to find animals. When an animal is identified, drivers are notified through flashing signs installed at the border on the highway. On the other hand on board systems, which are installed in cars, warn drivers when animals are found.

In this paper, the algorithm is largely based on the work of viola and jone from 2001. It is a popular method that has been widely used has mainly been developed & evaluated for face detection rather than animal detection. The algorithm operates in the next way: A classifier is trained using positive and negative image region of an object of the same size. The classifier consists of several so called weak classifiers, containing of Haar like feature [5], Which are trained using a boosting technique called adaboost[5]. The boosted weak classifiers are combined into a cascade classifier [5]. The idea is to reject the lost of non- objects in the early levels where the computation is light, reducing processing time.

II. LITERATURE SURVEY

In the past, different techniques for detection and tracking of animals have been used by many researchers. Work done in [7] showed that in Saudi Arabia, the number of collisions between the camel and the vehicle was estimated more than hundred each year. To prevent this collision, an intelligent Camel Vehicle Accident Avoidance System (CVAAS) was designed using GPS (global positioning system). In [8] showed the different animal detection methods and this method have some limitation like lighting problem and speed of the animal cannot monitor, then this paper also showed the templet matching mechanism using the normalize cross correlation method to detect the animal but this animal detection method is taking a lot a time. For finding the correct position of fishes in the sea, researchers in [9] designed a technique using LIDAR (light detection and ranging). Work done in [10] showed the viola and jone algorithm. It helps in achieving a high detection rate. And there are three main parts of this algorithm Integral Image which allows very fast feature evaluation. Classifier function which is built using the smallest number of important features. The method of combining the classifiers in a cascade structure to increase the speed of the detector by focusing on the promising regions of interest.

III. BRIEF OVERVIEW OF HAAR FEATURE AND CLASSIFIER:

A. *Why use the feature [5]:*
A feature is the characteristic that is used to distinguish objects from nonobjects. The two main reasons why futures are used instead of using the pixel values directly are that it improves speed and that they can capture different kinds of properties in an image.

B. *Haar features [5]:*
Haar features, also known as Haar-like features, are a simple and inexpensive image feature based on intensity differences between rectangle-based regions that share similar shape to the Haar like wavelet. Haar features are used in object recognition as they feature digital image. They owe their name to the similarity with Haar wavelets. Viola and Jones joined their hand and found out the idea of using Haar wavelets and developed the method named Haar-like features.
The difference in pixel value between adjacent rectangles is used as features. The features can be seen in fig 2. The value of the pixels in the white rectangle is subtracted from the value of pixels in the black rectangle.

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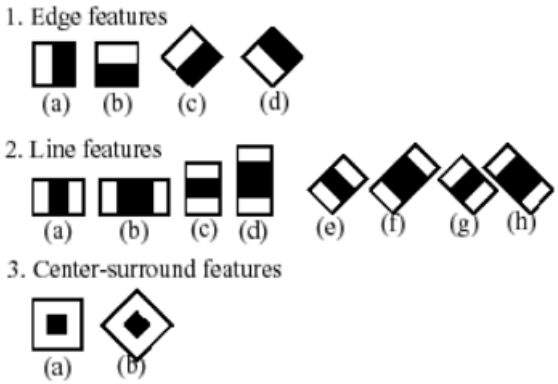

Fig 2: Haar feature [5]

To speed up the calculation of the features in integral image is used. The integral image at location *(x, y)* contains the sum of the pixels above and to the left of x and y. It is the summation of all the pixel values in an original image.
The object detection is described below using Haar like feature. And also use the classifier (namely a cascade of boosting classifier working with Haar like features). Classifier is used to search the object in the whole image.

C. *Classifier [5]:*

The word "cascade" in the classifier means that resultant classifier consists of several simpler classifiers that are applied subsequently to a region of interest until at some stage the candidate is rejected or all the stages are passed, The word boosted means that the classifiers at every stage of the cascade are complex themselves and they are built out of basic classifiers using gentle adaboost.

IV. PROPOSED METHOD

Fig 3 shows the block diagram of the proposed system. Video is taken from the camera in which moving animal is there from other stationary and non-stationary objects. This video is converted into a frame. After finding the different images, create a database: Positive and negative. In Positive images correspond to image with detected animal and negative images correspond to image with non detected animal. And then find the specific feature using Haar like feature extraction method. After that training the Haar feature using Opencv and generate the XML file. Using XML file testing the classifier.

Fig 3: Block diagram of proposed system

V. IMPLEMENTATION

For implementation part, we have to use the OpenCV software.

A. *OpenCV [6]:*

OpenCV(Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision, developed by Intel Russia research center in Nizhny Novgorod, and now supported by Willow Garage and Itseez. [6] It is free for use. The library is cross-platform. It focuses mainly on real-time image processing. If the library

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finds Intel's Integrated Performance Primitives on the system, it will use these proprietary optimized routines to accelerate itself. OpenCV is written in C++ and its primary interface is in C++.

Why OpenCV?
Speed:
Matlab is built on Java, and Java is built upon C. Then when run a Matlab program, the computer is busy trying to understand all that Matlab code. Then it turns it into Java, and then lastly performs the code. OpenCV, on the other hand, is basically a library of functions written in C/C++. You are near to directly provide machine language code to the computer to get performed. And then in the end you get more image processing performed in your computers processing cycles, and not more understanding. As a minute of this, programs written in OpenCV run much quicker than similar program written in Matlab.
Resources needed:
Referable to the high level nature of Matlab, it uses a portion of your system resources. Matlab code requires over a gig of RAM to run through the video. In comparison, typical OpenCV programs only require ~70mb of RAM to play real-time. The difference is Vast.

Cost:
OpenCV is open source and free for business and commercial use both. MATLAB is a licensed version.

Visual studio 2010:
We have used Microsoft visual studio 2010 as a programming platform for writing, compiling and running my OpenCV codes, it's very comfortable to integrate OpenCV libraries with visual studio and it is quick and effective.

B. *Following steps were taken out during the implementation phase:*
1) Capturing the video
2) Create the database
3) Feature extraction using haar features
4) Training
5) Testing

1) Capturing the video:
For capturing the real time video, we have used the camera and a webcam. For over algorithm we have used the stored real time videos.

2) Create the dataset:
After capturing the video, we have created the frame and create the dataset. One is Positive dataset and second is negative dataset. In positive dataset contains an image with detected animal. And negative dataset contains non detected animal. Negative dataset is also called background data set.

3) Feature extraction using haar features:
Haar features are composed of either two or three rectangles. Animal are scanned and searched for haar features of the current stage. The weight and size of each feature and the features themselves are generated by the learning algorithm AdaBoost. Each Haar feature has a value that is calculated by taking the area of each rectangle, multiplying each by their respective weights, and then summing the results. The area of each rectangle is easily found using the integral image. The coordinates of the any corner of a rectangle can be utilized to find the total of all the pixels above and to the left of that location using the integral image. By using each corner of a rectangle, the area can be computed quickly.

4) Training steps:
Training of Haar-like feature based classifiers includes several steps as described in [3]. It is required to collect positive images that contain only objects of interest (animal in the present context) as well as the negative images which is devoid of the object of interest to build the classifier. The following steps are taken to obtain the final classifier in XML format using Intel's Open Computer Vision (OpenCV) library.

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1) Collection of training images containing animal in different orientation under varying light.
2) Find the ROI (Region of interest) animal in the present setting.
3) Positive and negative images were generated along with corresponding informative text files like ‘ positive.txt’ and ‘negative.txt’. Text file contains the coordinates of the positive and negative training samples along with their names in a specified order. The name of the image file contains following format.

< File Name > < x > < y > < width > <height > .jpg

Where x, y, width, and height define the object's bounding rectangle.
4) A vector (. vec) file is obtained from the text files generated in the previous step. The vector file contains compact information of positive instances of objects and the negative image such as background.
5) The classifiers are trained using the vector file.
6) Once the Haar training was complete, the output was stored in the specified directory in the form of text files. The last measure of the procedure was to convert these files into a single XML file was the final classifier.

5) Testing:

Using this xml file test the video and get the output with detected animal.

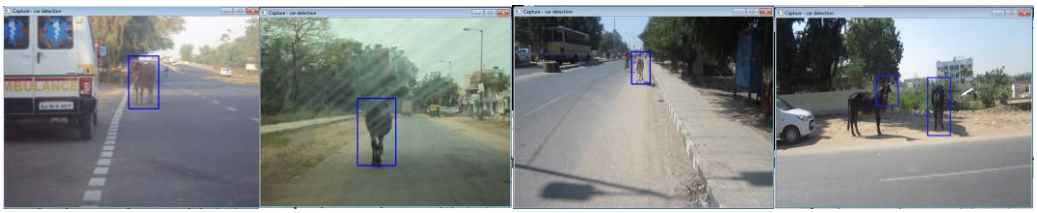

Fig 4: Detected Animal

We have taken same different real time videos and find the output with the detected animal, result is shown in in fig 4.
Fig 4 shows the detected animals in the frame using haar like feature method.

VI. CONCLUSION

Automatic animal detection systems can help us in reducing the number of accidents. Collision between vehicle and animal is harmful to everyone. In this paper, we discussed the importance of animal detection system and next we explained our method based on viola and jone haar like feature detection method for animal detection. The algorithm presented in this paper forms the basis of many ‘Real time system’ which gives accurate results in less time for detection of animals.

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