Drowsiness Detection System Using MATLAB

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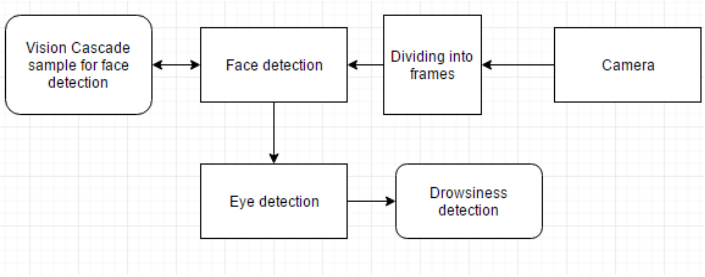
Abstract—Life is a precious gift but it is full of risk. Therefore, there is a need to take safety precautions in order to avoid accidents. Now-a-days, road accidents have become one of the major cause of insecure life. It is very important to take proper care while driving. Carelessness for a single minute can cause major problems. Most of the road accidents occur due to carelessness and inactiveness of the driver while driving. This is the reason, every year the number of road accidents is increasing especially by cars. Due to drowsiness, drivers become inactive while driving. Drowsiness detection could have saved number of lives if it could have been detected earlier. Development of drowsiness detection is due to the use/help of machine vision-based concepts. In order to detect fatigue or drowsiness, small camera has been used which points directly towards the driver's face and detects the eye ball movement of the driver. At the very first stage, system detects the face and then detects the eyes and then determines whether the eye detected is open or closed. Changes between the intensity in the eye takes place due to which, it narrows down area of the eye and further gives information to the system. Within a time limit, a system gives information that the driver is falling asleep and there is a need to alert him/her.

Index Terms—Viola Jones algorithm, Hough Transform, Vision Cascade Object Detector, Image Acquisition.

1 Introduction

As the survey done, driver fatigue is the major reason why half (50 %) of road accidents takes place. It is an interesting challenge in today's date to detect drowsiness in order prevent accidents. Various experiments have been done earlier with regard to the drowsiness detection of driver. In the past few years, many countries became curious to pay high attention towards driver's safety problems. Researchers have been making various efforts to invent techniques for the detection of drowsy driver such as monitoring of road and physiological techniques which requires the contact of electrode with our body such as chest, face making it an implantable method. In this thesis, we described the direct method which can detect drowsiness without any help of electrode using various detection function.

2 Proposed Work



2.1 Image Acquisition

It mainly involves obtaining the image of the Automobile driver. It can be acquired with the help of camera with diving into different frames. Live image is taken as its input and then it converts those images into the series of images which are further proceed to make various operations.

2.2 Face Detection

Face detection activity takes one of the frame at a time 't' from frame grabber which later tries to detect the face of Automobile driver in every frame. And it can be done with the help of Vision Cascade samples.

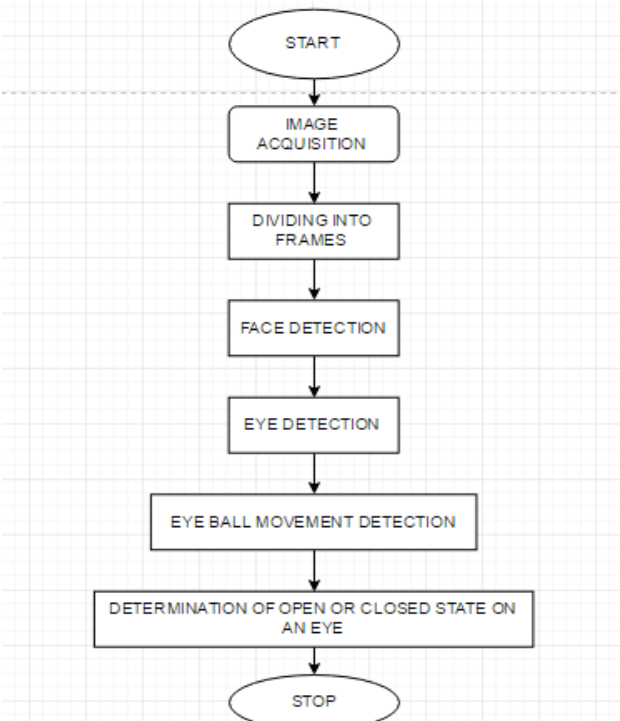
2.3 Eye Detection

After detecting the face of Automobile driver with the face detection function, the eyes detection can be done with the help of eyes detection function. This can be done with Voila Jones Algorithm.

2.3 Drowsiness Detection

Once the eyes of Automobile driver are detected, the drowsiness detection function detects whether the driver is drowsy or not, by taking into consideration whether the eyes are open or closed that is the state of the eyes.

3 Flow Charts



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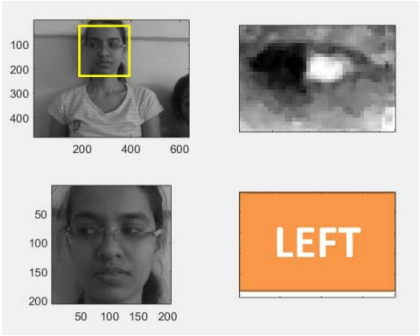
4 MATLAB CODE

```
clear all
clf('reset');
cam=webcam();  %create webcam object
right=imread('RIGHT.jpg');
left=imread('LEFT.jpg');
noface=imread('no_face.jpg');
straight=imread('STRAIGHT.jpg');
detector = vision.CascadeObjectDetector(); % Create a detector for face using Viola-Jones
detector1 = vision.CascadeObjectDetector('EyePairSmall'); %create detector for eyepair
while true % Infinite loop to continuously detect the face
vid=snapshot(cam);  %get a snapshot of webcam
vid = rgb2gray(vid);   %convert to grayscale
img = flip(vid, 2); % Flips the image horizontally
bbox = step(detector, img); % Creating bounding box using detector
if ~ isempty(bbox)  %if face exists
biggest_box=1;
fori=1:rank(bbox) %find the biggest face
ifbbox(i,3)>bbox(biggest_box,3)
biggest_box=i;
end
end
faceImage = imcrop(img,bbox(biggest_box,:)); % extract the face from the image
bboxeyes = step(detector1, faceImage); % locations of the eyepair using detector
subplot(2,2,1),subimage(img); hold on; % Displays full image
fori=1:size(bbox,1)   %draw all the regions that contain face
rectangle('position', bbox(i, :), 'lineWidth', 2, 'edgeColor', 'y');
end
subplot(2,2,3),subimage(faceImage);    %display face image
if ~ isempty(bboxeyes)  %check it eyepair is available
biggest_box_eyes=1;
fori=1:rank(bboxeyes) %find the biggest eyepair
ifbboxeyes(i,3)>bboxeyes(biggest_box_eyes,3)
biggest_box_eyes=i;
end
end
bboxeyeshalf=[bboxeyes(biggest_box_eyes,1),bboxeyes(biggest_box_eyes,2),bboxeyes(biggest_box_eyes,3)/3,bboxeyes(biggest_box_eyes,4)];  %resize the eyepair width in half
eyesImage = imcrop(faceImage,bboxeyeshalf(1,:));    %extract the half eyepair from the face image
eyesImage = imadjust(eyesImage);   %adjust contrast
r = bboxeyeshalf(1,4)/4;
[centers, radii, metric] = imfindcircles(eyesImage, [floor(r-r/4) floor(r+r/2)], 'ObjectPolarity','dark', 'Sensitivity', 0.93); % Hough Transform
[M,I] = sort(radii, 'descend');
eyesPositions = centers;
subplot(2,2,2),subimage(eyesImage); hold on;
viscircles(centers, radii,'EdgeColor','b');
if ~isempty(centers)
pupil_x=centers(1);
disL=abs(0-pupil_x);      %distance from left edge to center point
disR=abs(bboxeyes(1,3)/3-pupil_x);%distance from right edge to center point
subplot(2,2,4);
ifdisL>disR+16
subimage(right);
else if disR>disL
subimage(left);
else
subimage(straight);
end
end
end
end
else
subplot(2,2,4);
subimage(noface);
end
set(gca,'XtickLabel',[],'YtickLabel',[]);
hold off;
end
```

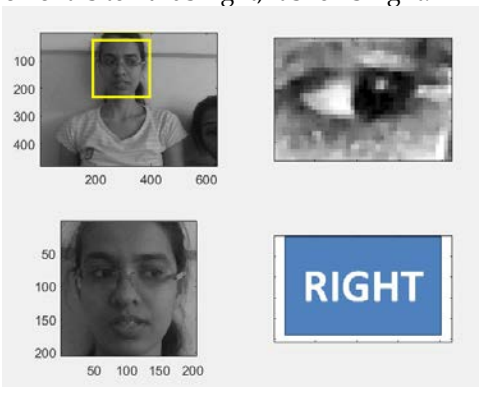
5.RESULTS

5.1EYEBALL MOVEMENT

When the eyes move towards the left side i.e., when the eye ball movement is towards left, it shows left.



When the eyes move towards the right side i.e., when the eye ball movement is towards right, it shows right.

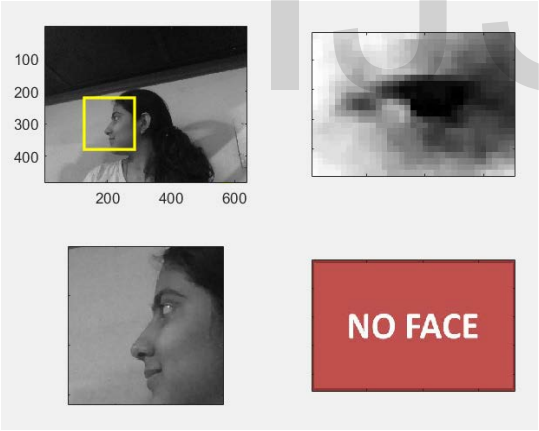


5.2 Eyeballs Straight

When the eyes do not move to any side i.e., when the eye ball sees straight, it shows straight.

5.2 Eyeballs Not Visible

When there is an obstacle in between the eye and web-cam or if there is a random movement, then it shows No-Face



6 Description

An image here is processed with the help of Viola Jones Algorithm. In the first step, the face is detected and then the eyes are sectioned and are processed to detect drowsiness/ fatigue. With the help of rectangular ( ) function, it measures the length and width of an eye. The position, length and width can be obtained with the help of Vision class. 'Cascade Object Detector' which is an inbuilt object detector in MATLAB is used to detect eye. The obtained image is then cropped using 'imcrop( )' command in MATLAB. Colored image is converted into grey scale image using 'rgb2grey( )' function. In order to create box, we used 'bbox( )' function. 'immadjust( )' help in adjusting the level of contrast. Accuracy of the project depends on the quality of Web-Camera. The processing time is increased with the 'getsnapshot( )' function in MATLAB. By defining the region of interest for detection is done by using Viola Jones Algorithm in order to reduce computational requirements of the system. Using MATLAB Image processing , sleep detection system can be explained.

Conclusion

In this way, we have successfully implemented drowsiness detection using MATLAB and Viola Jones Algorithm. The developed system has been successfully tested and its limitations are indentified.

Limitations

Limitations of the proposed system are as follows:
If the driver is using sunglasses then the computation doesn't work.If there is the striking light directly on the web-camera then the system doesn't work.

Future Work

It is required to make the speed of vehicle slow or slow down the speed of vehicle in real time drowsiness detection. In order to create continous monitoring, threshold drowsiness detection should be kept aside. While monitoring the drowsiness continuously, when the level exceeds certain value a signal is generated which directly controls the braking of vehicle.

References

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