IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 6, June 2016

Accident Prevention of Pedestrian on Road

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Abstract: Efficient and instant recognition of pedestrian moving across road by vehicle's ECU system is very challenging and it is crucial. As the shape features of on-road pedestrians are irregular and complex, and the computation for detection is very complex. To resolve this challenge, we propose fast pedestrian detection algorithms based on histogram of oriented gradients (HOGs), and support vector machines (SVMs). This technique is evaluated and implemented in on any embedded systems which can communicate with vehicle ECU and make the detection of pedestrian with the required action to avoid collision. This approach is improvised for this challenge.

Keywords: Pedestrian collision, Application of HOG, Accident avoidance.

I. MOTIVATION

The ongoing protection system for driver inside the vehicle and pedestrian who are crossing the road need number of sensor to detect and prevent the accidents, they are infra-red sensors, ultra-sonic sensors for obstacle detection, laser light sensor. By these sensors we find presence of pedestrian in front of the vehicle through human infra-red spectrum and give alert signal to the driver who is driving the vehicle so that he can take precautionary measure to avoid accident. The present implemented way to protect driver inside vehicle and pedestrian is to use more number of sensors to sense and protect possible obstacle in front the host vehicle, such as ultrasonic distance sensor, infrared sensor, and laser sensors, Such sensors can detect possible pedestrians via the human body temperatures, then warn the drivers to slow down the speed or stop the car for protecting the driver and pedestrians. However, the cost is the critical problem for using multiple sensors, and cannot provide salient information for drivers to perceive actual situations to take best driving actions. Detecting an object moving across a running vehicle on road is a challenging task in image processing, there are already developed techniques which can detect human based on HOGc (Histogram Of Gradient) and in addition of support vector machine (SVM) classifies to detect human pedestrian appearing in a image extracted from video. The HOG feature cells composed of blocks with blocks. So each cell is of 2x2 pixels then the block will consisting of 4 cells. The block consists of 4x4 pixels and in images there are number of blocks, each object in the image can use required number of block to well define it. There is a window which is used over an object area in an image which is of type bonding box, each window is the collection of several blocks. Even though the HOGs method of pedestrian detection provide a necessary detection performance, still it need high computational cost and on small embedded system the HOGs cannot be computed due to high computational overload on the machine by this it is unfit algorithm to implement in real time scenario as in that case fast computation is very crucial to take precautionary actions.

The HOGs algorithm is segregated into four steps at the majority of the time, they are: mapping edges, cell computation, windows are grouped and in each block of a window gradient is calculated. In the references referred during the literature survey to prepare the paper researchers had worked on speeding up f above steps to improve computational cost of pedestrian and in complete process time. For example in some papers they have proposed a method based on cascade and to filter unwanted windows to optimize the power of computer and in some papers they have combined LBP (Local Binary Pattern and features of HOGs for the betterment of the rate of detection. This paper proposes a computational efficient technique for detecting pedestrian moving across the road to best fit for small embedded system that can assist driver. This technique can be evaluated and deployed on any embedded platform and experimental result found to be very accurate in terms of detection and computation. Using proposed efficient detection technique with high detection accuracy a quick detection can be achieved once the pedestrian come across the vicinity of the vehicle.

With this efficiency and detection accuracy we can able to detect the pedestrian as soon as it come across, but once it is detected at fast instant we can't stop the vehicle at that instant without considering the rarer traffic strength and intimating with proper traffic rules otherwise while avoiding collision with the pedestrian we can invite a huge collision with the rarer vehicles. So the proper solution would be an intelligent system detecting obstacles from both side and slow down the vehicle with the required indication when front pedestrian is successfully detected.

II. DETECTION TECHNIQUE

Optimization of the cost of computation of object detection using HOGs based algorithm. This paper total focus is on minimizing the number of search windows and optimized computation approach for embedded system. Reducing number of searching window At the base stage of HOGs-Based object detection algorithm for 720x480 pixels image

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will need have both possible images that is necessary features and impossible features that is redundant of a pedestrian moving across. His will take a huge computational cost to recognize a pedestrian I that on of large number of search windows to resolve this overload need to be filtered some of redundant windows so that only necessary windows is set to recognize the pedestrian by the HOGs algorithm. So that the computational overload to detect pedestrian is minimized significantly in the reference a paper is on Horizon based filter to find the non-redundant window in the large number of search window, adopting this filter in that makes 5295 search window of 33554 windows reducing the effort to search windows up to 85% in each feature vector of HOGs.

A. Optimising the use of Embedded system.

The embedded system resources need to be optimally used due to limited power supply and limited area since it need to be mobile. To perform pedestrian detection using mobile embedded system this paper proposes three steps to the algorithm using that is HOGs-based, that steps includes Size adjustment of dynamic window, Non-floating point implementation and An approach on lookup table.

1. Adjustment of dynamic window

During the earlier detection technique that using HOGs algorithm. The size of the window is fixed, if the pedestrian in the image is bigger that the window size than the algorithm fails to detect the pedestrian. For this at original HOGs algorithm they will be used the resize of the window so that an object need to be detected does not miss during the detection action. But in embedded systems resizing all the window and detection makes computational overload. So in this paper proposing resizing of window different from each other that is dynamic window size to detect a pedestrian of any size with corresponding window size.

2. Non-floating point approach

Most of the embedded systems won't support floating point computation, But the original HOGs algorithm will work on floating point computation load on embedded system. This paper proposed a solution to resolve this issue by using shift and add operation to obtain fixed-point computation by converting from floating point operations hence this will optimise the HOGs based detections computations.

3. An approach of lookup table

In Hogs algorithm of pedestrian detection it need to calculate gradient and then using arctangent operation to find the angle in an edge image. But in this case to operation need high load of computation to conclude a result. By convention can use G_X and G_y as the gradient feature of horizontal and vertical respectively ranging between 1 and 255. By this using the literature survey to answer can be normalized to a single byte data. Using this data create a lookup table to record the result for the fast computation of features with the experimental value this paper proposed the improve I computation features by about 45%.

$$G = \frac{\sqrt{G_X(X,Y)^2 + G_Y(X,Y)^2}}{\sqrt{255^2 + 255^2}} * 200 \ldots\ldots\ldots (1)$$

III. EXPERIMENTATION

1) To take action to the proposed method in the paper, the experiment is implimented at a TI DM648 DSP with 783MH frequency of operations.

Evaluation Result from 3 Test Sequence

TABLE I. EVALUATION RESULT FROM 3 TEST SEQUENCE

Sequence	Total Pedestrian Event	Number of Detected	Detection rate
[2]	56	51	91%
[3]	36	32	91.%
Project Approach	50	47	94%

TABLE II. PERFORMANCE EVALUATION ON EACH METHOD

	Method	320 x 240	640 x 480	Detection rate
[2] work	HOG	160 ms	779 ms	87.4%
[3] work	Cascaded HOG	108 ms	613 ms	93.15
Project Approach	SVM & HOG	25 ms	150ms	92.15%

With the experimental ca including the embedded system running the above proposed paper has recorded the 3 videos with running in live road. TABLE I show the result tabulated that with the 3 videos of length 32 minutes, 26 minutes and 18 minutes consisting of actual pedestrian encountered with the number of pedestrian encountered by the system hence the experiment got the result up to remarkable level of 94%. In Table II it is comparison of the methods with using the different sizes of the image by maintaining the detection rate above 90%. The below figures show the experiment sample snapshot that took during the algorithm is running. This result demonstrates that this paper proposes a better performance with the previous work with more than 4 times faster as compared.

Fig: 1. Single pedestrian image for detection pedestrian

DOI 10.17148/IJARCCE.2016.56143

Fig: 2. Single pedestrian image is detected

Fig: 3. Double pedestrian image for detection pedestrian

Fig: 4. Single pedestrian image is detected

IV. CONCLUSION

In this study and experimentation, this paper proposed a computationally brilliant pedestrian detection approach using the less resources on road using embedded system which a mobile and assisting the driver to avoid majority of the accidents caused by pedestrian The experimental results demonstrated that the proposed method can effectively reduce achieve the real-time computational requirements on an embedded DSP, and the detection accuracy is more than 90%.

ACKNOWLEDGEMENT

With sense of gratitude and great pleasure, author would like to acknowledge the whole hearted co- operation extended by staff MIT college of Engineering, Pune.

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