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EMBEDDED NIGHT-VISION SYSTEM FOR PEDESTRIAN DETECTION

P. SANDEEP[1], AEMULA RAVI KIRAN GOUD[2], AMMAGUNTA ARPITHA[3], LEBAKA SANDEEP REDDY[4]

[1]Assistant Professor, Department of CSE, Malla Reddy College of Engineering Hyderabad, TS, India.

[2,3,4] UG students, Department of CSE, Malla Reddy College of Engineering Hyderabad, TS, India.

ABSTRACT:

The paper describes the use of thermal camera and IR night vision system for the detection of Pedestrians and objects that may cause accident at night time. As per the survey most of the accidents cause is due to low vision ability of human at night time, which leads to most dangerous and higher number of accidents at night with respect to day time. This system include the IR night vision camera which detects the object with the help of IR LED and photodiode pair, this camera have capability to detect the object up to 100m. The thermal camera detects the heat generated by any of the object like cars, Human animals etc. which gives us the facility to detect the object for higher range and with low reflective surface where IR night vision may fails. With the use of these two cameras mounted on car which helps the driver to drive safely. In this system, HOG (Histogram of orientated gradients) algorithm and support vector machine (SVM) is performed with the help of OpenCV in Matlab and EmguCV in Visual Basic 2012. The system is tested on the video recorded using these cameras, and got good and efficient result. And this system is cost efficient and easy to implement.

Key words: SVM, HOG, OpenCV, humam activity.

INTRODUCTION

Humans are the most intelligent creation of god. Human’s one of the most important discover is transportation systems. But with the increase of population, needs and desires of human being road transportation is getting bit one of the major reasons of human made death. Pedestrian Detection system is now requirement in the new era of transport. Is ancient time we use to travel by bullock cart or on a horse which does not causes any causality. But now-adays people have 2-3 vehicles at their house which increases the traffic at roads and accidents and eventually deaths cause by it. In this system, we have tried to reduce the rate of accidents by more than a half. This project help to build a good and efficient and cost affective system for car/ automobile manufacturers to develop more safe and luxuries vehicles. As the population and needs of human being is increasing the numbers are increasing government is trying to decrease the rate of causality and death. In recent years, According to survey 38% of fatal accidents in the European Union occur in darkness places, instead the fact that, the traffic during nights time is several times smaller than that on a day. This means that the risk of an accident in darkness increased. This stats has a strong relation and effect on the pedestrians. Currently, the pedestrians are of about 20 % of all traffic accidents. More than half of pedestrian deaths take place at night (51 %). As per survey by The Times of India, in various major city of India (figure 1),we can see that 60% of accident occur at Delhi is at night time. So it is more necessary to find a good solution for reducing the numbers.

RELATED STUDY

The Local Binary Patterns (LBP) [4] operator is one of the most successful texture descriptors and has been widely used in various applications. The idea of this operator is to assign each pixel a code depending on the gray levels of its neighborhoods. The gray level of the central pixel (ic) of coordinates (xc, yc) is compared to that of its neighbors (in). This descriptor is robust against monotonous gray scale changes caused, and against lighting variations. Another important property that is its simplicity of calculation, which allows analyzing images in difficult settings in real time.

Several studies have shown that the simultaneous or alternating use of several types of descriptors allows a significant improvement of the results [5]. For example, the combined use of HOG and LBP provides better results than independent use because HOG works poorly when the background is cluttered with noisy edges. Local binary patterns are complementary in this aspect. It can filter noises using the concept of uniform pattern. Characteristic analysis determines the class of data membership. It is thus a question of classifying the data. Numerous classification methods exist, each answering very specific problems.

These will be the supervised learning classification methods, in order to realize the final application which is pedestrian detection in real time. Support Vector Machine (SVM) is a two-class classification method [6] that attempts to separate positive and negative examples in all samples. The method then looks for the hyperplane that separates the positive examples from the negative ones, ensuring that the margin between the nearest positive and negative is maximal. This ensures a generalization of the principle because new examples may not be too similar to those used to find the hyperplane but be located on one side or the other of the border.

The Relevance Vector Machine RVM method was developed by Tipping [7]. It is a method that can also deal with regression problems. It uses the classical linear model of SVM kernel machines, but uses a Bayesian formulation to determine the parameters and select the relevant examples that will make the final discriminant model possible. Boosting [8] is a method that combines numerous algorithms that rely on sets of binary classifiers: boosting optimizes their performance. The principle comes from the combination of classifiers (also called hypotheses). By successive iterations, the knowledge of a weak classifier is added to the final classifier (strong classifier). The classifier provided is weighted by the quality of its classification: the better it ranks, the more important it will be. Misclassified examples are boosted so that they become more important to the weak learner in the next round, so that he or she can make up for the lack. The pedestrian detection system needs acceleration to enable real-time adaptive processing. Hardware acceleration has the potential to speedup these algorithms, making real-time processing for many image and video processing. The Hardware acceleration can be achieved using field programmable gate arrays (FPGA) or Graphic Processor Unit (GPU), which are devices consisting of reconfigurable hardware, allowing their function to be customized for a specific application. For intensive computing, FPGAs have very large logical resources (multipliers, accumulators). In addition, they offer highly flexible architectures, they can easily divide the video source to independently feed the display (video output) or different additive blocks for subsequent video processing. Also, an FPGA can perform different processing with independent clocks without the need for additional resources for time multiplexing, unlike classical CPU or GPU processors. Thanks to advanced semiconductor technologies, modern FPGA-SoC (Field Programmable Gate Arrays System on Chip) generations are powerful enough to support realtime image processing because of their high logical density, generic architecture and their memory on chip. Today, faced with the integration density of FPGAs and the progressive demand for logical resources of advanced applications, it is very difficult or impossible to design IPs for embedded vision with the traditional hardware description language (HDL). Indeed, an implementation of an intensive image processing on FPGA requires a very important development time and generally leads to problems of reliability in the design. As a result, many efforts have been made to cope with this huge amount of resources through the integration of tools that offer a design flow at a higher level of abstraction than traditional HDL. Vivado High-Level Synthesis Tool speeds up the creation of IPs by allowing C, C ++ and SystemC specifications to be directly targeted in all Xilinx All Programmable SoC FPGAs without having to create the RTL manually. It offers an opportunity to go faster to IP creation while exploiting its properties. With the introduction of reconfigurable platforms such as AP SoC and the advent of new high-level tools for configuring them, FPGA-SoC image processing has emerged as a practical solution for most computer vision problems and image processing. In this context, we were interested in the design and implementation of an embedded video processing architecture. This research aims to propose an embedded architecture of a pedestrian detection algorithm on a hardware/software co-design platform suitable for use as an embedded system.

PROPOSED SYSTEM

The first night vision system in the automobiles has been introduced to the market bya company was General Motors in the year 2000 and it is applied in the Cadillac DeVille. Development of this project took 15 years of 70 persons team and costed approximately $100 million. After this in 2003, Toyota has firstly develops the commercial grade active night vision system for the car Toyota Landcruiser and Lexus LX470 which can reached up to the range of 100 m. In 2004 Honda has develops the same in the Legend model, which was an optional system named as "Intelligent Night Vision" with the prime option as pedestrian detection. The system is capable of the range between 30 and 80 m .

WORKING METHODOLOGY

Now a days with advance technologies drivers may get lots of information from sensors such as upcoming traffic signals, diversions, traffic conditions and many more information but this sensors may not provide accurate information about pedestrian or any other objects at night due to darkness or low quality cameras. To overcome from this problem author is evaluating performance of YOLOV2 CNN (convolution neural networks) object detection model but this model also unable to detect objects from NIGHT VISION.

In propose work to detect objects from NIGHT VISION author using HAAR HOG descriptor with ADABOOST algorithm and this algorithm providing better detection compare to YOLOV2 and its false detection rate is also less. This algorithm will clear the image using OPENCV and ADABOOST and then apply HAAR HOG features to detect pedestrian in that image.

In propose work I am using 6 night vision images and YOLOV2 able to detect pedestrian from 4 images and ADABOOST

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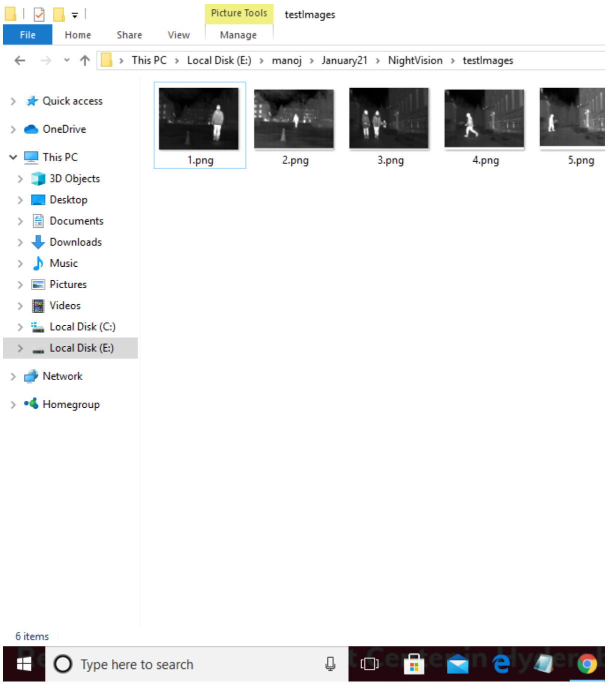
able to detect pedestrian from all 6 images but it is detecting some false images also as pedestrian due to this reason ADABOOST detection accuracy will be 80% and YOLOV2 detection accuracy will be 4/6 = 0.66.

ADABOOST detection rate = 6/6 * 100 = 100% - 20 (for false detection rate) = 80%

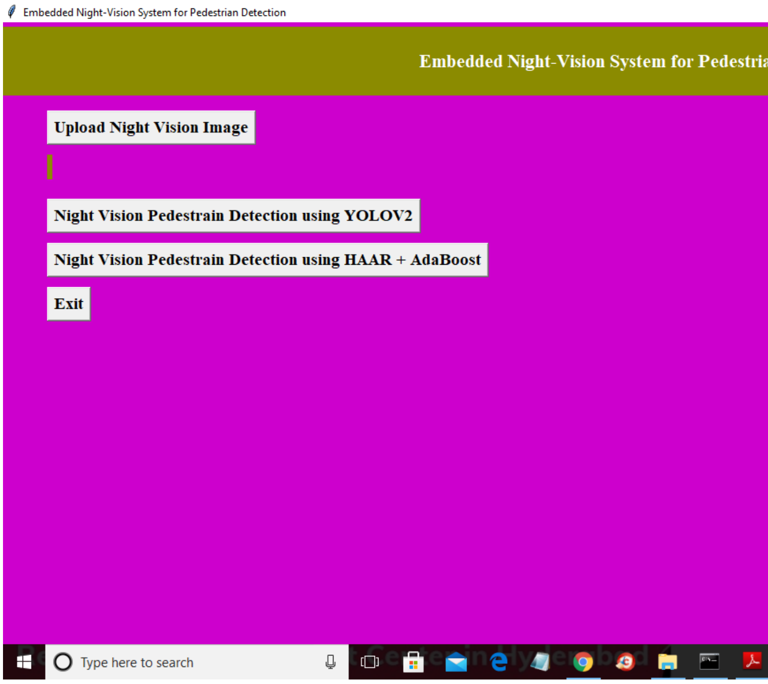
YOLOV2 = 4/6 * 100 = 66%

To test above 2 algorithms I am using below NIGHT VISION images

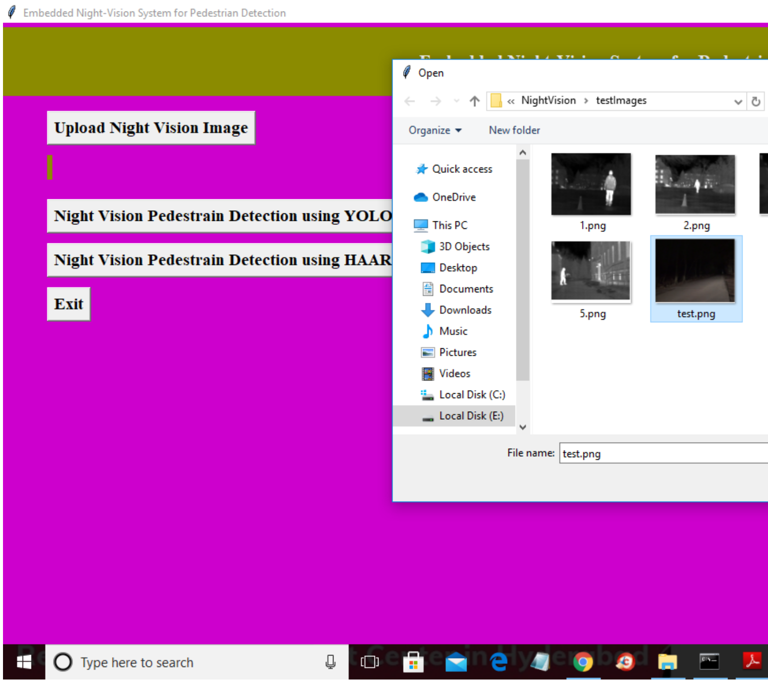


In last image we can see we are unable to see any pedestrian but ADABOOST can detect it.

To run project double click on 'run.bat' file to get below screen

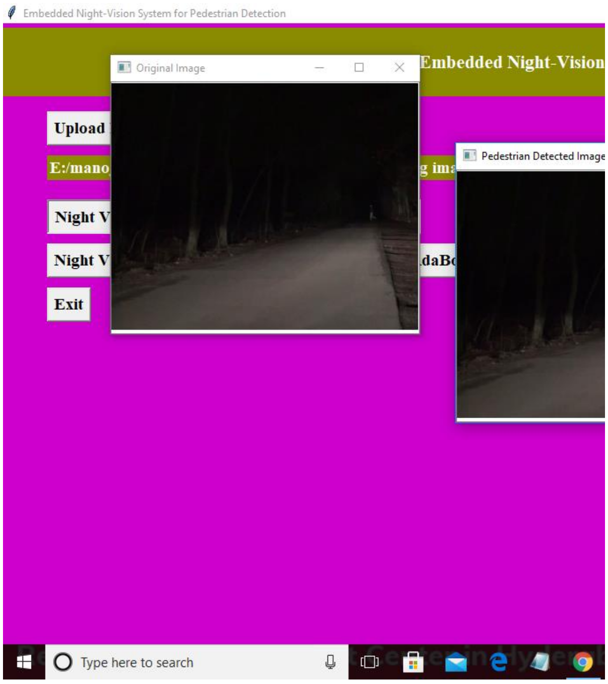


In above screen click on 'Upload Night Vision Image' button and upload image

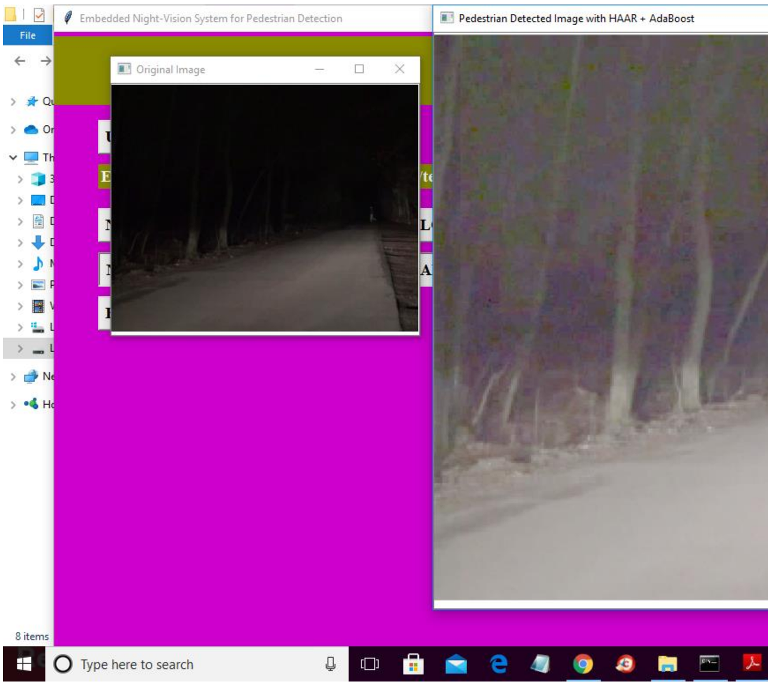


In above screen I am selecting 'test.png' image and then click on 'Open' button to load image and to get below screen

In above screen showing uploaded original image and hardly we can see the pedestrian and now try to detect that pedestrian using YOLOV2 algorithm by clicking on 'Night Vision Pedestrian Detection using YOLOV2' button



In above screen first image is the original image and second image is the YOLOV2 resultant image and in second image we did not find any bounding box across pedestrian so YOLOV2 unable to detect that pedestrian and now click on 'Night Vision Pedestrian Detection using HAAR + AdaBoost' button to get below result



In above screen first image is the original image and second image is the resultant image from HAAR + ADABOOST algorithm and this algorithm able to detect pedestrian successfully and putting bounding box across detected pedestrian.

Now test with other image

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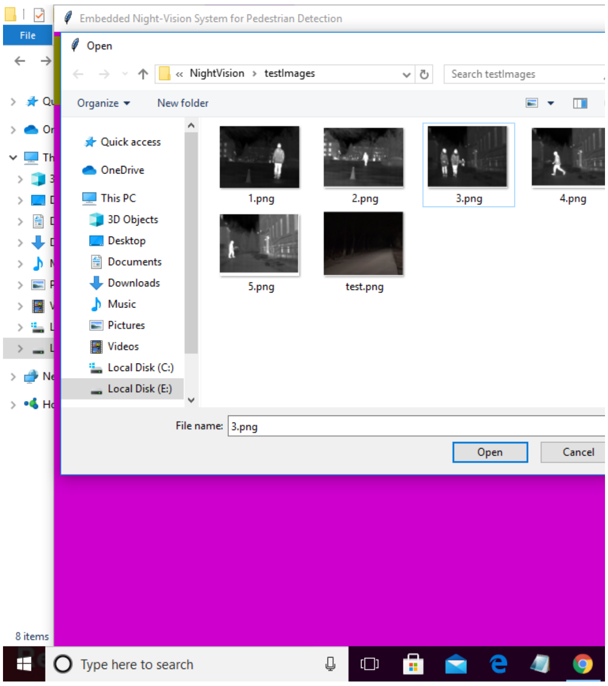
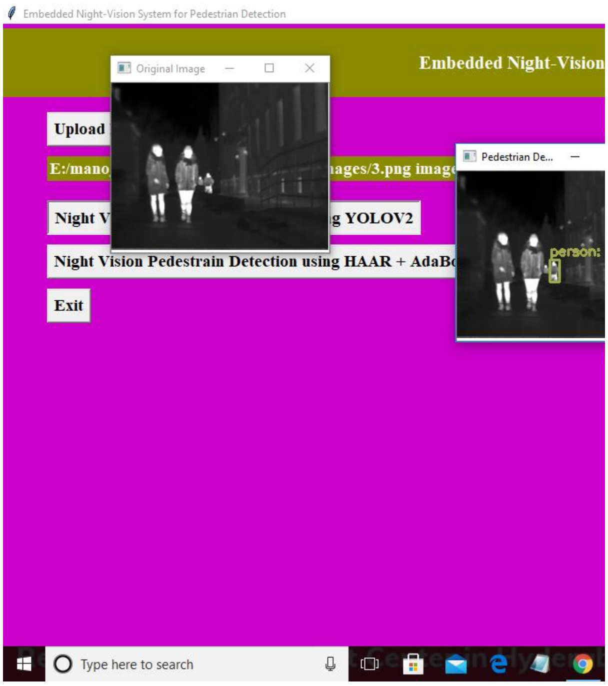
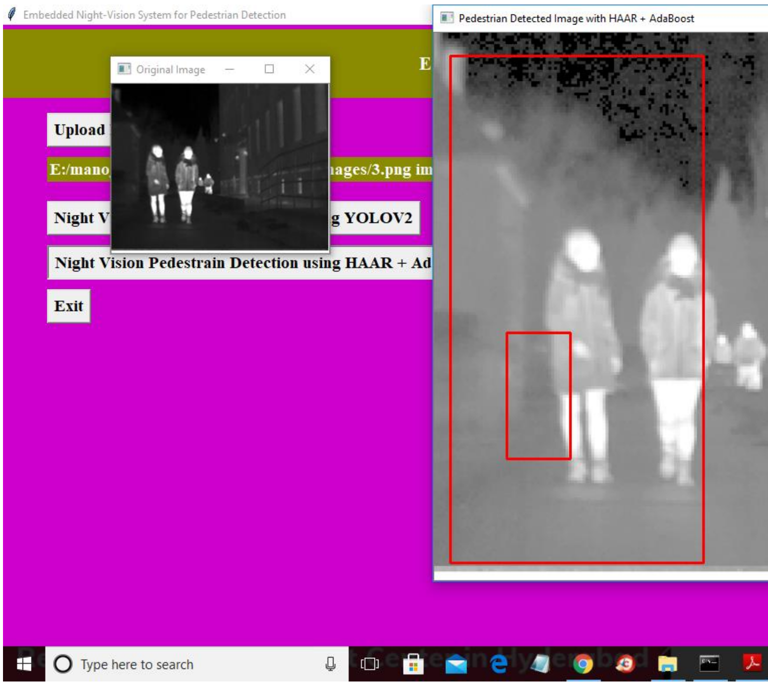


In above screen uploading 3.png and then below is the YOLOV2 result



In above image YOLOV2 able to detect the persons and now test with ADABOOST



In above screen we can see ADABOOST detecting both persons accurately. Similarly you can upload other images and test the application.

CONCLUSION

In this process of object detection we have processed image of night vision camera as well as thermal camera image , a Histogram of Oriented Gradients (HOG) algorithm and Features from accelerated segment test (FAST) is used, which is very good and efficient technique to process and analysing the feature of image. And Moving object detection is also efficiently applied using BLOB algorithm. This method is more efficient and reliable In this process of object detection we have processed image of night vision camera as well as thermal camera image , a Histogram of Oriented Gradients (HOG) algorithm and Features from accelerated segment test (FAST) is used, which is very good and efficient technique to process and analysing the feature of image.And Moving object detection is also efficiently applied using BLOB algorithm.

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