Infrared Night Vision With Pedestrian Detection And Auto Break System

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***Abstract*— Unfortunately the analysis of normal video tapping has its limits such as the noises produced by the electronic devices,even if the aperture and ISO are large enough.However even though visible light is dim during night time,infrared is emitted when an object with considerable temperature is present.In this case human body temperature is relatively higher than the environment and hence the more intense infared can be detected.After applying the computation of spatial distance,the intensity of infrared and appropriate position,we can infer the objects which satisfy these analysis to be potentially pedestrians.However because of the fast speed driving especially on highways this system has to be efficicent and gives real time feedback to be considered useful.A NIR near infrared camera is used to take images of a night scene.As there are large inta class pedestrians poses,a tree structured classifier is proposed here to handle the problem by training it with different subset of images and different sizes.**

***Index Terms*— histogram of oriented gradient, Thermal imaging , Spatial-temporal silhouette analysis, auto break system.**

I. INTRODUCTION

The Night vision technology, by definition literally allows one to see in the dark. Originally developed for military use, it has provided the United states with strategic military advantage, the value of which can be measured in lives. Federal and state agencies now routinely utilize the technology for site security, surveillance as well as search and rescue. Night vision equipment has evolved from bulky optical instruments in light weight goggles the advancement of image intensification technology. Night vision has had many improvement thought-out the course of history. Its beginning data back to second world war when the Germans idealized a very effective way to easily use their sniper rifles during the night. This was later researched very deeply into because night vision proved to have a devastating advantage for those who used. The proper night-vision equipment, you can see a person standing over 200 yards (183 m) away on a moonless, cloudy night.

II. DESCRIPTION OF PROJECT

A. Early Attempts At Night Vision Technology

Military tacticians throughout history have seen the advantages of being able to maneuver effectively under the cover of darkness.

For example, a useful infrared sniper scope that used near infrared cathode coupled to visible phosphor to provide a near infrared image converter was fielded. A small number, perhaps 300 sniper scopes, were shipped to the pacific some time in 1945, but received very little use.

Their range was less then 100 yards, and they were used mainly for perimeter defense. However this device had several disadvantages. The infrared sniper scope required an active IR searchlight that was so large it had to be mounted on a flatbed truck.

This active IR searchlight could be detected by any enemy soldier equipped with similar equipment. The rifle mounted scope also required cumbersome batteries and provided limited range. However, the infrared sniper scope showed night vision technology .

Military leaders immediately saw many uses for this technology beyond sniping at the enemy under cover of darkness. An army equipped with night vision goggles, helmets, and weapons sights would be able to operate 24 hours a day.

B. Night Vision Approaches

- Spectral Range

Night-useful spectral range techniques make the viewer sensitive to types of light that would be invisible to a human observer. Human vision is confined to a small portion of the electromagnetic spectrum called visible light. Enhanced spectral range allows the viewer to take advantage of non-visible sources of electromagnetic radiation (such as near-infrared or ultraviolet radiation). Some animals can see well into the infrared and/or ultraviolet compared to humans, enough to help them see in conditions humans cannot see.

- Intensity Range

Sufficient intensity range is simply the ability to see with very small quantities of light. Although the human visual system can, in theory, detect single photons under ideal conditions, the neurological noise filters limit sensitivity to a few tens of photons, even in ideal conditions. Many animals have better night vision than humans do, the result of one or more differences in the morphology and anatomy of their eyes. These include having a larger eyeball, a larger lens, a larger optical aperture (the pupils may expand to the physical limit of the eyelids), more rods than cones (or rods exclusively) in the retina, a tapetum lucidum, and improved neurological filtering. Enhanced intensity range is achieved via technological means through the use of an image intensifier gain multiplication CCD, or other very low-noise and high-sensitivity array of photo detectors.

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C. Working Of Night Vision

Image enhancement-

This works by collecting the tiny amounts of light, including the lower portion of the infrared light spectrum, that are present but may be imperceptible to our eyes, and amplifying it to the point that we can easily observe the image.

Here's how image enhancement works:

- A conventional lens, called the objective lens, captures ambient light and some near-infrared light

- The gathered light is sent to the image-intensifier tube. In most NVDs, the power supply for the image-intensifier tube receives power from two N-Cell or two "AA" batteries. The tube outputs a high voltage, about 5,000 volts, to the image-tube components.

- The image-intensifier tube has a photocathode, which is used to convert the photons of light energy into electrons.

- As the electrons pass through the tube, similar electrons are released from atoms in the tube, multiplying the original number of electrons by a factor of thousands through the use of a microchannel plate (MCP) in the tube. An MCP is a tiny glass disc that has millions of microscopic holes (microchannels) in it, made using fiber optics technology. The MCP is contained in a vacuum and has metal electrodes on either side of the disc.

- At the end of the image-intensifier tube, the electrons hit a screen coated with phosphors.

These electrons maintain their position in relation to the channel they passed through, which provides a perfect image since the electrons stay in the same alignment as the original photons. The energy of the electrons causes the phosphors to reach an excited state and release photons. These phosphors create the green image on the screen that has come to characterize night vision.

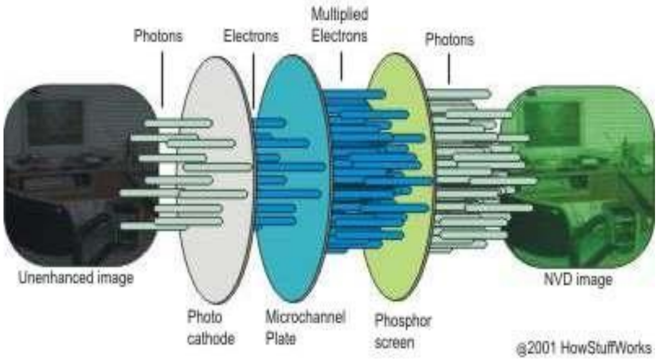
The green phosphor image is viewed through another lens, called the ocular lens, which allows you to magnify and focus the image. The NVD may be connected to an electronic display, such as a monitor, or the image may be viewed directly through the ocular lens.

Thermal imaging –

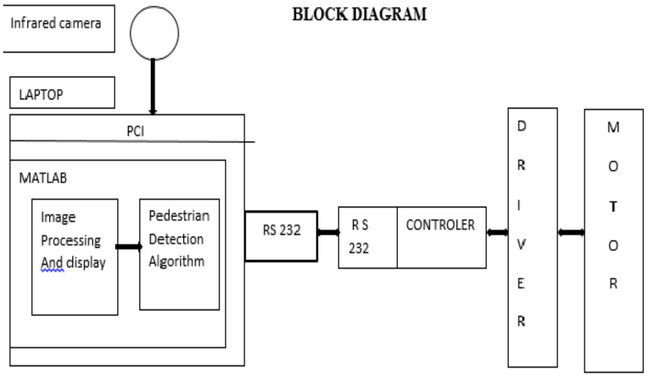
This technology operates by capturing the upper portion of the infrared light spectrum, which is emitted as heat by objects instead of simply reflected as light. Hotter objects, such as warm bodies, emit more of this light than cooler objects like trees or buildings.

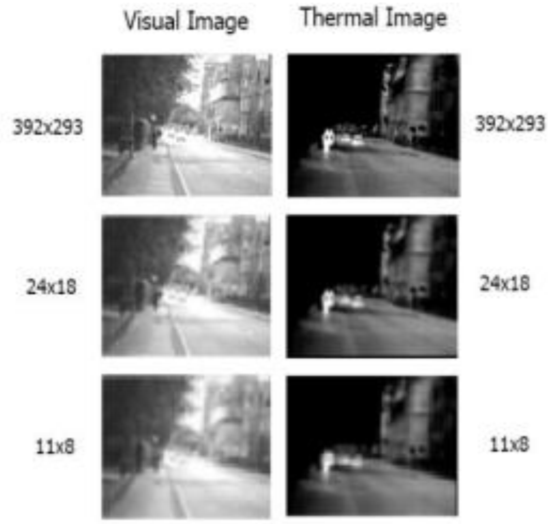
Here's how thermal imaging works

- A special lens focuses the infrared light emitted by all of the objects in view.
- The focused light is scanned by a phased array of infrared-detector elements. The detector elements create a very detailed temperature paten called a thermo gram.
- It only takes about one-thirtieth of a second for the detector array to obtain the temperature information to make the thermo gram.
- This information is obtained from several thousand points in the field of view of the detector array.
- The thermo gram created by the detector elements is translated into electric impulses.
- The impulses are sent to a signal-processing unit, a circuit board with a dedicated chip that translates the information from the elements into data for the display.
- The signal-processing unit sends the information to the display, where it appears as various colors depending on the intensity of the infrared emission.
- The combination of all the impulses from all of the elements creates the image.



BLOCK DIAGRAM





III. ALGORITHMS USED

- Spatial-temporal silhouette analysis-

Identifying people based on the way they walk. In this paper, a simple but efficient gait recognition algorithm using spatial-temporal silhouette analysis is proposed. For each image sequence, a background subtraction algorithm and a simple correspondence procedure are first used to segment and track the moving silhouettes of a walking figure. Then, eigenspace transformation based on principal component analysis (PCA) is applied to time-varying distance signals derived from a sequence of silhouette images to reduce the dimensionality of the input feature space. Supervised pattern classification techniques are finally performed in the lower-dimensional eigenspace for recognition. This method implicitly captures the structural and transitional characteristics of gait. Extensive experimental results on outdoor image sequences demonstrate that the proposed algorithm has an encouraging recognition performance with relatively low computational cost.

- Shapelet features, a set of mid-level features-

In this paper, we address the problem of detecting pedestrians in still images. We introduce an algorithm for learning shapelet features, a set of mid-level features. These features are focused on local regions of the image and are built from low-level gradient information that discriminates between pedestrian and non-pedestrian classes. Using Ad-aBoost, these shapelet features are created as a combination of oriented gradient responses. To train the final classifier, we use AdaBoost for a second time to select a subset of our learned shapelets. By first focusing locally on smaller feature sets, our algorithm attempts to harvest more useful information than by examining all the low-level features together. We present quantitative results demonstrating the effectiveness of our algorithm. In particular, we obtain an error rate 14 percentage points lower (at 10-6 FPPW) than the previous state of the art detector of Dalal and Triggs on the INRIA dataset.

- Background subtraction method-

This work proposes a general purpose method which combines statistical assumptions with the object level knowledge of moving objects apparent objects (ghosts) and shadows acquired in the processing of the previous frames. Pixels belonging to moving objects, ghosts and shadows are processed differently in order to supply an object based selective update. The proposed approach exploits gray color information for both background subtractions to improve object segmentation. The approach proves fast, flexible and precise in terms of pixel accuracy. The implementation of the background subtraction algorithm is done in two domains code is written in Matlab, then using Simulink blocks sets.

- Histogram of Oriented Gradient- Histograms of oriented gradient (HOG) descriptors significantly outperform existing feature sets for human detection. We study the influence of each stage of the computation on performance, concluding that fine-scale gradients, fine orientation binning, relatively coarse spatial binning, and high-quality local contrast normalization in overlapping descriptor blocks are all important for good results. The new approach gives near-perfect separation on the original MIT pedestrian database, so we introduce a more challenging dataset containing over 1800 annotated human images with a large range of pose variations and backgrounds.

IV. AUTO BREAK SYSTEM

- After detection of pedestrians the next stage involves controlling automatically brakes of the vehicle if the distance between the pedestrian and the vehicle is much less.
- This is achieved by using a controlled which is interfaced with the laptop using R S 232.
- And also motor drivers are connected which control the speed of the motors.
- A PWM code written in the controller for this purpose.
- Whenever sudden occurance of pedestrians is detected or distance between vehicle and pedestrian is less controller will give signal to the drivers.
- The drivers will convert the 5V signal received from controller into 12V which will then control speed of the motors and hence automatically speed of the vehicle will get reduced hence lowering the chances of fatal accidents.

V. APPLICATIONS

- MILITARY SURVELLIANCE
- WILDLIFE OBSERVATION
- SECURITY
- NAVIGATION

The original purpose of night vision was to locate enemy targets at night. It is still used extensively by the military for that purpose, as well as for navigation, surveillance and targeting. Police and security often use both thermal-imaging and image-enhancement technology, particularly for surveillance. Hunters and nature enthusiasts use NVDs to maneuver through the woods at night.

Detectives and private investigators use night vision to watch people they are assigned to track. Many businesses have permanently-mounted cameras equipped with night vision to monitor the surroundings.

Night vision technology was invented keeping various scenarios of war in mind. In fact, US army is the pioneer to get the technology evolved and established over the due course of time. Devices such as Night Vision Goggles and night vision scopes are major devices used by armed forces. All the planes of the army are well equipped with this technology and complementing Stealth technology, night vision technology makes the fighter planes highly dangerous during the dark.

With progress in time, the technology is used for security purposes in various civilian and restricted areas. Also, aviation sector is using various forms of night vision technology for navigation purposes in private and commercial areas. Through this technology, landings can be made on rough terrains too which is quite beneficial for air ambulances.

Further adding to medical sciences, night vision technology has made possible study of some systems which were not even visible through X-rays or MRI because of their complex presence. Using this technology, easy views of the lymphatic system, the tissue cleaner system, were observed which was not clearly visible using the conventional medical technologies.

A number of wild life sanctuaries and national parks also have night vision cameras installed so as to monitor wild life during the night and keep an eye on illegal activities such as poaching. Also, intelligence services have surveillance cameras which work efficiently under dark conditions.

Quite a number of commercial electronics companies have inherited this technology in their cameras and camcorders to facilitate night shooting modes.

VI. Results

The above fig. shows the comparasion between visual image and image after processing and we get the clear view of pedestrian walking on the road.

VII. Conclusion

The system we've developed is a simple yet realistic model of detecting the pedestrians in the real world with the successful rate of 74.2% in verification, and 80% correctness in tracking. Under certain circumstances the detection was limited by some possible factors as discussed above. In the future, we hope to incorporate the technique of machine learning and AI to further enhance the correctness into this system, including the ability to detect subjects regardless of weather, clothing, or other noises, to precisely locate the whole human body. We believe that this will be a very practical application which is able to efficiently reduce the traffic accidents caused by low visibility during night time. Further improvements of this system might include pedestrian detection and tracking during the daytime, snow days where the light is intensively reflected to harm the visibility, or even marine applications which performs under deep water (a typical environment with extremely low visibility).

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