International Journal of Advanced Technology in Engineering and Science
Vol. No.5, Issue No. 03, March 2017
www.ijates.com
ijates
ISSN 2348 - 7550

AN INTRUSION DETECTION SYSTEM FOR PREVENTING INTRUDERS IN THE BATTLE FIELD

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ABSTRACT

One of the biggest challenges our Army faces today is to articulate a convincing vision of major land combat. Implementing an effective intrusion detection capability is an elusive goal, not solved easily or with a single mechanism. The System for Anti-Intrusion in Battle field is a compact warning system that can be used as a tactical stand-alone system. This system consists of a Static Camera and provides coverage across a platoon's defensive front (45 meters). We proposed a Density detection algorithm to detect and track the contour of objects moving in a cluttered environment. Motion can be detected by measuring change in speed or vector of an object. The existing systems are unable to identify the location of intruders; current systems are unable to sense the difference between light and object and then the sensors may fail and sometimes triggers false alarm. This system identifies the geographic location of the intruder and not being an alarm system it reduces the risk of false alarms and is more secure.

Keywords: Computer Vision, Density Detection, Image Processing, Intrusion detection, Monitoring Cameras

I. INTRODUCTION

1.1. Intrusion Detection

Intrusion Detection (ID) has been studied in both industry and academia, but security analysts still desire much more alert accuracy and overall threat analysis in order to secure their system within the space. Intrusion detection is a type of security management system for computers and networks. An ID system gathers and analyzes information from various areas within a computer or a network to identify possible security breaches, which include both intrusions (attacks from outside the organization) and misuse (attacks from within the organization).Improvements that can be made to Intrusion Detection could be achieved by embracing a more comprehensive approach in monitoring security events from many different heterogeneous sources.

In order to alleviate or put off attacks, awareness of an attack is essential to being able to react and defend against attackers. Military protection can be further improved by utilizing Security Analytics and Intrusion Detection data to look for hidden attack patterns and trends. ID is also important for forensic purposes in order to identify successful breaches even after they have occurred, such as it is important to know afterwards if information such as credit card data has already been stolen, in order to take additional precautions or possibly

take law enforcement or legal actions. ID can also be very helpful beyond detecting attacks in noticing abnormal system behaviour to detect accidents or undesired conditions. For example, an Intrusion Detection System (IDS) could report anomalies where a malfunction or human error is causing customer credit card numbers to be erroneously charged multiple times. Or IDS could alert on something out of the ordinary and detect a gas leak, and help prevent an explosion which could harm or even kill humans. ID can be helpful in providing early warnings and minimizing damage.

1.2 Image Processing and Computer Vision

Image processing is usually concerned with pre-processing operations such as edge detection, Fourier filtering and morphological operations. Computer vision is an interdisciplinary field that deals with how computers can be made for gaining high-level understanding from digital images or videos. From the perspective of engineering, it seeks to automate tasks that the human visual system can do. It is a field that includes methods for acquiring, processing, analyzing, and understanding images and, in general, high-dimensional data from the real world in order to produce numerical or symbolic information, example in the forms of decisions. It extends the image processing paradigm to include understanding of scene content, tracking and object classification.

Motion sensors are approach that can be used to cause an action when motion is detected. An electronic motion detector contains a sensor that transmits a signal when triggered by motion. That signal can be used to activate an alarm, a light, or practically anything electrical or electronic.

1.3Need for the Proposed System

In an age which bears witness to a proliferation of Closed Circuit Television (CCTV) cameras for security and surveillance monitoring, the use of image processing and computer vision techniques which were provided as stop end bespoke solutions can now be realized using desktop PC processing. At present, army couldn't able to identify the intruders whenever they enter into our country due to Extreme Geographical Areas. And also they are unable to identify the location of Intruders. Current Systems are unable to sense the difference between Light and Object. Sensors may fail and sometimes triggers false alarm. The proposed system avoids the other psychological stresses faced by the army such as preventing Long Deployments, Combat Epidemic diseases, Post-Traumatic Stress disorder among soldiers.

As security attacks have evolved and grown in sophistication, Intrusion Detection products have also become much more sophisticated, monitoring an ever increasing amount of diverse heterogeneous security event sources. IDSs were the first specialized products developed to detect and alert for potential security attacks, and they can either employ misuse detection or anomaly detection. An IDS utilizing misuse detection evaluates data it is monitoring against a database of known attack signatures to determine attack matches. An IDS utilizing anomaly detection, on the other hand, evaluates data it is monitoring against a normal baseline, and can issue alerts based on abnormal behaviour.

II. RELATIVE WORK

Rosin P and Ellis T [1] "Detecting and classifying intruders in image sequences", 1991. It describes a knowledge-based vision system for automating the interpretation of alarm events resulting from a perimeter intrusion detection system (PIDS). Moving blobs extracted over a sequence of digitized images are analyzed to identify the cause of alarm. Yang, Y H [2] "The background primal sketch: An approach for tracking moving objects, Machine Vision and Applications", 1992. It integrates the spatial and temporal information for the tracking of moving non-rigid objects. In addition, they obtain outlines of the moving objects.

Horner M [3] "An Enhanced Detection System Intelligently Combining Video Detection and Non-Video Detection Systems in International Carnahan Conference on Security Technology",1995. Refers to the "QUAD" system where four cameras are connected to a single monitor whose screen continuously and simultaneously displays the four different images. In a "quaded quad" prior art surveillance system, sixteen cameras are linked to a single monitor whose screen now displays, continuously and simultaneously all sixteen different images. Michael Isard [4] "Visual Motion Analysis by Probabilistic Propagation of Conditional Density",1998. It uses conditional density algorithm to track outlines and features of foreground objects modelled as curves as they move in substantial clutter and to do it at or close to video frame-rate.

Michael Isard and Andrew Blake [5] "Conditional density propagation for visual tracking",1998. The problem of tracking curves in dense visual clutter is challenging. The algorithm uses "factored sampling", previously applied to the interpretation of static images, in which the probability distribution of possible interpretations is represented by a randomly generated set. Kingsley Sage and Stewart Young [6] "Security Applications of Computer Vision", 1999.It uses pre-processing operations such as Fourier filtering, edge detection and morphological operations. Computer vision extends the image processing paradigm to include understanding of scene content, tracking and object classification.

M. Valera and S.A Velastin [7] "Intelligent distributed surveillance systems", 2004. The ability to recognize objects and humans, to describe their actions and interactions from information acquired by sensors is essential for automated visual surveillance. The increasing need for intelligent visual surveillance in commercial, law enforcement and military applications makes automated visual surveillance systems one of the main current application domains in computer vision. Richard Zuech, Taghi M Khoshgoftaar and Randall Wald [8] "Intrusion Detection and Big Heterogeneous Data",2015. SIEM (Security information and event management) technology is proprietary and it is difficult to speculate on some of the internals of different product offerings, but it is apparent that SIEMs do attempt to normalize the data sources into as common formats as possible.

III. PROBLEM FORMULATION

A System for Anti Intrusion in Battle field is a compact warning system that can be used as a tactical stand-alone system. Proposed System enhances unit awareness during all types of operations and environments, including those in urban terrain. The system was originally designed for infantry soldiers at the platoon level to provide early warning of personnel and vehicle intrusion in austere environments. This system works based on comparing of the current video frame with one from the previous frames or with background. Motion can be detected by measuring change in speed or vector of an object.

IV. PROPOSED WORK

One of the challenges faced by the army today is to articulate a convincing vision of major land combat. Implementing an effective intrusion detection capability is an elusive goal, not solved easily or with a single mechanism. The system for battlefield anti intrusion majorly overcome all these problems. The proposed system can be used as a tactical stand-alone system. This system consists of a static camera and provides coverage across a platoon's defensive front (45 meters). It delivers early warning and situational awareness information. The proposed system enhances unit awareness during all types of operations and environments. The system helps the soldiers at the platoon level to provide early warning of personnel and vehicle intrusion in austere environments. The proposed system consists of the following functionalities and they are discussed below.

4.1 Movement Detection

Movement detection is the process of detecting a change in the position of an object relative to its surroundings or a change in the surroundings relative to an object. A static camera is used in order to detect the movement which scans the distance of 45meter for any small movement. If any movement is detected, then the static camera uses conditional density algorithm and it checks if the movement is static or dynamic.

$$y_t^{(i)} = p(co_a|x^{(i)}) / \sum_{j=1}^{I} p(co_a | x^{(j)}) \text{ ---------- (1)}$$

If the movement occurs in the same place for few seconds then it is considered to be static and the static images are discarded. The movement is dynamic if the location of intruding moving object is different or if the location of movement changes constantly.

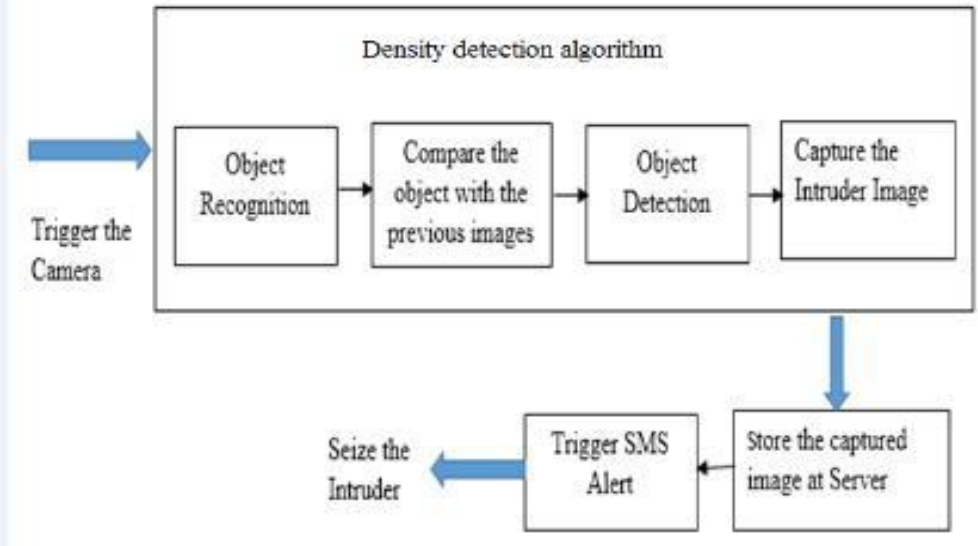

Fig 1. System Architecture

4.2 Image Capturing and Sending Messages

Image capturing and sending is based on the movement detected. If the movement is detected as static then the image is discarded and then the camera continues detecting other intrusions or movements.

If the movement is identified as dynamic based on the space, position and time using density detection algorithm, then the image is captured for every 5 second and the images are sent to the storage location.

4.3 Storing and Analysing Images

Storing and analyzing the image is completely based on the image captured. The image is received by the server after the analysis of static and dynamic detection. After that the image is directly stored into the server. The admin credentials are important in order to analyze the image after storing into the server. The analysis of the image is based on the movement of the intruder, number of intruders entering and so on.

4.4 SMS Triggering

The final captured and analyzed image is then triggered as an SMS in order to alert the battalion. The SMS will be sent to all the registered people in the server as a notification of an intruder detected. A copy of the SMS will be stored in the database too.

The SMS triggering that is used in our application is a very big advantage. We are notifying through SMS because this does not need internet connection and it is more secured and confidential. The intruder can never be intimated that we know their whereabouts and required actions can be taken.

V.MODEL AND ALGORITHM

To detect and track the contour of the objects moving in a cluttered environment, we proposed an algorithm called the Density Detection Algorithm (DDA).

The Density Detection Algorithm uses “factored sampling”, previously applied to the interpretation of static images, in which the probability distribution of possible interpretations is represented by a randomly generated set. Density detection uses learned dynamical models, together with visual observations, to propagate the random set over time. The result is highly robust tracking of agile motion. Notwithstanding the use of stochastic methods, the algorithm runs in near real-time.

1. The set $\{x_0^{(i)(j)},\ i=1,\ldots I\}$ has samples with I replacement and the probability is given using $\{y_0^{(i)(j)}, i=1,...I\}$
2. Each set generates a new set when $p\ (z_a|z_{a-1})$ is applied to it.
3. Let current observation be,

$$y_t^{(i)(j)} = p(co_a\,|x^{(i)(j)}) \,/\, \sum_{j=1}^{I} p(co_a\,|x^{(i)(j)})$$

The proposed system works based on comparing of the current video frame with one from the previous frames or with background. Motion can be detected by measuring change in speed or vector of an object.

VI. EXPERIMENTAL EVALUATION

1. Evaluation Setup

A mobile phone with 5MP camera or more than 5MP was used to conduct our experiment. In the proposed model, the camera scans for any movement detection and starts capturing the image if the detection occurs. The static image is discarded where the dynamic image is captured for every 5 seconds and stored into the server location. The dynamic image is identified based on the space, position and time using density propagation algorithm (Density detection algorithm).

2. Results

After capturing the images, they are analyzed and then triggered as an SMS in order to alert the Battalion. The SMS will be sent to all the registered people in the server as a notification of an intruder detected. A copy of the SMS will be stored in the database too. We are notifying through SMS because this does not need internet connection and it is more secured and confidential.

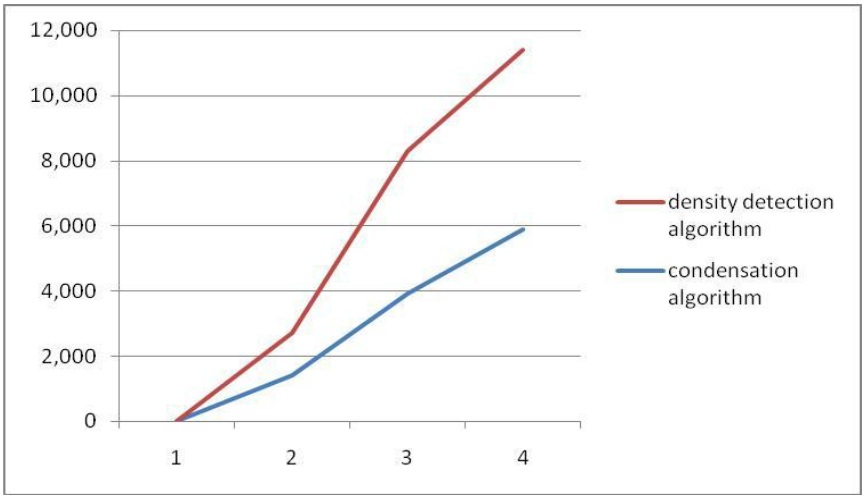

Fig2.Accuracy in density detection and condensation algorithm

V. CONCLUSIONAND FUTURERESEARCH

This technology delivers an early warning and situational awareness information. It enhances unit awareness during all type of operations and environments. It differentiates between light and the object. It can also differentiate moving and non-moving objects. It helps in identification of extreme geographical areas and it also helps the soldiers at the platoon level to provide early warning of personnel and vehicle intrusion in austere environments. The experimental result shows that the proposed system gains optimal result over existing algorithms. The future enhancements depends on detailed analysis among moving objects i.e., it can identify differences between human, animal and moving vehicles.

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