

Comparison of Human Motion Detection Between Thermal and Ordinary Images

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Abstract—The comparison of human motion detection between images from thermal and ordinary camera is developed to track object motion in video using background subtraction technique. The purpose of this application is to generate technology development of the video sequence field and closed to all technology toward of fast growth. The User Interface (GUI) programming development is to aid user to use the system and understanding the system hierarchy. GUI is the medium between user and system. The process that used to develop this system is such as image differential technique, morphology process and plotting process. The analyzed scene involved video recording of the human dynamic motion. Motion detection analysis is done using the sum of absolute difference algorithm within each image frame. Morphology processes are needed to eliminate noise to obtain a more accurate foreground object image. Results obtain thus far clearly indicate that the developed algorithm achieves its objective and successfully compared the detection of the motion object between thermal and ordinary camera.

Index Terms—infrared, thermal image processing, background subtraction algorithm-based approach

I. INTRODUCTION

Analysis of detection movement using technology systems use thermal cameras to be part of military technology; it is important and relevant for the time being. Application using thermal camera is most used in developed countries like the United States [1]. This application detects movement by using a thermal camera which is more accurate than an ordinary. Therefore, thermal camera technology is proposed as it is the most particularly used in image processing. Recent technology use regular camera to do movement detection analysis, however this study will also use thermal camera in the application [2]. Currently our national authorities are unable to detect object movement in the same environment and condition, for example, the Malaysian Armed Forces find it difficult to detect enemies during battle in the battlefield, especially at night or in dark areas. Another problem that can be detected is to identify the most suitable technique that can be applied to detect the movement of objects or people in the video. In order to determine the movement of an object in a video, the military particularly facing problems with measurement

of long distance video at a certain time [3]. Normally, a regular camera is unable to show the present of hidden object situation in the picture, therefore, a possible solution is to use the thermal camera which is particularly enable user to detect hidden object in short or long distance surveillance system. Infrared (IR) thermal screening, hitherto, has been found as powerful, quick and non-invasive method to detect the elevated temperature of individuals when the temperature of the the face is above 36C and excellent area that represents the core body is detected [4]. In realistic situation, the moving subjects are random and the angles of the skin surface and distance change dynamically and misdetection of core body also be due to any unwanted objects that have same temperature [4]. Thus, we will develop an application that is called Comparison of Human Motion Detection between Thermal and Ordinary Camera.

II. RELATED WORK

Human motion detection (HMD) is an increasingly important topic in the general area of military enforcement and it appears to be a critical technology for dealing with enemy in war at battlefield or terrorism, which appears to be the most significant military enforcement problem for the next decade [5]. Existing image technologies for HMD applications include thermal/infrared (IR) and visual. Limitation in HMD application needs to recover with new improvement in software and war technology so that development in military defending systems become more strong and accurate.

Thermal imaging is a process of transforming imperceptible infrared radiation to visible image [6]. In realistic situation, the moving subjects are random and the angles of the body surface and distances change dynamically. Begin with specific algorithm, this paper also include background subtraction algorithm via optical flow algorithm to collecting and processing thermo image and this estimation between thermal images is a challenging task in many computer vision and image processing problems.

Therefore, the limitation of ordinary camera made this study proposes the acceptable performace in human motion detection which include combining complementary algorithm to generate contains of

accurate information using thermal image from thermal camera.

III. MATERIAL AND METHODOLOGY

A. Pattern Recognition and Image Processing

Pattern recognition and image processing use images as the main domain to recognise and delineate image pattern [7]. This stage may involve measurement of the object to identify distinguishing attributes, extraction of features for the defining attributes, and comparing the pattern to determine whether they are matching or not [8]. Image processing and pattern recognition have extensive application in defends system, medicine, astronomy, robotics, remote sensing by satellites and others [9]. The pattern recognition and image processing are divided into four phases; (i) collect data (ii) pre-processing (iii) feature extraction and (iv) testing and verification. As shown in Fig. 1, in the collecting data and preprocessing stages, the captured imagea are resized in order to reduce the color index of the image. Each image of the object will be structured and analysed by system. These video frame images uniformly change to gray-scale index level.

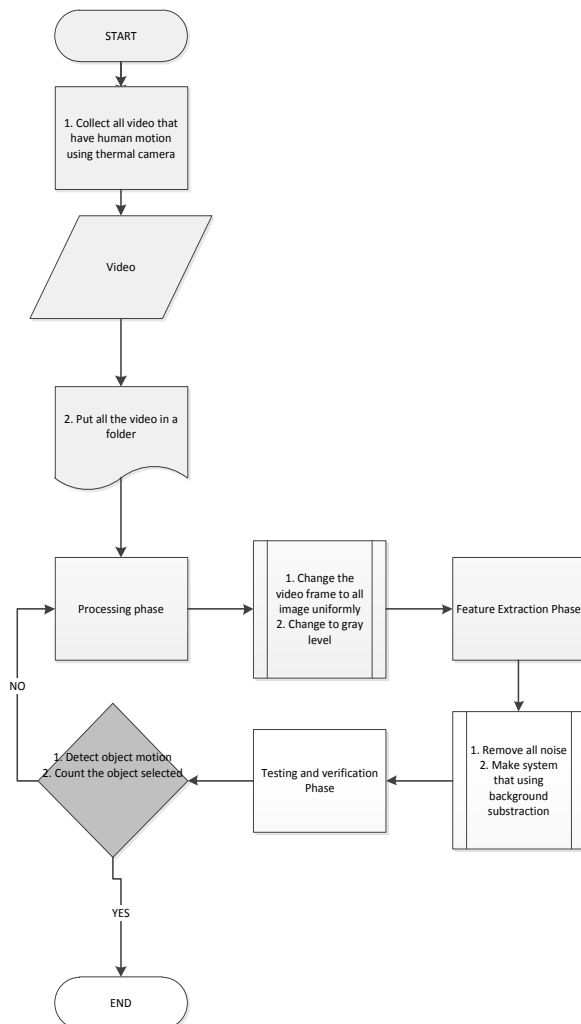


Figure 1. Methodology of pattern recognition and Image processing is used to process thermal image based on colour-based segmentation.

B. Background Subtraction Algorithm

In this paper, background subtraction technique is used. The background subtraction technique is widely used approach for detecting moving objects under fixed camera condition and put forward an important rule for thermal images process. And as it is the first stage of foreground and background classification, this approach will detect the foreground object as the difference between current frame and image of the scenes static background [10]. After labelling and segmentation process is done to an object, at each new frame, we have to figure out what kind of object and how to examine an object; that means, each object has to be classified as either foreground or background. Next, morphological filtering is introduced to eliminate the noise and solve the background disturbance problem [11]. As shown in Fig. 2, an image will be acquired using thermal camera that will be processed that involves colour-based segmentation using the L*a*b colour space for selecting the region of interest. Algorithm of background subtraction continued combine with morphological filtering to enhanced the effectively of tracking object motion. However, classification technique depends on implementation of motion detection [12]. Using multiple feature points rather than a single point [13] makes the matching of the same subject between consecutive frames more reliable but more features can be used as an input to classify an engine to differentiate object motion.

$$B(x) = \begin{cases} 0, & I(x) - I(x-1) < kd(x) \\ 1, & I(x) - I(x-1) > kd(x) \end{cases}$$

Figure 2. Algorithm of background subtraction combined with morphological filtering to enhanced human motion detection.

Fig. 3 shows algorithm to upload the video of typical thermal images setup at surveillance area with dynamic angles and distances from the camera. At feature extraction level, system will remove all noise using background subtraction algorithm as shown in Fig. 4 [13]. Therefore, testing and verification will take action after the detection of object motion.

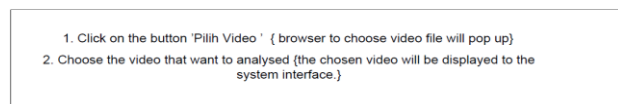


Figure 3. Algorithm to upload video in the system.

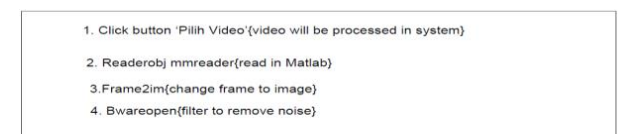


Figure 4. Algorithm of processing video using thermal image at feature extraction level in segmentation.

C. Tracking Human Motion Algorithm

The last process in the application of this system is plotting. The process consists of recovering the background and, finally, tracking the subject of interest. Also known as optical flow-based approach, this

algorithm usually using Horn-Schunck (HS) method and also suggested in human motion detection as this method can detect minor motion of object and could provide 100% flow field [4]. In the free-flow subjects, the optical flow could be used to track the region of interest and track the current location of the moving object. This begin with the box edge is selected to track moving object from the original image and then it will be analysed. Area of assembly that surrounded by the box edge is detected as a regions of the moving object. Whether the viewing system is moving or not, the difference between the image motion of the background and that of the moving subjects is a strong cue that we exploit to distinguish the image of moving subject from that of the background [14]. After this process, the moving objects have been successfully traced. However, plotting process of the box edges have to be done repetitively [15]. And as it is in testing and verification stage, this occurrence cause the plotting processes take some time to resolved, but the moving human body are accurately and reliably detected.

D. Adaptive Network- Based Fuzzy Interference System (ANFIS)

Thermography pre-processing alone may not sufficient without the analytical tools. Ng *et al* have successfully improved the fever identification performance using advance Integrated Technique of Parabolic Regression, Radial Basis Function Network (AAN RBFN) and receiving Operating Characteristics (ROC) from the biostatistical method which at 96% accuracy rate, 95% sensitivity, and 85.6% specificity. The result was better than using the biostatistical method which showed 93% accuracy, 85.4% sensitivity and 95% specificity. The algorithm proposed in this research is Adaptive Network-Based Fuzzy Interference Systems that combines the merots of fuzzy systems and neural networks (NNs). This is assumed to produce more powerful tool for modelling [15].

IV. RESULTS AND DISCUSSION

In this section, the results are presented based on thermal images of moving subjects in the airport area at the same angle. The frame rate is 160fps, and only 15 frames are used for the training data. The algorithm was implemented using the Matlab 7.1. We have implemented pattern recognition and image processing approach, background subtraction algorithm and tracking human motion algorithm in this experiments. The experiment results shown that the proposed methods runs quickly, accurately and fits for surveillance area.

Table I is the result of experiments that has been carried out using the background subtraction algorithm. The result shows that using ordinary camera during daytime moving objects could be detected but not at night. However, with thermal camera, moving objects whether they are explicitly can be seen or hidden both can be detected during daytime or night.

TABLE I. RECORDS ABOUT TYPE OF CAMERA AND EFFECT OF TRACKING

No.	Results of experiments	
	Type of camera	Effect of tracking
1	Ordinary camera	Daytime moving objects detected
2	Ordinary camera at night	No detectable
3	Thermal camera during the day	Movement and hidden object detected
4	Thermal camera during at night	Movement and hidden object detected

The interface that is shown in Fig. 5, the system is not able to detect the human motion as well as the hidden object which cannot be seen. The application system is not able to detect the motion and show the quantity of objects detected.

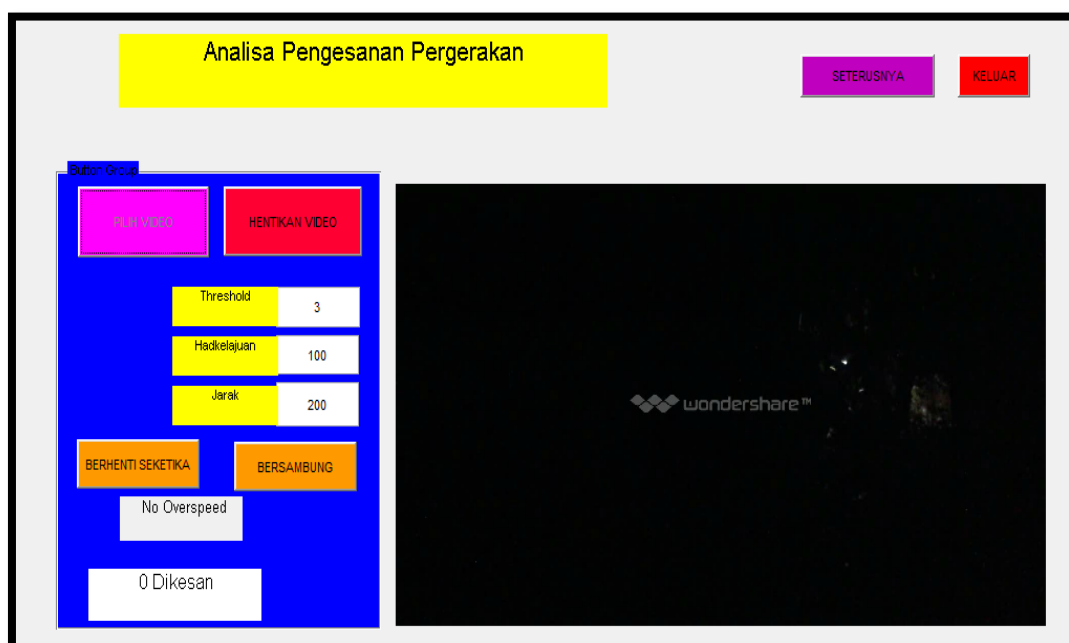


Figure 5. Interface system tested with common camera at night

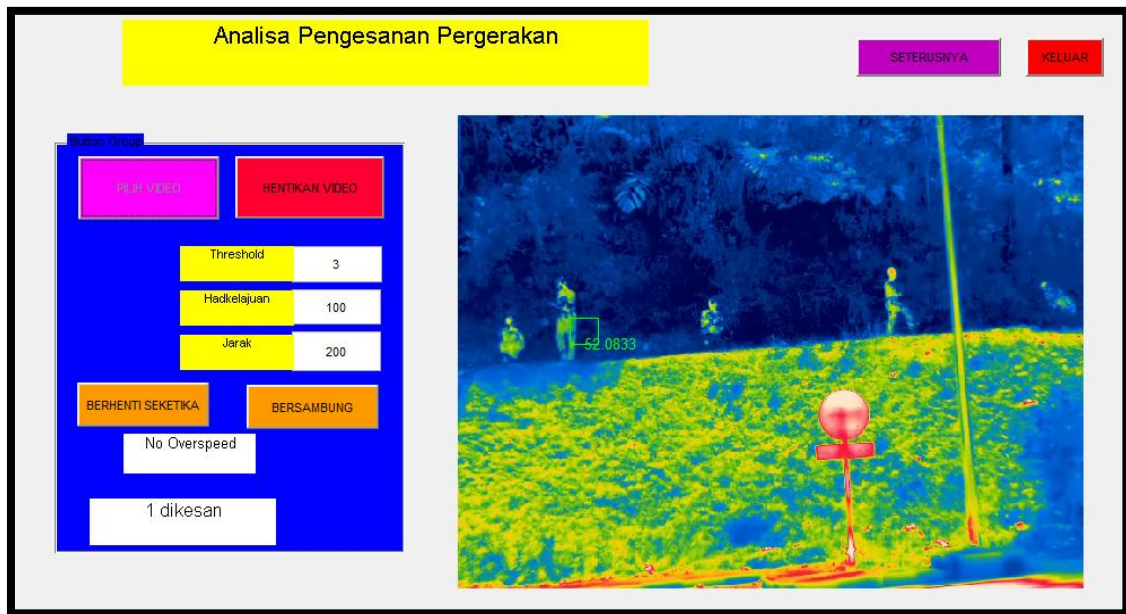


Figure 6. Interface system tested using thermal video

Fig. 6 that is shown below indicates that motion objects can be detected as well as the number of object detected can be determined.

V. CONCLUSION

In conclusion, the application of analysis for multi-camera motion detection can facilitate the Malaysian Army to detect the enemy before taking any action. By using thermal camera, information is provide in detail and merge with the military technology; allows organizations take precautions. In this paper, our approach to human motion detection through processing video captured by a thermal camera has been presented. There is an intelligent switching between background subtraction and optical flow, depending on the platform and processing load. Surveillance can be active on the whole route or only in certain point. This paper has described all elements that are required in implementing the system. The result are promising and with the existence of this application, tracking enemy is quick, accurate and easy.

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