MOVING OBJECT DETECTION AT NIGHT

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Specially dedicated to my family and friend

who have been there for me and inspired me along the way.

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ABSTRACT

Detection of moving object in during day light has been an active research areas and variety of well established algorithms have been proposed. However, the detection moving objects during night time has not yet received equal attention as the detection during the day time. There can be two important reasons for this. Firstly, because of the absent of light, the object does not appear to be visible and hence the camera or capturing device used for the day light would not able to capture this object during night time. Secondly, the method proposed during day light does not work during night time since the surrounding situation is different. During night time, moving vehicle for example will have its lights on that will enlighten its surrounding. This bright area will also change as the vehicle moves and as a result this will affect the image differencing operation. To avoid this false moving object, different approach has to be developed. A technique that this project will look at is to consider only dense bright regions that correspond to the vehicle's lights only. Depending on the angle of the camera, the distance between lights of the car will maintain so as for other vehicles. In addition, different distance value can be used to classify the type of moving vehicle i.e. either it's a car, lorry, or motorcycle. As such, this project will a software-based project. A video sequence captured from infrared sensitive camera for night vision application will be utilized.

ABSTRAK

Pengesanan pergerakan objek pada waktu siang telah menjadi satu bidang penyelidikan yang aktif dan pelbagai algoritma telah dicadangkan. Walau bagaimanapun, penyelidikan berkenaann pengesanan objek yang bergerak pada waktu malam tidak mendapat perhatian yang sama dengan pengesanan objek pada siang hari. Hal ini disebabkan oleh dua factor yang penting. Pertama, disebabkan ketiadaan cahaya, objek tidak kelihatan dengan jelas dan menyebabkan kamera atau perkakas rakaman yang digunakan pada waktu siang tidak dapat mengesan objek ini pada waktu malam. Kedua, kaedah yang dicadangkan pada waktu siang tidak dapat diaplikasikan pada waktu malam kerana persekitaran yang berbeza. Pada waktu malam, kenderaan yang bergerak akan memasang lampu, sekaligus menerangi persekitarannya. Luas kawasan yang terang akan berubah dengan pergerakan kenderaan dan memberikan kesan terhadap operasi pembezaan imej. Untuk mengelakkan objek bergerak yang palsu, suatu pendekatan yang berbeza perlu dikaji. Satu teknik yang akan dikaji dalam projek ini ialah dengan hanya menggunakan kawasan terang padat yang berkaitan dengan kenderaan sahaja. Sebagai tambahan, nilai jarak yang berbeza boleh digunakan untuk mengklasifikasikan jenis kenderaan yang bergerak, sama ada kereta, lori atau motosikal. Justeru itu, projek ini adalah berasaskan perisian. Satu rakaman video yang diperoleh menggunakan kamera peka-inframerah bagi aplikasi penglihatan waktu malam akan digunakan.

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INTRODUCTION

1.1   Introduction to Motion Detection.

A video sequence is made of basically a series of still images at a very small interval time between each capture. The use of image sequences to depict motion dates back nearly two centuries. One of the earlier approaches to motion picture "display" was invented in 1834 by the mathematician William George Horner.

The impression of motion is illusory. An image is perceived to remain for a period of time after it has been removed from view. This illusion is the basis of all motion picture displays. When an object is moved slowly, the images of the object appear as a disjoint sequence of still images. As the speed of movement increases and the images are displayed at a higher rate, a point is reached at which motion is perceived, even though the images appear to flicker. If the speed of the motion is increased, it will reach a point at which flicker is no longer perceived.

The first attempt to acquire a sequence of photographs from an object in motion is reputed to have been inspired by a wager of Leland Stanford circa 1872. The wager involved whether or not, at any time in its gait, a trotting horse has all four feet off the ground.

Motion detection done at broad daylight and night has some slight differences. Detection of moving object in during day light has been an active research areas and variety of well established algorithms have been proposed. However, the detection moving objects during night time has not yet received equal attention as the detection during the day time.

Moving object detection done at night is a more difficult task as it is done in the absent of light, thus, the object does not appear to be clearly visible. This explains why the camera or capturing device used for the day light would not able to capture this object during night time. Another reason to prove that the method proposed during day light does not work during night time is because the surrounding situation is different. During night time, moving vehicle for example will have its lights on that will enlighten its surrounding. This bright area will also change as the vehicle moves and as a result this will affect the image differencing operation. To avoid this false moving object, different approach has to be developed.

A technique that this project will look at is to consider only dense bright regions that correspond to the vehicle's lights only. Depending on the angle of the camera, the distance between lights of the car will maintain so as for other vehicles.

In addition, different distance value can be used to classify the type of moving vehicle i.e. either it's a car, lorry, or motorcycle. As such, this project will be a software based project. A video sequence captured from infrared sensitive camera for night vision application will be utilized.

1.2 Limitation of Motion Detection at Night

Motion detection is used extensively at night especially in the surveillance system. Motion detection done at night scene poses a few challenges in obtaining good or acceptable image quality due to a few reasons:

- Low Light scenario

    The scene or surrounding environment is not well lighted. In order to obtain a good and accurate image, the brightness level must be high enough to capture almost every single detail within the viewing scope of the camera. In a low-light situation, this is not possible because the brightness level is not sufficient to capture every single detail. A lot of detail information is lost due to low-light. In order to compensate that and at the same time to maintain the a decent image quality, some techniques are used to pre and post process the image.

- Noisy IR camera

IR camera has a relatively high noise level. IR camera works very well in the night scene because the image is captured based on the infra-red range in the light transmitted into the camera.

- Poor distinction between the object and the background
Since the scene is not well lighted, this makes the threshold value between the background and the object, small. Thus, it is harder to differentiate the background and the object due to the small threshold differences.

1.3 Objective

The objective of this project is to develop an algorithm for the purpose of detecting motion (specifically moving vehicle) from a video sequence captured by an infra-red sensitive camera.

A suitable technique of image processing is to be implemented for the purpose of detecting motion that exists in the video sequence. Secondary technique that is to be implemented is the filtering and thresholding process that is needed to improve the image to be less noisy, thus improving the image quality. Motion detection technique is chosen properly to suit the image captured at night scene whereby the light source is scarce.

1.4   Project Scope

This scope of the project is mainly to focus on the development of a software module that will do the image processing. The algorithm will be intelligent enough to filter out any noise that might exist in the IR sensitive video sequence. Besides that, this algorithm is designed to detect moving objects (specifically vehicles) at night, with the condition that the vehicle must turn on the headlights.

The scope of this project does not include object tracking and classification.