TRACKING OF A PERSON IN SEMI-DENSE CROWD

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To my dearest

Mother

Asiah binti Ahmad

Sisters

Ilyiana binti Ismail

Izaidah binti Ismail

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ABSTRACT

Security has always been the main agenda in ensuring the safety and welfare for government and agencies especially in public areas where possible threat that could cause a massive damage is intolerable. For this reason, immediate steps such as putting on CCTV cameras and employing sophisticated surveillance have been placed in some public and high security areas. More often than not, the system still involves manual monitoring by the security officer. As a solution, this project proposed an improved system with an automatic object tracking capability. The project will be focusing on tracking operation system such that a single person can be tracked in a semi-dense crowd. A person will be determined by a user clicking on that person and a box will be drawn encapsulating the person. As this person moves within the scene, the box will follow him/her until the person leaves the camera view. The research undertaken in this report is mainly concentrated on developing detection and tracking system which incorporates with some operation on images such as thresholding, blob labelling, blob matching, filtering and blob analysis. All the process will be done in a grayscale image in order to make the detection process becomes easier. Background subtraction model is being used for extracting the moving object from the background. Method used for object tracking is feature-based model method which used area, center point of each moving people and the Euclidean distance between object to recognized tracking object. Based on the experimental results, the percentage of accuracy decreases when the number of person increases in the scene.

ABSTRAK

Sekuriti selalu menjadi agenda utama dalam memastikan keselamatan dan kesejahteraan untuk badan-badan kerajaan dan masyarakat terutama di kawasan yang melibatkan kerosakan serius berlaku. Oleh itu, langkah seperti memasang kamera CCTV dan menggaji pengawal keselamatan yang berpengalaman telah ditempatkan di beberapa tempat awam dan kawasan yang memerlukan pengawasan yang ketat. Sehingga hari ini, sistem keselamatan masih melibatkan pemantauan secara manual oleh petugas keselamatan. Sebagai penyelesaian, projek ini telah dicadangkan untuk memperbaiki sistem sedia ada dengan sistem menjejak objek automatik. Projek ini tertumpu pada penjejakan satu objek di dalam keadaan separuh padat. Objek sasaran akan ditentukan oleh pengguna dengan mengklik pada objek berkenaan dan sebuah kotak akan dilukis mengelilingi objek tersebut. Selagi objek sasaran bergerak di dalam pandangan kamera, kotak akan mengikut objek berkenaan sehingga objek tersebut keluar daripada pandangan kamera. Penyelidikan ini memberi penekanan kepada penghasilan satu sistem mengesan dan menjejak objek bergerak dengan meggunakan kaedah-kaedah dalam pemerosesan imej seperti *thresholding, blob labeling, blob matching, filtering* and *blob analysis.* Semua proses akan dilaksanakan dalam imej skala kelabu bagi memudahkan proses mengesan objek. Model penolakan latar belakang digunakan untuk mengasingkan objek yang bergerak dari latar belakangnya. Kaedah menjejak objek yang digunakan adalah model *feature-based* dimana keluasan objek bergerak, titik tengah setiap objek dan jarak diantara objek digunakan untuk proses mengenal objek. Berdasarkan keputusan eksperimen, peratus kejituan sistem berkurang apabila bilangan objek bergerak bertambah.

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LIST OF SYMBOLS

M(x)	-	Maximum intensity value for pixels x
N(x)	-	Minimum intensity value for pixels x
I(x)	-	Image for pixels x
D(x)	-	Difference of pixels x
B(x)	-	Background model for pixel x (Binarizing)
F(u,v)	-	Fourier transform at distance u and v
H(u,v)	-	Low-pass filter at distance u and v
G(u,v)	-	Gaussian low-pass filter at distance u and v
D0	-	Distance origin
D(u,v)	-	Distance from point (u,v)
n	-	Filter order
A	-	Set of A
B	-	Set of B for structural element
$\cup$	-	Unity
$\cap$	-	Intersection
$\subseteq$	-	Element of
$\oplus$	-	Bounded sum
Θ	-	Bounded subtract
$\bullet$	-	Opening
$\circ$	-	Closing

LIST OF ABBREVIATIONS

MOD	-	Motion Object Detection
LP	-	Linear Prediction
fps	-	frames per second
pdf	-	probability density function
RGB	-	Red Green Blue
MEM	-	Maximum Entropy Method
ILPF	-	Ideal Low-Pass Filter
BLPF	-	Butterworth Low-Pass Filter
TH	-	Threshold

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CHAPTER 1

INTRODUCTION

1.1 Overview

Intelligence video surveillance has become one of the most important problems in computer vision with applications in security, vehicle guidance, people and traffic monitoring, patient observation, etc. Automatic visual surveillance in dynamic scenes has attracted recently a great deal of interest in research. Technology has reached a stage where, mounting a video camera has become so cheap causing a widespread deployment of cameras in public and private areas. Finding available human resources to supervise the videos is too expensive for most organizations. Moreover, surveillance by operators is error-prone due to fatigue and negligence.

Therefore, it is important to develop accurate and efficient automatic video analysis systems for monitoring human activity that will create enormous business opportunities. The purpose of visual surveillance is not to replace human eyes with cameras, but to make most of the surveillance task as automatic as possible. Lately, many improvements have been included in such system such as automatic moving object detection, object recognition, and object tracking.

This project is focused on presenting the system with an automatic object tracking system where person in the semi-dense crowd can be tracked. This system consists of two major components, one for the detection of moving person and the other one for the tracking purpose. The accuracy of these components largely affects the accuracy of overall surveillance results.

The research undertaken involves developing a motion tracking system that runs in real-time. The system is used for detecting and tracking a person in semi-dense crowd; so that the scene does not include other moving object accept the group of human. This project will be purely software and the entire person detection and tracking program will be developed using Matlab programming language.

1.2 Background of Study

The person will be determined by a user clicking on that person for which a box will be drawn encapsulating the person. Next, as this person moves within the scene, the box will follow him/her until the person leaves the camera view.

1.3 Problem Statement

Tracking of a single person is relatively easy. However, when it involves many moving objects or people in the image frame, the tracking becomes harder and difficult. This difficulty is based on tracking the suspected people by not losing him/her until the person leaves the camera view. It becomes more complex when the person is moving among other people. Not only because of the intersection of the people makes it complex, other environment such as shadow and speed of the moving people also affect in the tracking system.

The intersection among more than two persons can make the tracking system a problem when it happens. System cannot recognize suspected person if occlusion involved a lot of people. It can also affect the accuracy of the system. Tracking system should not be affected by the intersection between each moving people and environmental problem.

This problem can be solved by using image processing method which is useful for tracking. The image processing method is based on the specific algorithm for tracking and it will track down each moving people without errors.

1.4 Objective

The objective of this project is to improve the tracking operation system such that a single person can still be tracked in a semi-dense crowd. A suitable technique of image processing need to be implemented for the purpose of detecting motion and tracking moving objects that exists in the video sequences.

1.5 Scope of Study

In developing a system for tracking of the person in semi-dense crowd, the scope of the current research has been defined as follows:

- This scope of the project is mainly focus on the development of a software module that will do the image processing.
- Semi dense-crowd:
    - Scene with less than 10 people.
    - Tracked person can be seen in complete human form.
- The video only takes in the day scene in order to avoid illumination changes in the video taken.
- Consider only 2 directions : right and left (horizontal).
- Occlusion only happens between people who come from difference direction.
- Moving object involved in this project is only humans, not animals or vehicle etc.
- The design of the tracking and indexing algorithm will be based on MATLAB 7.8 environment using mainly the image processing toolbox. All the data of the moving people image will be pre-processed by MATLAB coding or programming.

1.6 Outline of Project Report

This thesis consists of five chapters and each chapter is briefly discussed as follows:

- Chapter 1: Introduction

This chapter discusses the objectives and scope of the project and introduces some background with respect to the problem to be solved.

- Chapter 2: Literature Review

This chapter is about previous works that have been done in tracking moving object regarding on object detection and object tracking method. It will also describe and explain how filtering was done to get a better tracking consumptions with reduced error by using low pass filter and morphological process.

- Chapter 3: Design Methodology

In this chapter, it tracking and indexing of moving objects will be explained. It also will describe method or model being used in this project for better object detection and indexing which will be based on certain features.

- Chapter 4: Results and Discussion

In results and discussions, it will show and explain the evaluation on performance of the experiments being done for all frame images which consists of people in semi-dense crowd condition in same background environment.

- Chapter 5: Conclusion

The last chapter will conclude every single detailed in this project. It also will give some future works development which will be based on the problems occurs in this project. The future work also is based on upgrading this project to the next level.