DETECTION AND CLASSIFICATION OF MOVING OBJECTS FOR AN AUTOMATED SURVEILLANCE SYSTEM

By
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Dedicated to my loving family, for their endless support

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment
of the requirement for the degree of Master of Science

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Faculty   : Engineering

Automated surveillance system has been the subject of much research recently. A completely automated system means a computer will perform the entire task from low level detection to higher level motion analysis. Since conventional system practically using human power to monitor and did not applicable for a long hour monitoring, thus automated system had been created to replace the conventional system. This thesis focuses on a method to detect and classify a moving object that pass through the surveillance area boundary. Moving object is detected by using combination of two frame differencing and adaptive image averaging with selectivity. Technically, this method estimate the motion area before updates the background by taking a weighted average of non-motion area of the current background altogether with non-motion area of the current frame of the video sequence. This step had created a focus of attention for higher level processing and it helps to decrease computation time considerably. The output of a motion–based detector is essentially a collection of foreground that might correspond to the moving objects. But usually the output image produced from this process contaminated with noise and shadow. As a solution, morphological operation has been employed as an

approach to remove noise from the foreground object. Mutual shadow that exists with the object had been abolished by combining chromatic colour values with lightness variable. Then, standardized moment invariant is employed to extract the features for each moving blobs. To recognize these blobs, the calculated moment values are fed to a support vector machine module that is equipped with trained extracted moment values for human and vehicle silhouettes. The system operates on colour video imagery from a stationary camera. It can handle object detection in outdoor environments and under changing illumination conditions. The applied post processing module capable to remove noise and shadow from the detected objects with less than 1% of error. Finally, classification algorithm that makes use of the extracted moment values from the detected objects successfully categorize objects into pre-defined classes of human and vehicle with 89.08% of accuracy. All the methods have been tested on video data and the experimental results have demonstrated a fast and robust system

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

PENGESANAN DAN KLASIFIKASI OBJEK-OBJEK BERGERAK UNTUK SISTEM PENGAWASAN AUTOMATIK

Oleh

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September 2006

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Sistem pengawasan automatik telah menjadi antara bidang penyelidikan yang utama ketika ini. Sistem pengawasan automatik menyeluruh bermakna komputer melakukan semua kerja daripada peringkat terendah pengesanan hingga ke peringkat tinggi analisa pergerakan. Oleh kerana sistem sedia ada menggunakan manusia , ia tidak sesuai dan berkualiti untuk pegawasan dalam tempoh waktu yang lama, maka sistem automatik ini merupakan alternatif terbaik menggantikan sistem konvensional tersebut. Tesis ini memfokuskan kaedah untuk mengesan dan mengklasifikasi objek bergerak yang merentasi kawasan pengawasan. Objek bergerak dikesan menggunakan kombinasi teknik pembezaan dua kerangka dan teknik purata imej suai dengan pemilihan, dimana secara teknikalnya, kaedah ini menganggar kawasan pergerakan sebelum mengemaskini latarbelakang dengan mengambil kira purata piksel pemberat diluar kawasan pergerakan daripada latarbelakang dan kerangka terkini daripada susunan video. Langkah ini memfokuskan kepada kawasan yang lebih khusus dan kecil untuk proses yang lebih inggi ,dengan itu secara tidak langsung mengurangkan masa untuk pengiraan. Hasil daripada pengesan pergerakan ini ialah koleksi penting latar depan yang merupakan objek bergerak. Namun

biasanya hasil imej daripada proses ini dicemari dengan hangar dan bayang-bayang. Sebagai langkah penyelesaiannya, operasi morfologi dipilih sebagai cara untuk membersihkan hingar daripada objek latar depan. Bayang-bayang yang terdapat pada objek pula dihapuskan dengan kombinasi nilai warna kromatik dan pembolehubah cahaya. Selepas itu piawaian momen tak varian digunakan untuk mengekstrak ciri daripada objek bergerak. Untuk mengecam objek ini, nilai momen yang telah dikira dihantar ke modul mesin penyokong vektor yang sebelum itu dilengkapkan dengan pemahaman tentang ekstrak nilai momen daripada bebayang bentuk manusia dan kenderaan. Sistem ini beroperasi menggunakan video warna daripada kamera yang dalam keadaan pegun. Ia boleh mengesan objek di persekitaran luar dan dalam keadaan perubahan keamataan cahaya. Modul pemprosesan pasca mampu menghapuskan hingar dan bayang-bayang daripada objek yang dikesan dengan ralat kurang daripada 1%. Akhir sekali, algoritma pengelasan menggunakan nilai momen yang telah diekstrak daripada objek yang dikesan berjaya mengkategorikan objek samada manusia atau kenderaan dengan ketepatan 89.08%. Semua kaedah ini telah diuji pada data video dan keputusan eksperimen membuktikan bahawa sistem ini pantas dan tegap.

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Finally, although my name is officially printed in this thesis, the contribution is come from all of you. So I specially dedicate this thesis for you.
vii

I certify that an Examination Committee has met on 14 September 2006 to conduct the final examination of Mohd Razali Bin Md Tomari on his Mater of Science entitled " Detection and Classification of Moving Objects for An Automated Surveillance System" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as a fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions

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MOHD RAZALI BIN MD TOMARI

Date:20 DECEMBER 2006

TABLE OF CONTENTS

Page