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# Smart Surveillance Camera based on Pattern

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***Abstract***

*Many research works has done on security surveillance camera system. Most of the experiment result shows good result in lab environment but the performance is not good enough when it apply to real life application. The experiment environment of research lab is different from outside world; therefore illumination condition is also different. Although false alarm works well in research environment but it has many problems in real world or dynamic background. False alarm is caused by shadow, smoke and light illumination condition and different type of noises these are major concern for effective surveillance camera system. So how to remove shadow effectively is more important than error detection and accurate result. Which is the main objective in surveillance system? The focus of our work is to remove the shadow efficiently. The computer vision researchers always give importance to the experimental issues such as image input color, morphological algorithms or moving object detection not to the real environmental issues. If the input image and shadow is similar with human then other algorithm not performs well while our proposed algorithm works very accurately. Experimental result shows our proposed algorithm can find out human and shadow from the input image. We have used different simulated illumination condition to find out the noise and successfully subtracted shadow. For our simulation environment we used unity 3D and Direct 10, tessellation (bump mapping).*

***Keywords****: Image processing, computer vision, surveillance system, SFM, shadow removal*

## 1. Introduction

Surveillance camera system in illumination problem is very challenge task. Illumination and environment light is change object reflecting energy. From start using surveillance camera their system has many problems, wind change camera pose, cloud, illumination condition, cat and dog all these noise from surveillance camera is moving object because the camera field of view these object is change background. These problems for all automatic surveillance system detection object of interest in input scene. Common algorithm is for segmentation of moving object is DOF (Different of Frame) background subtraction [1, 3]. This algorithm is very simple and performance is very good because analysis part only find previous frame and current frame. Algorithms are reference by background image in a pixel by pixel, find about different pixel, detection that area to find moving object [2]. But in real world this algorithm foreground segmentation cannot know object is shadow or moving object. Some researcher discusses shadow static shadow dynamic shadow, other researcher naming it pattern shad-ow. How to reduce shadow is main target, reduce illumination of light source is good solution, other researcher solution is input shadow to background model. Dynamic shadow problem are hard task, input it to background model. Other researcher based on grayscale algorithm threshold shadow area. But this algorithm also reduce moving object. In this paper our method is from video surveillance system analysis environments. Human position detection from Smart surveillance camera area is hot issue. It’s usually using for terrorist,

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crime prevention, and countermeasures against natural calamities. The base algorithm is HOG (Histogram of Gradient), DOF (Different of Frame), CAMSIFT (Continuously Adaptive Mean Shift) and the research goal is tracking object, pattern recognition, active analytics, and objects detection [9, 10]. Main target is found what object in a video scene. If we know the object, we can improve algorithm and performance. Car and human are different. But, the method of car detection program is very similar with the way of the detection program of a cat and dog. In detection system each object has 5 same features (car bodies, tiers like animal bodies and foot). So from the 1st finding of the object’s size is more important than pattern recognition. The 2nd finding use of pattern recognition detection object 3rd activity analytics.

## 2. Related Works

Other researcher focus on reduce shadow and find object morphology detection target. Main target is found what object in a video scene. If know the object, can compute improve algorithm and performance. Car and human are different. But, the method of car detection program is very similar with the way of the detection program of a cat and dog. In detection system each object has 5 same features (car bodies, tiers like animal bodies and foot). So from the 1st finding of the object’s size is more important than pattern recognition. The 2nd finding use of pattern recognition detection object 3rd activity analytics. Detection environment dynamic light and static light is main target. 1st our algorithm find object feature point from feature we find object silhouette. Second we need make 3D scene from real world. And that task need very easy, very simple, and cost need very low. From surveillance system need make visualization scene to visualization about real world problem.

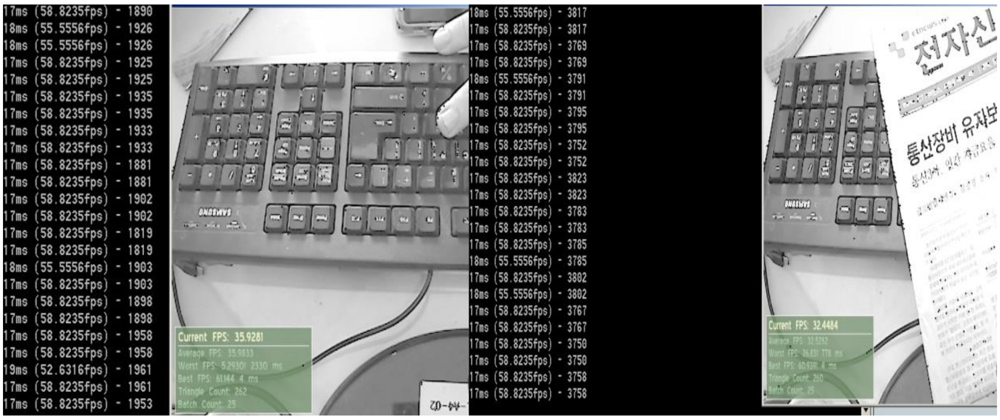


**Figure 1. Find Matching Point**

### 2.1. Human Pixel Model

Dalal and Triggs compared their R-HOG and C-HOG descriptor blocks against generalized Haar wavelets transform, PCA-SIFT algorithm, Generalized Haar wavelets algorithms are oriented Haar wavelets. PCA-SIFT algorithms are similar to common SIFT algorithm, but difference in that principal component analysis is applied to the normalized gradient patches. PCA-SIFT descriptors were first used in 2004 by Ke and Sukthankar and were claimed to outperform regular SIFT descriptors. Finally, Shape Contexts use circular bins, similar to those used in C-HOG blocks, but only tabulate votes on the basis of edge presence, making no distinction with regards to orientation. Shape Contexts were originally used in 2001 by Belongie, Malik, and Puzicha.

The testing commenced on two different data sets. The Massachusetts Institute of Technology pedestrian database contains 509 training images and 200 test images of pedestrians on city streets. The set only contains images featuring the front or back of human figures and contains little variety in human pose. The set is well-known and has been used in a variety of human detection experiments, such as those conducted by Papageorgiou and Poggio in 2000. The MIT database is currently available for research at http://cbcl.mit.edu/cbcl/software-datasets/PedestrianData.html. The second set was developed by Dalal and Triggs exclusively for their human detection experiment due to the fact that the HOG descriptors performed near-perfectly on the MIT set. Their set, known as INRIA, contains 1805 images of humans taken from personal photographs. The set contains images of humans in a wide variety of poses and includes difficult backgrounds, such as crowd scenes, thus rendering it more complex than the MIT set. The INRIA database is currently available for research at http://lear.inrialpes.fr/data. The above site has an image showing examples from the INRIA human detection database.

As for the results, the C-HOG and R-HOG block descriptors perform comparatively, with the C-HOG descriptors maintaining a slight advantage in the detection miss rate at fixed false positive rates across both data sets. On the MIT set, the C-HOG and R-HOG descriptors produced a detection miss rate of essentially zero at a 10−4 false positive rate. On the INRIA set, the C-HOG and R-HOG descriptors produced a detection miss rate of roughly 0.1 at a 10−4 false positive rate. The Generalized Haar Wavelets represent the next highest performing approach: the wavelets produced roughly a 0.01 miss rate at a 10−4 false positive rate on the MIT set, and roughly a 0.3 miss rate on the INRIA set. The PCA-SIFT descriptors and Shape Contexts both performed fairly poorly on both data sets. Both methods produced a miss rate of 0.1 at a 10−4 false positive rate on the MIT set and nearly a miss rate of 0.5 at a 10−4 false positive rate on the INRIA set.

Human silhouette width: human height average bigger than width average. From detection ROI (region of interest)[12,13], we easily know that detection object is human. Human object silhouette we can calculate about human height [4, 5, 6]. Figure 3 (a) shows using HOG detection human body [7, 8], and Came sift algorithm detection character [10,11] it image is big human body and (b) shows surveillance camera video human body is small size[4,5]. (a) Image resolution size is 600 X 400 tracking system performance is 15~18 frame/s and (b) is video resolution is 768 X 576 tracking system performance is 32~49 frame/s. Figure 2 shows recognition car.


**Figure 1. HOG Car Detection**

### 2.2. Car Pixel Model and Human Pixel Model

That are making a comparison, between car pixel structure and motor pixel structure, shows that some areas same. Smart surveillance camera system needs to find those. It needs to train two models classifier detection each other. Human is supposed to be on a sidewalk and in a building, and a car has to be on road.

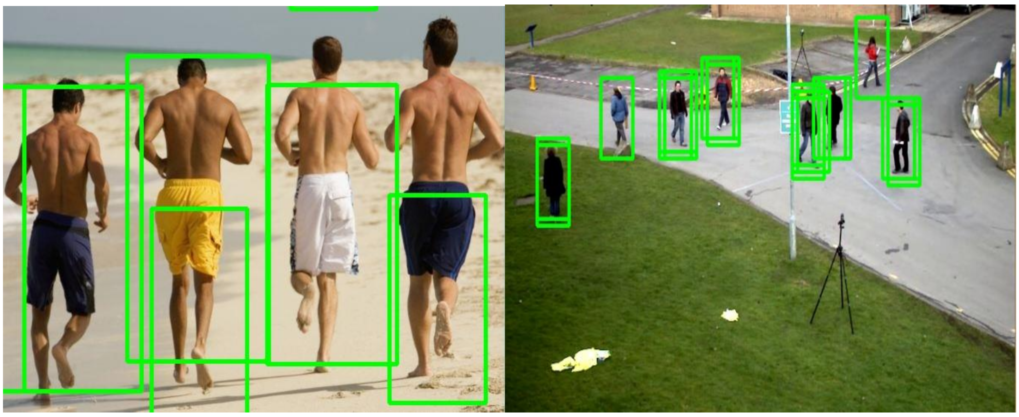
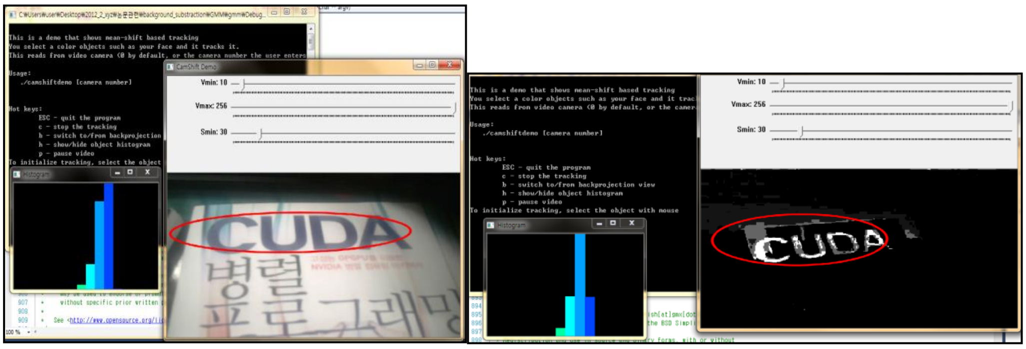


**Figure 3. Human Body Detection**

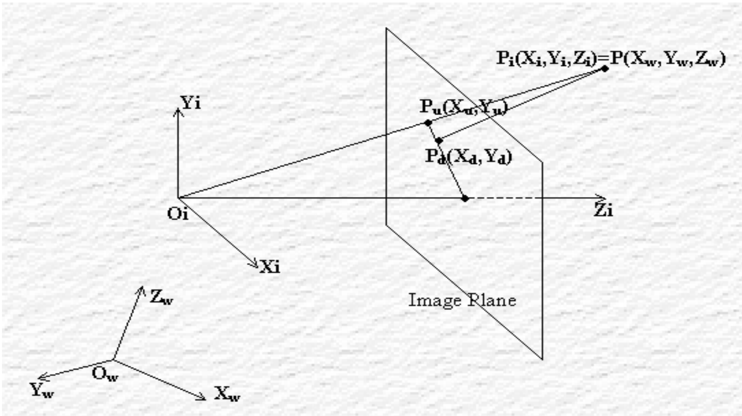
(a) CPU MODE Big Human Body Image and GPU MODE Small Body Image




(b) CAMSIFT Tracking Character String on Grayscale

## 3. Proposal Method

The proposal method based on related work algorithm combine and using calibration make new surveillance system. Figure 3 shows algorithm based on Direct linear transformation (DLT) method 2 A classical approach is "Roger Y. Tsai Algorithm”. It is a 2-stage algorithm, calculating the pose (3D Orientation, and x-axis and y-axis translation) in first stage. In second stage it computes the focal length, distortion coefficients and the z-axis translation. 3 Zhengyou Zhang's "a flexible new technique for camera calibration" based on a planar chess board. It is based on constrains on homography. 4 Tasi camera calibration algorithm Camera calibration and pose estimation are major issues in computer vision since they are related to many vision problems such as stereovision, structure from motion, robot navigation and change detection  The Tsai model is based on a pinhole perspective projection model and the following eleven parameters are to estimate: f - Focal length of camera, k - Radial lens distortion coefficient, Cx, Cy - Coordinates’ center of radial lens distortion, Sx - Scale factor to account for any uncertainty due to imperfections in hardware timing for scanning and digitization, Rx, Ry, Rz - Rotation angles for the transformation between the world and camera co-ordinates, TX, Ty, Tz - Translation components for the transformation between the world and camera coordinates. From this algorithm can know object size and position. Combine this algorithm to HOG algorithm can improve Smart Suveillance camera system.




**Figuer 4.Tasi Camera Calibration Algorithm Camera Calibration**

### 3.1. Experiment Data Pets 2007

Pets 2007: Tenth IEEE International Workshop on Performance Evaluation ofTracking and Surveillance video file for researcher.

Original Video file is provided calibration parameters were obtained using the freely available Tsai Camera Calibration Software by RegWillson. For instructions on how to use RegWillsons software visit Chris Needhams helpful page. More information on the Tsai camera model is available on CVonline.

An example of the provided calibration parameter XML file is given here. This XML file contains Tsai camera parameters obtained from RegWillsons software, using the calibration points image shown above and this set of points. C++ code (available here) is provided to allow you to load and use the calibration parameters in your program (courtesy of project ETISEO). Please note that separate calibration parameters are provided for each Scenario (located within each Scenario .zip)


**Figure 5. Tasi Video Camera Calibration**

### 3.2. Video Camera Hardware Specification

The DV cameras used to film all datasets are:

Camera 1: Canon MV-1 1xCCD w/progressive scan

Camera 2: Sony DCR-PC1000E 3xCMOS

Camera 3: Canon MV-1 1xCCD w/progressive scan

Camera 4: Sony DCR-PC1000E 3xCMOS

Camera 1: The entire scenario including the calibration data s00.zip (4500 frames, 180s, 862 Mb)

Camera 2: The entire scenario including the calibration data s01.zip (4001 frames, 160.04s, 862 Mb)

All scenarios come with four XML files. The XML files contains the camera calibration parameters for camera views 1-4 respectively.

The XML schema for the configuration / submission is given here.

### 3.3. Training Data

Background images are provided of the monitored surveillance system. Note that the scene is never completely empty of people. However, it is envisaged that the data is useful for training some systems. Note that testing (and corresponding generation of results) should not be performed on the training data, only based on some or all of sequences S0-S8 below.

## 4. Experiment Result

Experiment method simulation environment in game engine find environment dynamic and statics or pattern lighting energy support detection object area accuracy. Proposed system can support detection and recognition of object, tracking interest object, analysis behavior, and also it supports counting customer, analysis traffic gridlock, customer behavioral pattern, group behavior pattern, specific behavior pattern, analysis crime rate. Figure 5 shows surveillance system from Pets 2007. Figure 6 and Figure 7 is show result of surveillance camera system.

**Figuer 5. Proposal Surveillance Camera System**

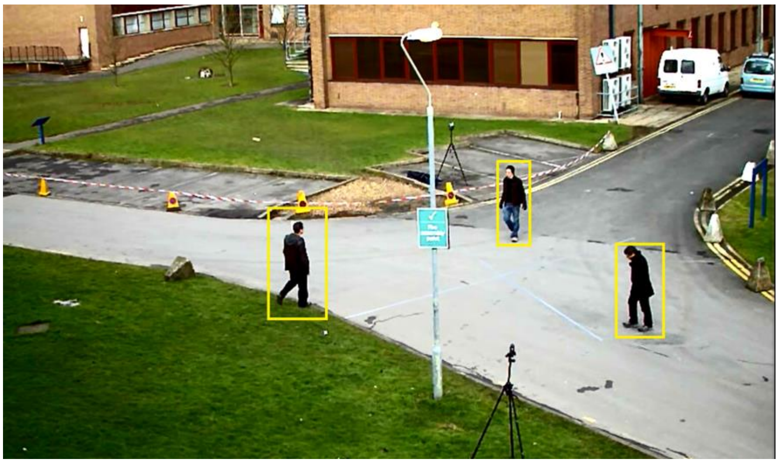


Figure 6. Surveillance System Test 1

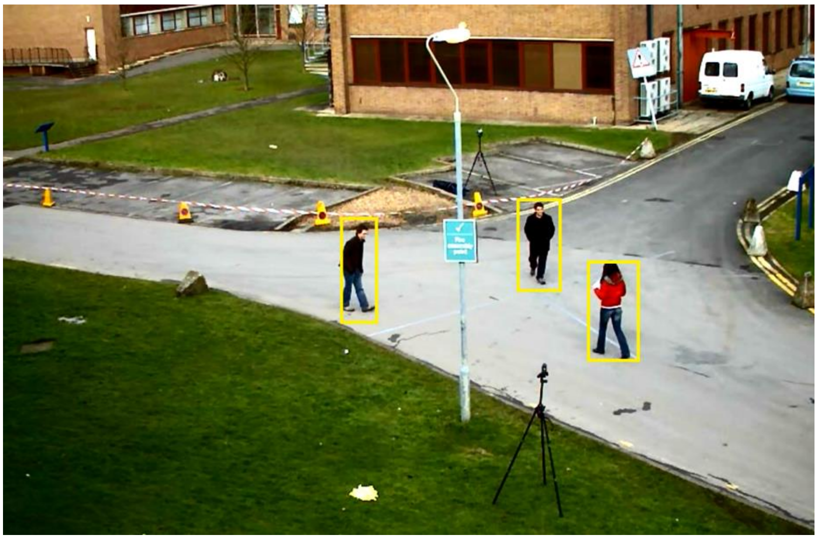


Figure 7. Surveillance System Test 2

Figure 8. Surveillance System Test 2

### 4.1. Experiment in University Field

Figure 9 is University INHA 4 Camera 13 floor testing, every camera specs is 420X280 15 frame/s record software is Bandicam. Test result is Figure 6. Using OpenCV GPU HOG testing this video.


**Figure 9. HOG Human Detection 4 Camera**

## 5. Conclusion and Future Work

In section 4 result In real world surveillance camera system detection object complex problem, in this paper based on Tasi algorithm combine HOG in one system improve detection algorithm and object matching. Startting to input video 1st reconization about object find it human or car. After find feather detection can improve computing time to find morphology. All these input video impalement in camera calibration algorithm. Proposed surveillance camera system had good accuracy and divide object to group but problem is system need good computing power. Human detection part algorithm using GPU, running need GPU support this algorithm. Future work find algorithm improves performance and tanning more object algorithm input it to surveillance object category.

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