SURVEILLANCE OF THE UNATTENDED BAGGAGE AND BACKTRACKING VERIFICATION OF THE OWNER

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ABSTRACT:

This paper designs an off the shell surveillance system which tracks, detects, categorizes the unattended objects (generally termed as abandoned object detection) in the scene using state-of-the-art computer vision technique. A much popular time efficient background subtraction algorithm MOG is used by this paper to generate long term and short term foreground models.. The temporal consistency has been added to reduce the percentages of false alarms. Also provides an efficient back tracking verification of the owner for the further inspections. . On spotting the emergent scenario, the hardware part (ARM 7 microcontroller, a buzzer and GSM) alerts the public by raising an alarm This surveillance system has been tested using the standard data sets PETS 2006 and AVSS 2007 .Subsequent reduction in false alarm rate has been noticed.

Keywords: *Abandoned object detection; temporal consistency; background subtraction; object tracking; visual surveillance*

I. INTRODUCTION

The traditional surveillance systems need a human operator to handle them. Moreover, the number of cameras and the area under the surveillance are restricted by the availability of man power. To overcome the limitations of traditional surveillance methods, a major effort is under way in the computer vision and artificial intelligence community to develop automated systems for the real-time monitoring of people, vehicles, and other objects. In the visual surveillance research, detecting abandoned or unattended luggage is referred to as the problem of abandoned-object Or left-luggage detection .The image segmentation background/foreground extraction using background subtraction methods is used to address the problem. The static foregrounds for a period of time are recognized and semantic analysis is done.

II. RELATED WORKS

A voracious academic research addressing the task of robustly recognising unattended baggage in public spaces is going on. The paper by Bayona et.al [3] brings an exclusive survey of the papers [4][5][6][7][8]used for the object detection. Mainly, classified the entire object detection models into single and dual foreground [frame by frame, sub sampling]. The earlier model requires much work while tracking where as the latter requires a detailed analysis of the foreground mask for abandoned or removed object detection. Also MMGA with RTDENN [9] a light weight, time efficient algorithm combination of Real Time Dynamic Elliptic Neural Network and MGM for the segmentation of background and foreground has been worked out to address the challenges in the embedded environment. A survey paper written by T. Boumann et.al [10] covers an extensive inspection of all the papers and provides a detailed understanding of the strengths and weakness of all the research papers available. Also it covers and analyzes extensively about the datasets available for the background subtraction. The paper classifies the modeling into traditional and recent models. Also provides a relative statistical analysis of the performance evaluation metrics over the models. So a glimpse of the rankings of the various models on hand for researchers, even in the case of the hybrid models for background subtraction or change detection. The input to the object tracking module is the output of the background subtraction, generally a fore ground mask. The tracking and semantic analysis depends on the representation of the object, selection of image features, and modeling of the object appearance and motion. The tracking of unattended baggage is usually incorporated in the event detection algorithm. Kalman Filter (KF) and Unscented Kalman Filter (UKF) are utilized to track the foreground objects including human and carried luggage. Liao *et al.* [13] uses the features of skin colour and contour matching with Hough transform for tracking. Lv *et al.* [12] used a combination of the KF-based blob tracker and a human detector and had a more reliable tracking result However; these tracking approaches fail in the overcrowded scenes, where cast shadows prevent proper segmentation.

III. PROPOSED WORK

This paper uses a temporal consistency added dual foreground approach for the static foreground detection (termed here after as BGS – T).The long term and the short term foreground masks for the single camera based surveillance system are modeled using much popular algorithm Mixture Of Gaussians Model (MGM), further analyzed by five tuple based state machine for the static foreground detection. Here the temporal consistency has been added to decrease the perfections in the extractions of the FG masks, thereby reducing false alarms. The semantic analysis is also done for the back tracking of the owner. On the surgence of the emergency event, the hardware part raises an alarm.The hardware block consists of Arm 9 microcontroller, a buzzer, (LCD) and a GSM module to send messages to the corresponding authorities. This approach has been tested over the standard data sets PETS (Performance Evaluation Tracking System) 2006 and iLids 2007.

System Architecture: The block diagram of the proposed system is as in the below System Diagram

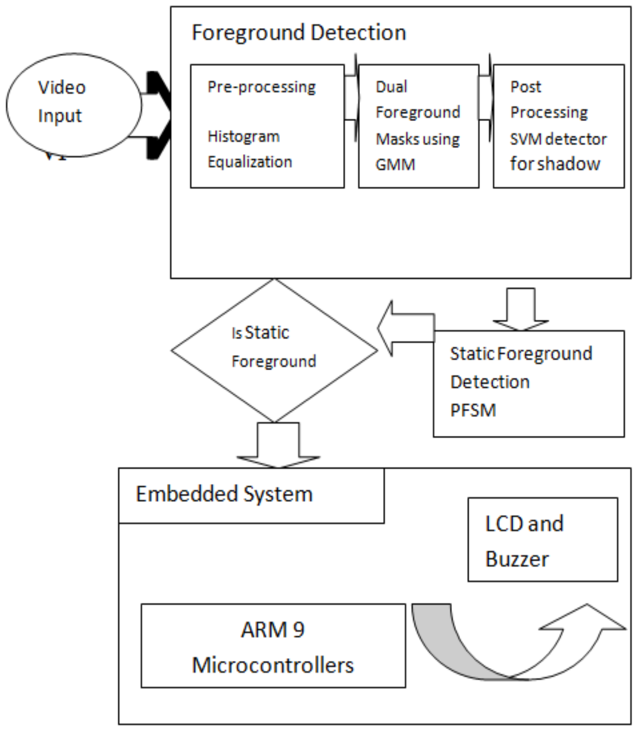
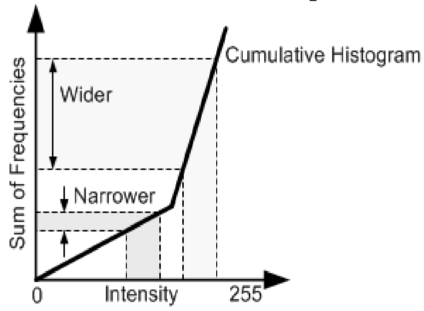


Figure: The block diagram of the proposed system is as in the below System Diagram

A. Pre-processing:

The pre-processing is done by histogram equalization of the luminance component.



Histogram equalization redistributes the pixel intensity values evenly by using cumulative (sum) histogram as a transfer function or as a look-up table.

B. Dual BackGround Modeling using GMM:

To detect new static objects based on the foreground masks background is modeled at different learning rates ,a short-term foreground mask FS, and a long-term foreground mask FL using GMM. A small learning rate λ_s updates the background model at a faster speed. By contrast rate λ_l yields the model that is updated at a slower speed. The below figure shows an example of the foreground regions obtained using the long- and short-term background models

C.Post-processing:

The so obtained foregroung masks are post processed using a SVM(support vector model) designed for cast shadows .The obtained so foreground masks are temporally tested for the static foreground detection using the finite state machine.

D.Static Foreground Detection –Finite State Machine.

The two obtained foreground masks for a single frame are concatenated and the given hypothesis state table is obtained as shown in the below table.

The single frame is inconsistent to find the static object detection. Hence temporal-continuity information is used to improve the performance.

Long term F_L mask	**Short term F_S mask**	Hypothesis
0	**0**	Background
0	**1**	Uncovered BackGround
1	**0**	Canditate Static Foreground
1	**1**	Moving Foreground

Table 1:State Diagram Based on Dual Foreground Models

The image sequences code pattern should primarily follow a temporal rule, and that the rule is represent able by a very four state tupled finite state machine is modelled to find out the unattended baggage as shown in the figure below

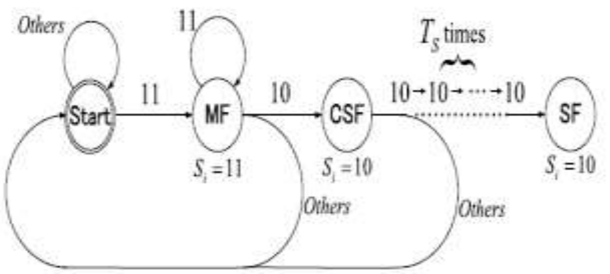


Figure :FSM for static foreground detection. MF is moving foreground, CSF denotes candidate static foreground and SF represents static foreground. Ts is the transition time for changing state from 10 to 10.

E.Object Tracking

The object is tracked using the KF and UKF methods as the foreground maska are already post processed and thecast shadows has been removed which soothes out the tracking problems due to occlusions.

F. Object Abandoned Event Analysis

After obtaining the trajectory of owner the unattended baggage is detected and alarm is raised according to the following two rules, which are officially defined by PETS2006.

1) Temporal Rule: The luggage is declared as an unattended object when the luggage is left by its owner, and the luggage was not re-attended in a consecutive period of time **T**= 30 seconds.

2) Spatial Rule: The unattended luggage is declared as an unattended object when its owner leaves it. When the distance between owner and luggage is larger than apredefined distance **D**= 3 meters, then it is the point to trigger an alarm event.

G. Embedded System

IV ARM7 LPC2148 DEVELOPMENT BOARD

ARM Seven Development Board is a powerful platform which comes with a micro controller on-chip memory. These boards are ideal for developing embedded applications like high speed wireless communication, real time data monitoring and control, interactive control panels and USB based data logging. Manufactured from double sided PTC and PCB material, these boards provide extra strength to the connector joints for increased reliability. ARM Seven Development Board can support the operating supply voltage ranging from 7V to 14V and comes with a built-in reverse polarity protection.

V. GSM

GSM (Global System for Mobile Communications, originally Grouped Special Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones. GSM networks operate in a number of different frequency ranges (separated into 31TGSM frequency ranges31T for 2G and 31TUMTS frequency bands31T for 3G).

VI. CONCLUSION

A framework for robust and efficient determination of unattended baggage In automatic intelligence video surveillance systems has been proposed. The mixture of Gaussians background subtraction method is employed. Without using any tracking or motion information, static objects were detected by using the concept of finite state machine, and then the semantics were verified using the tracking system. Our method can handle occlusions in complex environments with crowds by the post processing module svm detector. The testing results based on different scenarios proved that our approach can handle almost successfully the real-world surveillance scenarios.

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