

# Combining Motion Segmentation and Feature Based Tracking for Object Classification and Anomaly Detection

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## Abstract

We present a novel pipeline for automated visual surveillance system based on utilising conventional adaptive background modelling in-conjunction with optic flow to provide motion sensitive foreground/background segmentation. Furthermore active contours are then used to detect robust motion boundaries within the scene from which PCA is used for object classification. Feature based tracking is then used to build an object and trajectory inventory for the scene from which basic anomaly detection is implemented.

## 1 Introduction

Automated visual surveillance is now a common goal in computer vision research to reduce the burden of large scale video monitoring. Prior work in this area is discussed in [2]. Here we present a novel extension to conventional adaptive background segmentation by utilising both colour [1] and correlated scene motion in the form of optic flow [3]. We further integrate this into feature-point based tracking [4] to provide a basic trajectory analysis and subsequent anomaly detection.

## 2 Motion-enhanced segmentation

Firstly, we isolate the foreground motion using non-parameter adaptive background method [1]. Though this algorithm gives good segmentation result, it needs to clear the scene and train the background model in advance. Moreover, it can not perfectly handle the halting/leaving problem, e.g. if a moving car stops in the scene, it will still be detected as motion. In order to handle these two problems, we use logical AND operation to combine its segmentation result with the one obtained from Lucas-Kanade optical flow algorithm [2], where, the image is divided into sub-regions and the resulting region-wise velocity is calculated. Fig.1 shows the resulting segmentation (b) result that can both solve this problem (a) and be achieved without any advanced prior scene training.

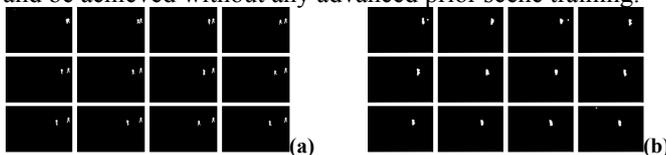


Figure 1 Segmentation results (a) Adaptive background model (b) Combining optical flow with adaptive background model

## 3 Feature-based tracking

Our tracking method is based on feature-points identified in each motion segmented scene object [4]. These are then compared to a temporal inventory of objects in the previous N frames to facilitate the continuous tracking of persistent objects and the identification of new objects entering the scene [1]. PCA of the feature-points, to recover primary orientation, together with conventional blob analysis from our original motion segmentation then allows object classification {vehicle, person, other}.



Figure 2 Feature-based object tracking

## 4 Anomaly detection

Tracking facilitates the recovery of object trajectory by class from which a set of up to T mean trajectories can be established within the scene based on 2D line fitting. Recovered trajectories that differ significantly from these established class norms can then be highlighted in relation to both relative orientation and spatial location within the scene (Fig. 3).



Figure 3 Abnormal trace differs from established class norms

## 5 Results

Overall our robust motion-based object segmentation, coupled with feature-based tracking facilitates robust scene accounting and a trajectory based approach to anomaly detection.

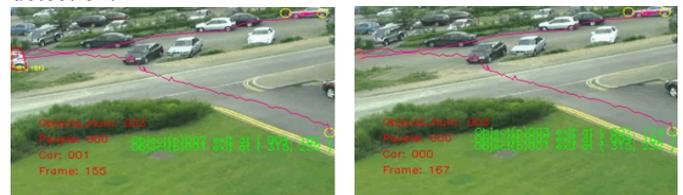


Figure 4 Surveillance result

**Future work:** machine learning based anomaly detection

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