

# Chapter 3

## Hybrid Attributes Technique Filter for the Tracking of Crowd Behavior

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### **ABSTRACT**

*In this chapter, the authors propose two algorithms based on the device of attributes for tracking of the abnormal behavior of crowd in the visual systems of surveillance. Previous works were realized in the case of detection of behavior, which uses the analysis and the classification of behavior of crowds; this work explores the continuity in the same domain, but in the case of the automatic tracking based on the techniques of filtering one using the KALMAN filter and particles filter. The proposed algorithms he the technique of filter with particle is independent from the detection and from the segmentation human, so is strong with regard to (compared with) the filter of Kalman. In conclusion, the chapter applies the method for tracking of the abnormal behavior to several videos and shows the promising results.*

### **INTRODUCTION**

The security of the people and the goods is one of major problems in the public zones such as airports, subway stations, shopping malls or squares. The automatic processing of videos resulting from security cameras is more and more used to present relevant information to the operators who have to act in the critical, dangerous or unusual situations. These last year's saw the integration in the systems of video surveillance of algorithms of detection of movements, events, abandoned luggage or follow-up of people. However, seen the complexity of the problem, few systems dealt with the situations implying crowds of people.

The analysis of the flows of people consists in detecting the unusual behavior in the watched zones. She becomes necessary when the follow-up of individual objects fails; what is often the case in a scene of crowd. This analysis is made by handling the information of movement through successive images, and then to make follow-up the behavior by technique of filtering. The detection of events is defined

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as being the detection of the situations which draw the attention of a person (Chebi 2015; Chebi 2017; Chebi 2018; Chebi 2020).

In this article, we introduce techniques of tracking of behavior by attributes to allowing following the behavior to represent in a scene. This model manages effectively the complexity of the scenarios and the unpredictability of the behavior.

These approaches were applied to a selection of events and experimented on the sample of videos of the workshop PETS'2009 (Dataset 2009).

This article is organized as follows. First of all, the section II presents some previous works dealing with the problem of the analysis of crowd and tracking of behavior of crowds. The section III details the techniques of attributes (KALMAN filter and particles Filter). The results of the experiment on the sample of videos PETS'2009 are presented in the section IV. The section V concludes this article and describes the future potential works.

## **STATE OF THE ART OF TRACKING**

Tracking methods propose to recognize and locate over time objects present in a temporal sequence of images (Gabriel 2003). In the context of crowds, they find a particular interest in video surveillance where the tracking of individuals makes it possible to automatically control the comings and goings in a space. Like image recognition, tracking can rely on graphic properties such as colors or outlines (Mathes 2006; Yang 2005). The added temporal dimension also makes it possible to assume continuity in the presence and position of people in the scene, despite the occlusions (Rabaud 2006).

In this part, we will therefore explore four main approaches: follow-up by regional approach, follow-up using a model, follow-up by contours approach, follow-up using attributes. For each of these methods, it must be kept in mind that a good monitoring method must be robust, precise and above all fast to be able to follow a person in real time. The quality of monitoring is also dependent on good detection of people on the move. We will present the different monitoring techniques, in order to draw the different advantages and disadvantages:

### **Follow-up by Regional Approach**

The region approach is one of the most classic: people have been segmented in the image, and tracking consists of matching regions between two consecutive images. One of the simplest follow-ups is that of recovery (McKenna 2000). It does not require a position prediction; the objects are matched by box overlap between the image  $t - 1$  and the image  $t$ . This method requires that the movement is not too large for there to be overlap.

The advantage is that the amount of movement between two images can be greater since it is based on color information. Any tracking technique can be improved by combining other information such as texture, shape, speed of the person, etc. The follow-up of regions is not limited to that of people; it can sometimes be interesting to follow a characteristic element of the person.

1. Tracking using a template

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