ISSN (Online) : 2455 - 3662
SJIF Impact Factor :5.148

EPRA International Journal of

Multidisciplinary Research

Monthly Peer Reviewed & Indexed
International Online Journal

Volume: 4 Issue:11 November 2018

Published By :
EPRA Journals

Volume: 4 | Issue: 11 | November 2018 SJIF Impact Factor: 5.148 ISSN (Online): 2455-3662

EPRA International Journal of

Multidisciplinary Research (IJMR)

DETECTION OF OBJECTS IN MOTION USING VIDEO SURVEILLANCE

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ABSTRACT

Video surveillance system is the most important issue in homeland security field. It is used as a security system because of its ability to track and to detect a particular person. To overcome the lack of the conventional video surveillance system that is based on human perception, we introduce a novel cognitive video surveillance system (CVS) that is based on mobile agents. CVS offers important attributes such as suspect objects detection and smart camera cooperation for people tracking. According to many studies, an agent-based approach is appropriate for distributed systems, since mobile agents can transfer copies of themselves to other servers in the system.

KEYWORDS: *Video Surveillance; Object Detection; Image Analysis*

1. INTRODUCTION

Various papers in the literature have been proposed and focused on computer vision problems in the con- text of multi-camera surveillance systems. The main pro- blems highlighted in these papers are object detection and tracking, and site-wide, multi-target, multi-camera tracking. The importance of accurate detection and tracking is obvious, since the extracted tracking information can be directly used for site activity/event detection. Furthermore, tracking data is needed as a first step toward controlling a set of security cameras to acquire high-quality imageries, and toward, for example, building bio- metric signatures of the tracked targets automatically. The security camera is controlled to track and capture one target at a time, with the next target chosen as the nearest one to the current target. These heuristics-based algorithms provide a simple and tractable way of computing. Conventional video surveillance systems have many limitations to their capabilities.

In one case, con- ventional video surveillance systems have difficulty in tracking a great number of people located at different positions at the same time and tracking those people automatically.

In another case, the number of possible targeted people is limited by the extent of users' in- volvement in manually switching the view from one video camera to another. With cognitive video surveil- lance system, mobile agent technologies are more effec- tive and efficient than conventional video surveillance systems, assuming that a large number of servers with video camera are installed. If one mobile agent can track one person, then multiple mobile agents can track nu- merous people at the same time, and the server balances the load process of the operating mobile agent on each server with a camera.

We consider the scenario that the smart camera cap- tures two similar objects (e.g. twin), then each object selects a different path. The tracking process will be confusing. Furthermore, the smart camera is limited to cover a certain zone in public place (Indoor). Next sec- tion introduces many solutions that have been suggested to the above problem. The suggested solutions to improve the conventional video surveillance system are extended in various ways.

A part of the approaches is to use an active camera to track a person automatically, and thus the security camera moves in a synchronized motion along with the projected movement of the targeted person. These approaches are capable of locating and tracking a small number of people. Another common approach is to position the camera at strategic surveillance locations. This is not possible in some situations due to the number of cameras that would be necessary for full coverage, and in such cases, this approach is not feasible due to limited resources.

A third approach is to identify and track numerous targeted people at the same time involving image processing and in- stallation of video cameras at any designated location,

2. REVIEW OF HUMAN BODY ANALYSIS

This section introduces various approaches that considered the object detection and object tracking in video surveillance field [1]. The analysis of human body ovements an be applied in a variety of application domains, such as video surveillance, retrieval, human-computer interaction systems, and medical diagnoses. In some cases, the results of such analysis can be used to identify people acting suspiciously and other un-usual events directly from videos. Many approaches have been proposed for video-based human movement analysis [4].

In [7] Oliver *et al.* developed a visual surveillance system that models and recognizes human behavior using hidden Markov models (HMMs) and a trajectory feature. In [8] proposed a probabilistic posture classification scheme to identify several types of movement, such as walking, running, squatting, or sitting. In [11] traced the negative minimum curvatures along body contours to segment body parts and then identified body postures using a modified Iterative Closest Point (ICP) algorithm. In addition [12] used different morphological operations to extract skeletal features from postures and then identified movements using a HMM framework.

In [14] has been described the real-time finder system for detecting and tracking humans. In [15] proposed a shape-based approach for classification of objects is used following background sub-traction based on frame differencing. The goal is to detect the humans for threat assessment.

In [16] presented a method to detect and track a human body in a video. First, background subtraction is per-formed to detect the foreground object, which involves temporal differencing of the consecutive frames. In [17] presented a novel approach to detect the pedestrians, which is shown to work well in a indoor environment. They make use of a new sensing device, which gives depth information along with image information simultaneously. In [18] proposed method that deals with the direct detection of humans from static images as well as video using a classifier trained on human shape and motion features.
The training dataset consists of images and videos of human and non-human examples. In [19] has been suggested to use the mobile agent for multi-node wireless video cooperation in order to reduce redundancy which will result repeated information collection in over-lapping regions.

Motion Detection

This section aims to provide the status of art of the dif-ferent techniques of motion detection estimation. Various studies have been introduced on the subject and the literature is very plentiful in this province. We are trying to list some methods used methods. The idea is to give an overview of the most commonly used methods and approaches. The most used algorithms for moving objects detection are based on background subtraction. The background subtraction is based on comparing of the current video frame (foreground objects) with one from the previous frames that is called sometimes background.

3. VIDEO SURVEILLANCE SYSTEM

In this section we introduce the system model of the video surveillance system. Video surveillance system has been used for monitoring, real-time image capturing, processing, and surveillance information analyzing. The infrastructure of the system model is divided in three main layers: mobile agents that are used to track suspect objects, cognitive video surveillance management (CVS), and Protocol for communication as shown in Figure 1. Each end device, smart camera, covers a certain zone or cell. Smart camera used for collecting parameters of human face.

3.1. Communication Protocol

In the system model has been introduced two communication protocols. The first protocol used for agent-to- agent protocol. Agents used this protocol for communication. The protocol is based on messages exchange as shown in Figure 2. The goal of the protocol is to update the agents. The second protocol is used for communication between CVS and mobile agent.

3.2. Mobile Agent Features

Mobile agents are placed in smart camera stations. Mo- bile agent aims to track the suspect object from smart camera station to others. Mobile agent offers various characteristics, e.g. negotiation, making decision,roam-ing,and cloning.

A large number of correlating factors is defined by CVS and grouped in sets. A number is linked with each correlating factor. Each factor is then turned into a single number which represents the strength of the correlation factors for each frame with respect to the probability that this frame belongs to the certain family or not.

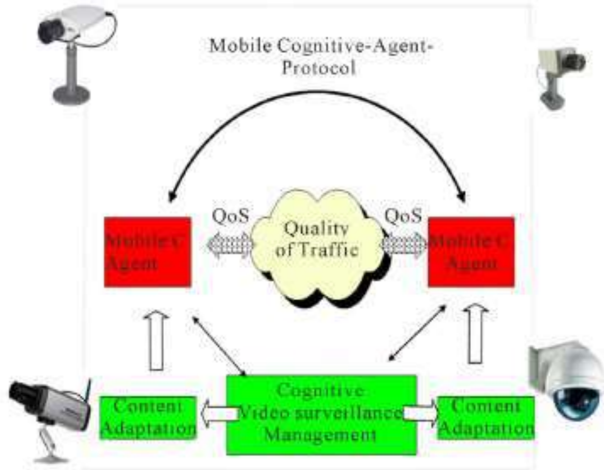

Figure 1. System model.

As a result we have a large number of frames, for each pair of a frame we have a number which is correlated to the prob- ability that this frame belongs to a certain attribute (color similarity) or does not belong.

3.3. Tracking Moving Objects

In order to track moving objects, we introduce two strategies. The first strategy is based on messaging protocol (msg-protocol). The goal of this msg-protocol is to inform the mobile agent about the position of the suspect object. The second strategy uses the protocol to help the mobile agent to roaming from point to others.

4. METHODOLOGY

Cognitive video surveillance (CVS) uses a data base of images. Pixels are described by a set of binary sequences. Each sequence presents certain properties (color). The database is divided into two separate sets of pixels—the training set and the test set. In both sets there are both pixels, which belong to a certain family of colors (attrib- utes) and sequence,which do not belong

$$TP = X = \{X_1, X_2, X_3 \ldots\ldots\ldots\ldots\ldots X_n\}$$

$$TP = Y = \{Y_1, Y_2, Y_3 \ldots\ldots\ldots\ldots\ldots Y_n\}$$

Each image is then divided into frames, a frame being a subset of pixel from the sequence. The number of pixel in each frame is a variable and is dynamically set to obtain optimal results.

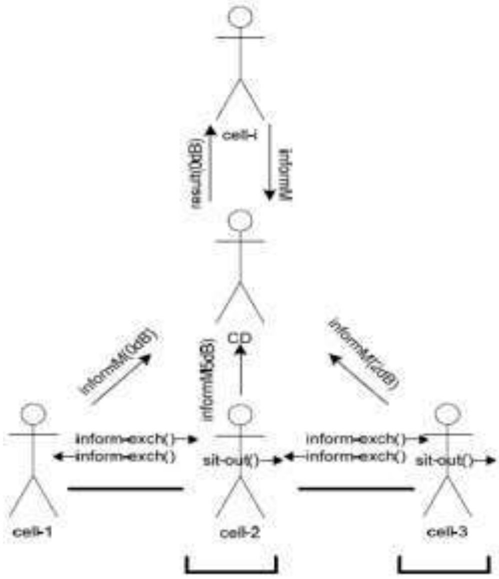

Figure 2. Agent protocol.

The basic logic of statistical differentiation of pixel is known and widely used in many prediction systems.

$$J = X \oplus Y$$

$$J = \begin{cases} 1 & \text{if } x \neq y \\ 0 & \text{otherwise} \end{cases}$$

5. PERFORMANCE ANALYSIS

We have used the object oriented programming language C # to present the image in binary system as shown in **Figure 3**. Hence Binary vectors are implemented in WEKA platform. WEKA is stand for Waikato Environ- ment for Knowledge Analysis. WEKA implements many machine learning and data mining algorithms.

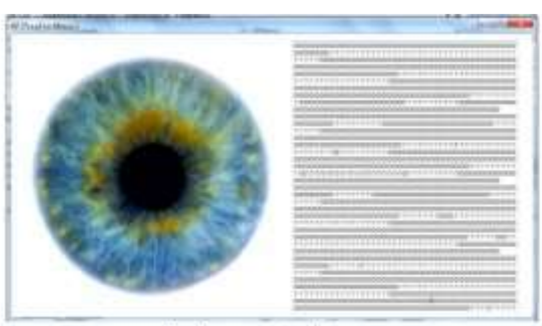

Figure 3. Image representation in binary system.

Furthermore we have compared the actual observations to EMA model as shown in **Figure 4**. Results indicate that all three moving average methods have more or less similar performance in forecasting short-term times. However, as one would expect the method using opti- mized weights produced slightly better forecasts at a higher computational cost. Quality of forecast is dimin- ished as the time for which forecasts are made is farther in the future. Moving average methods overestimate travel speeds in slow-downs and underestimate them when the congestion is clearing up and speeds are in- creasing.

6. CONCLUSION

In this paper, we discussed several methods in the recent literature for human detection from video. We have or- ganized them according to techniques which use back- ground subtraction and which operate directly on the input. In the first category, we have ordered the tech- niques based on the type of background subtraction used and the model used to represent a human. In the second category, we have ordered the techniques based on the human model and classifier model used. Overall, there seems to be an increasing trend in the recent literature towards robust methods which operate directly on the image rather than those which require background sub- traction as a first step

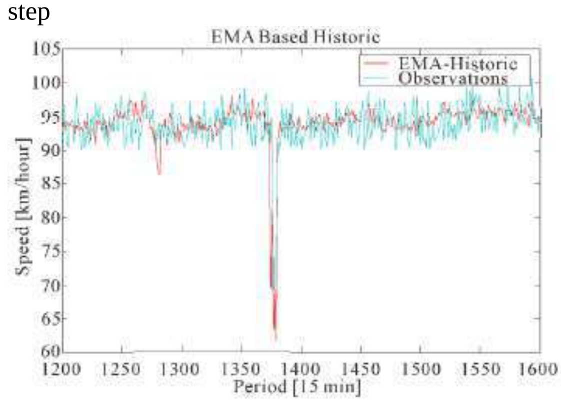

Figure4. Actual observation vs. forecasting model.

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