JOURNAL OF INFORMATION, KNOWLEDGE AND RESEARCH IN COMPUTER ENGINEERING

ADVANCE CONCEPT OF COMPUTER VISION CONTROL FOR VIDEO SURVEILLANCE SYSTEM

[1]AMIT K. SHARMA, [2]DR. SURENDRA YADAV, [3]MANISH MATHURIA, [4]ANKIT TIWARI

[1-3-4,] Department Of Computer Science Engineering, Maharishi Arvind College Of Engineering And Research Center, Sirsi Road, Jaipur–302012, Rajasthan, India.

[2,] Department Of Computer Science Engineering, Carrier Point University, Kota

amitsharmacse09@gmail.com, syadav66@gmail.com, manish.4598@gmail.com, ankittiwari148gmail.com

ABSTRACT: *This paper is review of many existing video surveillance systems. With the growing quantity of security video, it becomes vital that video surveillance system be able to support security personnel in monitoring and tracking activities. The aim of the surveillance applications is to detect, track and classify targets. In this paper is described object modelling, activity analysis and change detection. In this paper we will also describe a design of our video surveillance system. The image processing tool MATLAB is best option for researchers, though it provides a separate functionality under Computer Vision System Toolbox. The special libraries for Object Tracking are available. This research paper is dedicate to get best solution for video surveillance with the available resources as well as research contents.*

KEY WORDS *: video surveillance systems, surveillance applications, traffic sign detection, security video, security personnel*

1. INTRODUCTION

The Video surveillance systems are widespread and common in many atmospheres. Video surveillance has been a key component in confirming security at airports, banks, casinos, and correctional organizations. More recently, governments' agencies, businesses, and even schools are turning toward video surveillance as a means to increase public security. With the proliferation of inexpensive cameras and the availability of high-speed, broad-band wireless networks, deploying a large number of cameras for security surveillance has become economically and technically feasible [1].

Several important research questions remain to be addressed before we can rely upon video surveillance as an effective tool for crime prevention, crime resolution, and crime protection [2].

Much of the current research in video surveillance focuses on algorithms to analyze video and other media from multiple sources to automatically detect significant events [3].

Example applications include intrusion detection, activity monitoring, and pedestrian counting. The capability of extracting moving objects from a video sequence is a fundamental and crucial problem of these vision systems. For systems using static cameras, background subtraction is the method typically used to segment moving regions in the image sequences, by comparing each frame to a model of the scene background [4, 5].

The remainder of this paper is organized as follows. Section 2 describes visual information acquisition; section 3 describes video surveillance system and applications of graphical surveillance. In section 4 is explained video system for urban surveillance that comprises the function of object detection, tracking, recognition and classification. Sections 5, 6, 7 and 8 describe activity analysis, object modelling, and change detection and one solution for the tracking system. Our video surveillance system in which people are recognition with their luggage are reported in section 9.

1.1. Benefits of Video Surveillance

- Availability- There was a time when the surveillance methods were developed only in shopping centers and malls. These days, you can notice closed-circuit TVs almost at any place you visit, from a small store to homes and holy places. As a result, they guarantee greater public security at a fraction of the cost.
- Real-time monitoring- Traditionally big organizations have always had the benefits of video surveillance manned by security experts. In the past times, the

events captured on video were used to expose important information and work as proof after the event happened. But, latest technologies let users to check and reply to alarms immediately.

2. PURPOSE OF THE SYSTEM

The main purpose of this system is to improve the awareness of security personal and decision makers by collecting real-time information automatically. The system raises an alarm whenever offensive movements are detected. Hence, the system has the ability to detect mobile objects in the scene and to classify their activities. Planned a human-shape-based falling algorithm and this algorithm was implemented in a multi-camera video surveillance system. The algorithm is implemented in real world environment for functionality proof. In this algorithm, multiple cameras are used to fetch the images from different regions required to monitor. A falling-pattern recognition approach is used to determine if an accidental falling has occurred. Also, in that case a short message will be sent to someone who needs to be alerted. Hae-Min Moon(Hae-Min Moon*et al.*,2010) proposed the system on human identification method that uses height and clothing-colour information appropriate for the intelligent video surveillance system based on smartcard. Reliable feature information can be obtained using the smartcard. It uses octree-based colour quantization technique to the clothing region for colour removal and height is extracted from the geometrical info of the images. The similarities between the two images are related based on the Euclidean distance.

3. VISUAL INFORMATION ACQUISITION

An image or a video, if digitized is denoted by a number of frames per unit of time, with each frame in turn denoted by a number of components (three colors or more), each again denoted by a set of pixel at a given precision (8 or more bits), scanning the frame component on a raster, line by line. This is often referred to as first general demonstration, and was introduced taking into account practical issues such as camera and scan technologies, as well as simplicity of their demonstration. First generation image and video can be denoted as one or more matrices whose elements correspond to a frame's component pixel. When compared to the first, second generation demonstration approach represents image and video as set of what is called attributes. A largely popular second general demonstration is that of object-based demonstration where to each object has been given some colour, texture or motion attributes [6].

The majority of image and video segmentation techniques try to take a first general image or video as an input and provide as output a second generation demonstration of them. Other image and video analysis tools extract other and provide what one generally calls a content-based representation in form of ends, features points, and others.

4. VIDEO SURVEILLANCE SYSTEMS

Video surveillance is an active area of research. Object detection and tracking in video surveillance systems are commonly based on background estimation a subtraction. The major focus of today's video surveillance systems act is the application of video compression technology to efficiently multiplex or store images from a large number of cameras onto mass store devices (video tapes, discs) [7].From the perspective of real-time threat detection, it is well know that human visual attention drops below acceptance levels, even when expert personal and assigned to the task of visual monitoring [8]. On the other side, video analysis technologies can be applied to develop smart surveillance systems that can be aid the human worker in real-time threat detection [9]. Specifically, multi scale tracking technologies are the next step in applying automatic video analysis to surveillance systems.

Application of graphical surveillance includes car and pedestrian traffic monitoring, human activity surveillance for unusual activity detection, people counting, etc. A typical surveillance application consists of three buildings blocks: moving detection, object tracking and higher level motion analysis.

Multimedia systems can provide surveillance coverage across a wide area, ensuring object visibility over a large range if depths and can be employed to disambiguate occlusion. Techniques that address handover between cameras, in configurations with sheared or disjoint views, are therefore becoming increasingly important. Events of interest identified as moving object and people must be coordinated in the multi-view system and events of special interest must be tracked throughout the scene [10].

Several video surveillance products are available on the market for office and home security as well as remote surveillance. They monitor a home, an office, or any location of interest, capturing motion events using webcams or camcorders and detect abnormalities [11]. In the case of webcams, the visual data is saved into compressed or uncompressed video clips, and the system trigger various alerts such as sending an e-mail.

The necessarily of working with difficult scenes characterized by high variability, requires the use of specific and sophisticated algorithms for video acquisition, camera calibration, noise filtering and motion detection that are able to learn and adopt to changing scene. Working with scenes characterized by poor structure requires the use of robust design recognition and statistical methods.

5. ARCHITECTURE OF THE SYSTEM

The system comprises the function of object detection, tracking, recognition and classification. The problem of
object detection has been tackled using statistical models of the background image [12, 13], frame differences techniques or a combination of both sequences in order to cope with multiple relating targets.

Object recognition and classification is performed using statistical Pattern Recognition and neural network. Several features, which explore the specific situation of the problem, can be used. These include geometric features such as bounding box aspect ratio, motion
Patterns and color histogram [11, 13].
[14]. Several techniques have also been used for object tracking in video

5.1. System description

The surveillance system implemented can be viewed as four independent, but interacting modules: detection, tracking, classification and recognition. The approach followed uses two adaptive background images, per-pixel adaptive thresholds and a region grouping algorithm, named quasi-connected components (QCC).

The tracking algorithm determines the overlap between detected regions in consecutive frames, in order to link them, when no doubt exists. The linking of an active region in sequential frames originates a stroke, which describes the evolution of the mass Centre over time.

The classification task is performed each frame for all active regions detected, and the classification of a stroke is performed by determining the most voted class.

To cope with tracking ambiguities, a color-based recognition section is also integrated in the system [15].

5.2. Detection

The main difficulties of such approach lie in the fact that, even in controlled situations, the background undergoes a continual change, mostly use to the existence of lighting variations and distracters (example: clouds passing by, braches of trees moving with the wind). The robustness towards lighting variation of the scene is achieved using adaptive background models and adaptive per-pixel thresholds. The use of multiple backgrounds and the grouping technique QCC contribute to the robustness of the algorithm towards unwanted distracters [15].

The system implemented uses two gray scale background models, created during a training phase. The idea is to have both a lesser and a upper pixel value, contemplating this way to variations of "non-target" pixels in the scene. The per-pixel edge is then initialized to be above the difference between the two backgrounds.

Event detection, detecting and tracking objects are a critical capability for surveillance. From the perspective of a human intelligence analyst, the most critical challenge in video based surveillance is interpreting the automatic analysis data to detect events of interest and identify trends. Challenges here include: using knowledge of time and deployment conditions to improve video analysis, using geometric models of the environment and other object and activity models to understand events and using learning techniques to increase system performance and detect unusual events.

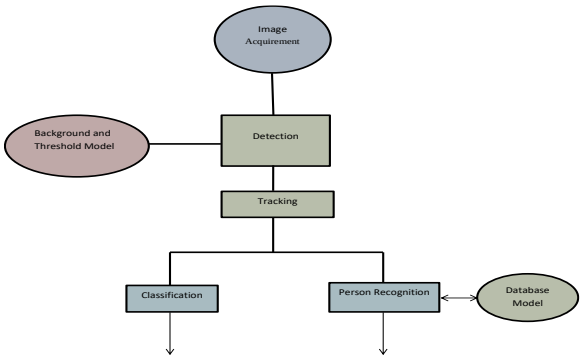

Fig. 1 Video Surveillance System Block Diagram

5.3. Tracking

The purpose of tracking is to determine the spatial-temporal information of each aim present in the scene. Since the visual motion of aims is always small in comparison to their spatial extends, no position prediction is necessary to construct the knocks [13]. The association of regions and their classification is based on a binary association matrix computed by testing the overlap of regions in consecutive frames. Whenever there is a match, the stroke is updated.

5.4. Classification

For the classification task three main questions must be answered, namely: which classes should be considered which features best separate these classes and which classifiers best adapt to the previous choices? One of the main goals of the classifiers is to achieve low miss-classification probabilities while considering a wide spectrum of classes. At the same time the goal was not to consider time-dependent features, controlling the classifier absolutely to geometric properties. In this way the resulting classifier can be used in different machines, as it is independent of the achieved frame-rate [15].

The classification task interacts with the tracker in each frame, voting for the class of each sensed target. In this way, a final class is chosen for each stroke as

being the most voted one.

In several surveillance applications, determining the type of object is critical. Video tracking-based systems used statistics about the appearance, shape and motion of moving objects to speedily distinguish people, vehicle, doors opening/closing, trees moving, etc. Image-based systems such as face, pedestrian, or vehicle detection, find object or certain type without prior knowledge of the image location or scale. These systems tend to be slower than video tracking based systems that leverage current tracking information to trace and segment the object of interest.

5.5. Recognition

As in the classification module, no time information is used to perform the recognition task. This recognition process is targeted at recognizing in a short term period, i.e. targets that become occluded for a few seconds or targets that merge for a few seconds and then split again. The models are characterized by the *pdf* estimates of the chosen feature space, in this color case [15]

.

6. ACTIVITY ANALYSIS

Understanding human activity is one of the most difficult open problems in the area of automated video surveillance. Detecting and analyzing social motion in real time from video pictures has only recently become viable with algorithms. These algorithms represent a good first step to the problem of identifying and analyzing persons, but they still have some disadvantages. Therefore the human subject must dominate the image frame so that the individual body components can be consistently detected [14].

7. OUR VIDEO SURVEILLANCE SYSTEM

Tracking accessibility of people to the desired rooms, where there is “Employees only!”. At airports, stations, schools and etc., the security is very important for stoppage of employees and all others.

We will design system that works follows. We will have video output from CCD camera. This video output will be divided into video sequences that will be input for process called preprocessing. To recognition moving objects on the background, head detection and luggage detection we will use the tracker. *Tracker* contained following blocks*: Motion Detector, Head Detector, Shape Tracker* and *Region Tracker*. Tracking output will be recognized in appreciation block. Our system use People Tracking algorithm which was designed by Nils Siebel. The Reading People Tracker is software for tracking people in camera images for visual surveillance purposes. It originates from research work on people tracking for automatic visual surveillance systems for crime recognition and anticipation [16].

A Motion Detector detects moving pixels in the image. It models the background as an image with no people in it. Simply subtracting it pixel wise from of the current video image and thresholding the result yields the binary Motion Image. Regions (bounding boxes) with detected moving blobs are then extracted and written out as the output from this module.

Main features of a Motion Detector are:

Simple background image subtraction image filtering (spatial median filter, dilation) depending on available CPU time,

Temporal inclusion of static objects into the background,

Background modeling using a speed-optimized median filter,

Static regions incorporated into background (multi-layer background).

A Head Detector makes rapid guesses of head positions in all detected moving regions.

Main features of a Head Detector are:

works in binary motion image, looks for peaks in detected moving regions, vertical pixel histogram with low-pass filter, optimized for speed not accuracy.

A Shape Tracker uses a deformable model for the 2D outline shape of a walking pedestrian to detect and track people. The initialization of contour shapes is done from the output by the Region Tracker and the Head Detector.

Main features of a Shape Tracker are:

local edge search for shape fitting, initializing of shape from Region Tracker, Head Detector and own predictions,

occlusion reasoning.

A Region Tracker tracks these moving regions over time. This includes region splitting and merging using predictions from the previous frame.

Main features of a Region Tracker are:

region splitting and merging using predictions, adjust bounding box from Shape Tracker results, identify static regions for background integration .

Recognition block contained two blocks: *Classificator* and *Personal Recognition*. Data from recognition output are compared with data from *Image Memory*.

Image memory is database of static images of human faces, that have guarded enter to this room (employees faces).

Learning is a process of personal identities creation.

An Optical Correlator is a device for comparing two signals by utilizing the Fourier transforming properties of a lens. It is commonly used in optics for target tracking and identification. The correlator has

an input signal which is multiplied by some filter in the Fourier domain.

An optical correlator repeatedly recognizes or identifies the contents of an image by combining an incoming image with a reference image, and the degree of correlation after combining the images determining the intensity of an output light beam.

First task for the optical correlator is to link together person with his luggage, case or package. This is then monitored if this person leaves guarded room with the same luggage, case, etc.

A new robust and efficient analysis method of video sequence allows the extraction of foreground objects and the classification of static foreground regions as abandoned or removed objects.

Finally, moving objects are classified as abandoned or removed by matching the boundaries of static foreground regions.

Fig. 3 a) Detection of one luggage b) Detection of one abandoned luggage

8. BENEFITS OF PROPOSED SYSTEM

- Our system allows user to view videos even if he is at some remote place. Due to http protocol usage, the application provides online video streaming functionality so that user can view the videos from web browser also i.e. through android device as well as user's computer.
- We do not require use of any additional hardware for image matching and intrusion detection.
- Our system uses image matching technique, so it gives more precise and accurate results.
- Entire Smart surveillance can be made remote using this architecture. User can even control the system through a remote place. He can give commands to switch on/off the system camera.
- The user gets notified as soon as the intrusion is detected. Thus, the user can take appropriate action without any delay.

Smart video surveillance is integrated with intelligent video movement detection analysis systems combine with SMS notification system.

9. CONCLUSION

Video surveillance system significantly contributes to situation awareness. Such systems transform video surveillance from data acquisition tool to information and intelligence acquisition systems. Real-time video analysis provides smart surveillance systems with the ability to react in real-time. Our system senses the intrusion and sends notifications to authorized persons so that action can be taken in response to the intrusion. The MATLAB's Toolbox for computer vision operation is very effective for the object detection and recognition which some more features may include in future advancements.

REFERENCES:

[1] RANGASWAMI, R. – DIMITRIJEVIC, Z. – KAKLIGIAN, K. - CHANG, E. – WANG, Y. F.: "*The SfinX Video Surveillance System"*, 2003.

[2] DIMITRIJEVIČ, Z. – WU, G. – CHANG, E.: "*A Multi-Sensor Fusion and Mining System"*, Proceeding of the 2nd Usenix FAST, March 2003.

[3] CUCCHIARA, R.: "*Multimedia Surveillance systems"*, Proc. ACM Workshop on Video Surveillance and Sensor Networks, pp. 3–10, 2005.

[4] ELGAMMAL, A. – HARWOOD, D. – DAVIS, L. A.: "*Non-Parametric Model for Background Subtraction"*, ICCV'99, 1999.

[5] HORPRASERT, T. – HARWOOD, D. – DAVIS, L. A.: "*A Statistical Approach for Real-Time Robust Background Subtraction and Shadow Detection"*, ICCV'99 Frame Rate Workshop, 1999.

[6] EBRAHIMI, T.: *"Image and Video Analysis: Trend and Challenges Position Statement"*, VIAMIS, Lisbon, April 2004.

[7] BOJKOVIČ, Z. – SAMČOVIČ, A. – TURÁN, T.: *"Object Detection and Tracking in Video Surveillance Systems",* COST 276 Workshop, Trondheim, Norvegia, pp. 113–116, May 25–26, 2005.

[8] POKRAJAC, D. – ZELJKOVIC, V. – LATECKI, L. J.: *"Spatial-Temporal Algorithm for Moving Objects Detection in Infrared Video Sequences"*, Niš, Sept. 2005.

[9] ARAKI, A. – MATSUOKA, T. – YOKOYA, N. – TAKEMURA, H.: "*Real-Time Tracking of Multiple Moving Object Contours in a Moving Camera Image Sequence"*, IEICE Trans. Inf. &Syst., vol. E83-D, no. 7, pp. 1583–1591, July 2001.

[10] RAO, K. R. – BOJKOVIČ, Z. S. – MILOVANOVIČ, D. A.: "*Introduction to Multi-media Communications: Applications, Middleware, Networking"*, Wiley, 2005.

[11] HARITAOGLU, H.: "*Hartwood and Devis, W4: Real Time Surveillance of People and their Activities"*, IEEE Trans. Pattern Anal. Machine Intell., vol. 22, no. 8, pp. 809–830, Aug. 2000.

12] *Surveillance of Noncooperative and Camouflaged Targets in Complex Outdoor Settings"*, in Procceding of the IEEE, vol. 89, no. 10, Oct. 2001.

[13] McKENNA, S. et al.: "*Tracking Groups of People"*, CVIU 80, pp. 42–56, 2000.

[14] COLLINS, R. - et al.: *"A System for Video Surveillance and Monitoring"*, CMU-RI-TR-00-12, 2000.

[15] OLIVEIRA, R. J. – RIBERIO, P. C. – MARQUES, J. S. – LEMOS, J. M.: *"A Video System for Urban Surveillance: Function Integration and Evaluation"*, VIAMIS, 2004.