RESEARCH ARTICLE OPEN ACCESS

Survey on Video object tracking and segmentation using artificial neural network in surveillance system

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ABSTRACT
This survey describes the current state-of-the-art in the development of automated visual surveillance systems so as to provide researchers in the field with a summary of progress achieved to date and to identify areas where further research is needed. The ability to recognize objects and humans, to describe their actions and interactions from information acquired by sensors is essential for automated visual surveillance. The increasing need for intelligent visual surveillance in commercial, law enforcement and military applications makes automated visual surveillance systems one of the main current application domains in computer vision. The emphasis of this review is on discussion of the creation of intelligent distributed automated surveillance systems the survey concludes with a discussion of possible future directions.

Keywords **–** ANN, Object Tracking, Visual Survillence.

Date of Submission: 21-04-2021 Date of Acceptance: 06-05-2021

I. INTRODUCTION

Now a day's computer vision has been applied to every organisation. Such that the all in security systems, computers are widely used regarding to this for the security purpose every organisation are used different monitoring system i.e. surveillance system, suspicious monitoring system etc. [1]. In practical application, since the camera moves and rotates, it needs to track objects in a dynamical background. In this situation the visual object tracking is one of the most important parts of the video processing. In video processing system there are various problems occurred due to some insufficient configuration of hardware as well as software such as How to select the initial target objects in video footage automatically and establish objects motion model, and how to update object and background models at each frame are the key in real-time Video object tracking with an active camera, some cases due to limitations of hardware of a CCTV cameras the video there are too much noise in the footage, video footage the most difficult task is to track the object or segment because in the footage the object in moving condition that's why the captured image of the particular object is unable to visualise in cleared form due to its background.[1]

To resolve this problem the various algorithms are published for tracking and segment the video objects efficiently such as Threshold decision and diffusion distance, partial list square analysis, CAMSHIFT, etc. [2]. All these algorithm are propose the various methods to tracking object form input image by solving their difficulties regarding object tracking. Such as Continuously Adaptive Mean Shift algorithm (CAMSHIFT) [2] is a popular algorithm for visual tracking, providing speed and robustness with minimal training and computational cost. An adaptive robust object tracking algorithm based on active camera is proposed. At the other algorithm Partial least squares analysis is a statistical method for modelling relations between sets of variables via some latent quantities. In PLS analysis, the observed data is assumed to be generated by a process driven by a small number of latent variables. In Threshold Decision and Diffusion Distance algorithm [7] video object segmentation and tracking framework for smart visual surveillance cameras is proposed with two major contributions. First, we propose a robust threshold decision algorithm for video object segmentation with a multi background model. The proposed algorithm can determine an appropriate optimal threshold value for our proposed multi background model; hence, it can enable good performance for conditions with dynamic backgrounds without threshold tuning by developers. Second, we propose a video object tracking framework based on a particle filter with diffusion distance (DD) [7] for measuring colour histogram similarity and motion clues from video object segmentation. For better tracking of no rigid objects, we include colour histogram in our object model as it is more stable for no rigid moving objects.

HISTORY OF SURVEILLANCE SYSTEM :

Video surveillance systems have long been in use to monitor security sensitive areas. The history of video surveillance consists of three generations of systems which are called 1GSS, 2GSS and 3GSS. The first generation surveillance systems (1GSS, 1960-1980) were based on analogue sub systems for image acquisition, transmission and processing. They extended human eye in spatial sense by transmitting the outputs of several cameras monitoring a set of sites to the displays in a central control room. [6] They had the major drawbacks like requiring high bandwidth, difficult archiving and retrieval of events due to large number of video tape requirements and difficult online event detection which only depended on human operators with limited attention span. The next generation surveillance systems (2GSS, 1980-2000)[6] were hybrids in the sense that they used both analogue and digital sub systems to resolve some drawbacks of its predecessors. They made use of the early advances in digital video processing methods that provide assistance to the human operators by filtering out spurious events. Most of the work during 2GSS is focused on real-time event detection. Third generation surveillance systems (3GSS, 2000-) [6] provide end-to-end digital systems. Image acquisition and processing at the sensor level, communication through mobile and fixed heterogeneous broadband networks and image storage at the central servers benefit from low cost digital infrastructure. Unlike previous generations, in 3GSS some part of the image processing is distributed towards the sensor level by the use of intelligent cameras that are able to digitize and compress acquired analogue image signals and perform image analysis algorithms like motion and face detection with the help of their attached digital computing components. The ultimate goal of 3GSS is to allow video data to be used for online alarm generation to assist human operators and for offline inspection effectively. In order to achieve this goal, 3GSS will provide smart systems that are able to generate real-time alarms defined on complex events and handle distributed storage and content-based retrieval of video data. The making of video surveillance systems smart requires fast, reliable and robust algorithms for moving object detection, classification, tracking and activity analysis. Starting from the 2GSS, a considerable amount of research has been devoted for the development of these intelligent algorithms.

II. LITERATURE REVIEW

To implement this object tracking system are used various algorithms. In this system object tracking is most important field in surveillance systems. In surveillance system cameras capture the footage for tracking suspicious movement in organisation, in this condition the videos prepare with the help of surveillance cameras the most difficult task is to tracking the object from the video and make the another image so that image should be vague to identification. Generally the surveillance system work in client server architecture, at the client side, video is captured by surveillance cameras [6].Such cameras can be either analogue or digital. Digital camera has become more and more popular, mainly because the captured video by digital surveillance cameras is easier to track and analyse with object detection and content analysis tools. The captured video is sent to the server for further processing. At the server side, video data is used for object detection as well as tracking. The working flow of the surveillance system shown in fig1.[6]

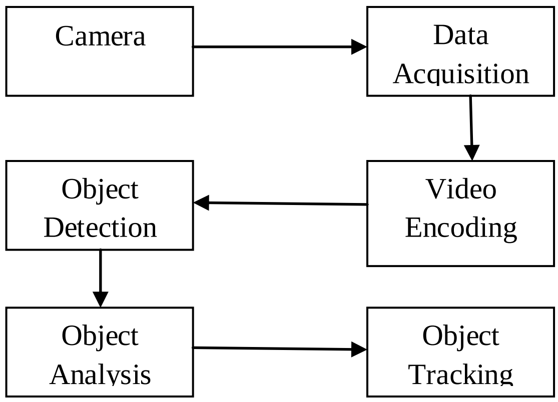


Fig.1 working flow of surveillance system

To tracking object, a method is implement which is object tracking station. OTS Stations implement the camera level and the scene level intelligent functions, like object tracking based on multiple camera views, shape classification, and detection of crossing perimeters of virtual zones. [1] Results of the OTS calculations are collected and processed in a central **Site Wide Object Tracking Server**. There is another problem is to object tracking that is nothing but the background just because of background the colour of object and their background are same in this situation the system is unable track the object to avoid this problem one solution is applied that is the segmentation. Due to segmentation the background of the image are segmented in number of images so that objects are free form background

WORKING PROCESS OF VIDEO PROCESSING : Object Tracking stations Receive analogue or IP camera images directly and perform the most time consuming video content analysis and image processing tasks. OTS Stations implement the camera level and the scene level intelligent functions, like object tracking based on multiple camera views, shape classification, and detection of crossing perimeters of virtual zones. Thus with the help of all these methods input data are collected on this basis the video processing has been done. Results of the OTS [4] calculations are collected and processed in a central Site Wide Object Tracking Server, which implements the site level intelligent functions, like identity tracking, evaluation of complex rules based on the identity and security clearance of moving persons or vehicles, and moreover this module is capable of recognizing the suspicious activities. The optional 3D World Model Server provides 3D calculation services for the other IDENTRACE modules. It can help OTS Stations in automatic calibration of the positions and viewing angles of cameras, while it can provide 3D location information to the SWOT Server, [5] and the generation of synthesized virtual images for the central monitoring console. The Remote Identification Server helps the SWOT Server to handle the inevitable uncertainties of object tracking (e.g. when the system loses track of persons in blind areas, like rest rooms). In these situations the task is "just" to decide whether a person currently visible in the scene is or is not the same as the person who was seen before. So the RID Server should determine the identity of persons from a limited set of alternatives, which can be solved with a much higher reliability than those identification solutions have, which try to identify a person out of the 6 billion living on Earth. Moving object detection is the basic step for further analysis of video. It handles segmentation of moving objects from stationary background objects. The given below fig2 show the process of video processing

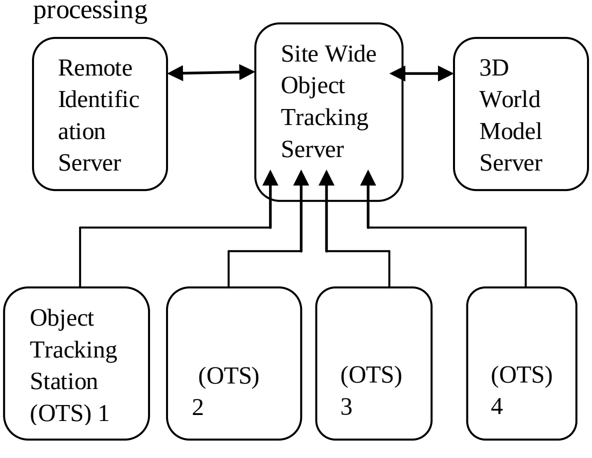


Figure 2Online video objects tacking for live video and movies

This not only creates a focus of attention for higher level processing but also decreases computation time considerably. Commonly used techniques for object detection are background subtraction, statistical models, temporal differencing and optical flow. Due to dynamic environmental conditions such as illumination changes, shadows and waving tree branches in the wind object segmentation is a difficult and significant problem that needs to be handled well for a robust visual surveillance system. Object classification step categorizes detected objects into predefined classes such as human, vehicle, animal, clutter, etc. It is necessary to distinguish objects from each other in order to track and analyze their actions reliably. Currently, there are two major approaches towards moving object classification, which are shape-based and motion-based methods. The objects 2D spatial information motion-based methods use temporal tracked features of objects for the classification solution. Detecting natural phenomenon such as fire and smoke may be incorporated into object classification components of the visual surveillance systems. Detecting fire and raising alarms make the human operators take precautions in a shorter time which would save properties, forests and animals from catastrophic consequences. The next step in the video analysis is tracking, which can be simply defined as the creation of temporal correspondence among detected objects from frame to frame. This procedure provides temporal identification of the segmented regions and generates cohesive information about the objects in the monitored area such as trajectory, speed and direction. The output produced by tracking step is generally used to support and enhance motion segmentation, object classification and higher level activity analysis. The final step of the smart video surveillance systems is to recognize the behaviors of objects and create high-level semantic descriptions of their actions. It may simply be considered as a classification problem of the temporal activity signals of the objects according to pre-labeled reference signals representing typical human actions. The outputs of these algorithms can be used both for providing the human operator with high level data to help him to make the decisions more accurately and in a shorter time and for offline indexing and searching stored video data effectively.
The advances in the development of these algorithms would lead to breakthroughs in applications that use visual surveillance. Monitoring of banks, department stores, Airports, museums, stations, private properties, parking lots for crime prevention, detection patrolling of highways, Railways for accident detection.[8] Measuring traffic flow, pedestrian congestion and athletic performance Compiling consumer demographics in shopping

centers and amusement parks Extracting statistics from sport activities Counting endangered species Logging routine maintenance tasks at nuclear and industrial facilities Artistic performance evaluation and self-learning Law enforcement: Measuring speed of vehicles Detecting red light crossings and unnecessary lane occupation Military security: Patrolling national borders Measuring flow of refugees Monitoring peace treaties Providing secure regions around bases Detecting the natural phenomenon fire besides normal object motion would be an advantage of a visual surveillance system, thus, the presented system is able to detect fire in indoor and outdoor environments. Conventional point smoke and fire detectors typically detect the presence of certain particles generated by smoke and fire by ionization or photometry. An important weakness of point detectors is that they are distance limited and fail in open or large spaces. The strength of using video in fire detection is the ability to serve large and open spaces. Current fire and flame detection algorithms are based on the use of colour and simple motion information in video. In addition to detecting fire and flame colour moving regions, the method presented in this thesis analyses the motion patterns, the temporal periodicity and spatial variance of high-frequency.

Detecting regions that correspond to/ moving objects such as people and vehicles in video is the first basic step of almost every vision system since it provides a focus of attention and simples the processing on subsequent analysis steps. [9] Due to dynamic changes in natural scenes such as sudden illumination and weather changes, repetitive motions that cause clutter (tree leaves moving in blowing wind), motion detection is a difficult problem to process reliably. Frequently used techniques for moving object detection are background subtraction, statistical methods, temporal differencing and optical flow whose descriptions are given below. Background subtraction is particularly a commonly used technique for motion segmentation in static scenes. It attempts to detect moving regions by subtracting the current image pixel-by-pixel from a reference background image that is created by averaging images over time in an initialization period. The pixels where the difference is above a threshold are classified as foreground. After creating a foreground pixel map, some morphological post processing operations such as erosion, dilation and closing are performed to reduce the effects of noise and enhance the detected regions. The reference background is updated with new images over time to adapt to dynamic scene changes.

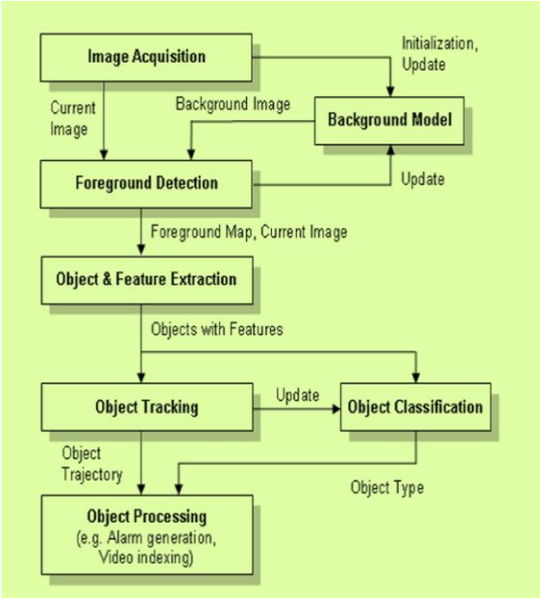


Figure 3 Process of video pre-processing and indexing

Object Detection And Tracking: The current system is able to distinguish transitory and stopped foreground objects from static background objects in dynamic scenes, detect and distinguish left and removed objects, classify detected objects into different groups such as human, human group and vehicle, track objects and generate trajectory information even in multi-occlusion cases and detect fire in video imagery. The computational complexity and even the constant factors of the algorithms we use are important for real time performance. Hence decisions on selecting the computer vision algorithms for various problems are affected by their computational run time performance as well as quality. Furthermore, the current system’s use is limited only to stationary cameras and video inputs from Pan/Tilt/Zoom cameras where the view frustum may change arbitrarily are not supported. The system is initialized by feeding video imagery from a static camera monitoring a site. Most of the methods are able to work on both colour and monochrome video imagery. The first step of our approach is distinguishing foreground objects.

Distinguishing foreground objects from the stationary background is both a significant and difficult problem. Almost the entire visual surveillance systems first step is detecting foreground objects. This both creates a focus of attention for higher processing levels such as tracking, [5] classification and behaviour understanding and reduces computation time considerably since only pixels belonging to foreground objects need to be dealt with. Short and long term dynamic scene changes such as repetitive motions, light repentance, shadows, camera noise and sudden illumination variations make reliable and fast object detection Difficult. Hence, it is important to pay necessary attention to object detection step to have reliable, robust and fast visual surveillance system. The aim of object tracking is to establish a correspondence between objects or object parts in consecutive frames and to extract temporal information about objects such as trajectory, posture, speed and direction. Tracking detected objects frame by frame in video is a significant and difficult task. It is a crucial part of smart surveillance systems since without object tracking, the system could not extract cohesive temporal information about objects and higher level behaviour analysis steps would not be possible. On the other hand, inaccurate foreground object segmentation due to shadows, reflectance and occlusions makes tracking a difficult problem. The information extracted by this level of tracking is adequate for most of the smart surveillance applications. Our approach makes use of the object features such as size, canter of mass, bounding box and colour histogram which are extracted in previous steps to establish a matching between objects in consecutive frames. Furthermore, our tracking algorithm detects object occlusion and distinguishes object identities after the split of occluded objects.

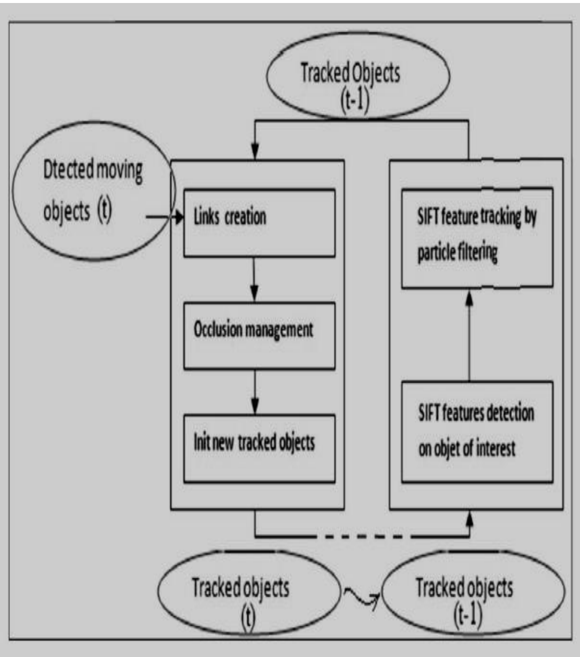


Fig 4 Process of object detection

By analysing the object trajectory information, our tracking system is able to detect left and removed objects as well. The ability of detecting left and removed objects in a scene is unconditionally vital in some visual surveillance applications. Detecting left objects such as unattended luggage in airports or a car parked in front of a security sensitive building is important since these activities might be performed by terrorists to harm people. On the other hand, protecting objects against removal without permission has important applications such as in surveillance of museums, art galleries or even department stores to prevent theft. Due to these critical applications, left/removed object is important part of a surveillance system. Recent advances in multimedia compression technology, coupled with the significant increase in computer performance and the growth of Internet, have led to the widespread use and availability of digital video. Applications such as digital libraries, distance learning, video-on-demand, digital video broadcast, interactive TV, multimedia information systems generate and use large collections of video data. The main advantage of the clustering-based segmentation is that it is a generic technique that not only eliminates the need for threshold setting but also allows multiple features to be used simultaneously to improve the performance it involves analysing intensity edges between consecutive frames. [3] During a cut or a dissolve, new intensity edges appear far from the locations of the old edges. Similarly, old edges disappear far from the location of new edges. Thus, by counting the entering and exiting edge pixels, cuts, fades and dissolves are detected and classified. To obtain better results in case of object and camera movements, an algorithm for motion compensation is also included. It first estimates the global motion between frames that is then used to align the frames before detecting entering and exiting edge pixels. However, this technique is not able to handle multiple rapidly moving objects. As the authors have pointed out, another weakness of the approach are the false positives due to the limitations of the edge detection method. In particular, rapid changes in the overall shot brightness, and very dark or very light frames, may cause false positives. The previous approaches for video segmentation process uncompressed video. As nowadays video is increasingly stored and moved in compressed format, it is highly desirable to develop methods that can operate directly on the encoded stream. Working in the compressed domain offers the following advantages. First, by not having to perform decoding/re-encoding, computational complexity is reduced and savings on decompression time and decompression storage are obtained. Second, operations are faster due to the lower data rate of compressed video. Last but not least, the encoded video stream already contains a rich set of pre-computed features, such as motion vectors (MVs) and block averages that are suitable for temporal video segmentation.[2] Several algorithms for temporal video segmentation in the compressed domain have been reported.

It is concerned with low-level visual processing and high-level image analysis, and is widely used in image understanding, human-computer interaction, surveillance, and robotics, to name a few. To tackle these challenges, this paper presents a tracking method that learns a robust object representation by partial least squares analysis and adapts to appearance change of the target and background [4] while reducing drift. Many classes of objects can now be successfully detected with machine learning techniques. Face, cars, pedestrians and hands, has all been detected with low error rates by learning their appearance in a highly generic manner from extensive training sets. These recent advances have enabled the use of reliable object detection components in real systems, such as automatic face focusing functions on digital cameras. One key drawback of these methods, and the issue addressed here, is the prohibitive requirement that training sets contain thousands of manually annotated examples. We propose to reduce the requirement for such an extensive labelling by exploiting the temporal consistency occurring in a training video. The performance of this approach is evaluated on pedestrian detection in a surveillance camera setting, and on cell detection in microscopy data. This comes with virtually no loss in performance when compared to a standard learning procedure trained on a fully labeled sequence. In fact, in some cases, gains in performance are observed. [4] Object detection and tracking is a major research area in computer vision. One of its application areas is traffic scene analysis.

The object tracking and segmentation from the video are the most difficult task because in running video there are various objects are in moving condition, while operator is going to track that object, the captured image become so noisy due to its pixel rate of that image. To overcome this problem till now various algorithms are used. Most of the algorithms are success to tracking and segment the video object but most of the algorithms are only track the object but not segment the background of the image. Another problem to use these algorithm is that, the tracked object stored in the database at the administrator of that system so that it can't be track that object next time until the particular algorithm apply on the video. There must be one provision in this that tracked object must be learned by the system so that the next time object will track and detect automatically.[4]

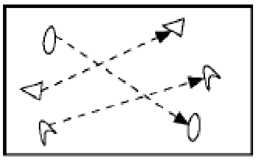
This kind of provision will be implemented in artificial neural network, such as in character recognition system the neural network plays vital role, in this system the input character must be learned by the neural network so that the next time the same kind of character is given to the system at that time the system will recognized very fast. The artificial neural network works in approximation so that the every input will mostly recognize perfectly. As we use neural network in surveillance system the most of the object will detect correctly and it reduces the time of the administrator.

III. PROPOSED SYSTEM

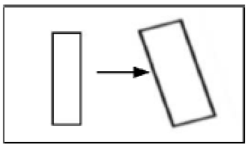
The increasing rate of multimedia data and transmission facility induces some problem of data loss and delay of delivery. Now in the process of video object detection background updating is important factor for analysis. For the background updating used segmentation process and segmentation used clustering technique. Now in our dissertation used RBF neural network model for segmentation process and reduces the loss of frame and video data during object tracking process. The basic processing elements of neural networks are called artificial neurons, or simply neurons or nodes. In a simplified mathematical model of the neuron, the effects of the synapses are represented by connection weights that modulate the effect of the associated input signals, and the nonlinear characteristic exhibited by neurons is represented by a transfer function. The neuron impulse is then computed as the weighted sum of the input signals, transformed by the transfer function. The learning capability of an artificial neuron is achieved by adjusting the weights in accordance to the chosen learning algorithm. The basic architecture consists of three types of neuron layers: input, hidden, and output layers. In feed-forward networks, the signal flow is from input to output units, strictly in a feed-forward direction. The data processing can extend over multiple (layers of) units, but no feedback connections are present. [5] Recurrent networks contain feedback connections. Contrary to feed-forward networks, the dynamical properties of the network are important. In some cases, the activation values of the units undergo a relaxation process such that the network will evolve to a stable state in which these activations do not change anymore. In other applications, the changes of the activation values of the output neurons are significant, such that the dynamical behavior constitutes the output of the network.[5] The issue of where the network gets the weights from is important but suffices to say that the network learns to reduce error in its prediction of events already known (i.e., past history).The problems of using neural networks have been summed by Arun Swami of Silicon Graphics Computer Systems. [6] Neural networks have been used successfully for classification but suffer somewhat in that the resulting network is viewed as a black box and no explanation of the results is given. This lack of explanation inhibits confidence, acceptance and application of results. He also notes as a problem the fact that neural networks suffered from long learning times which become worse as the volume of data grows. The Clementine User Guide has the following simple diagram to summarize a neural net trained to identify the risk of cancer from a number of factors.[5]

Object Tracking Technique

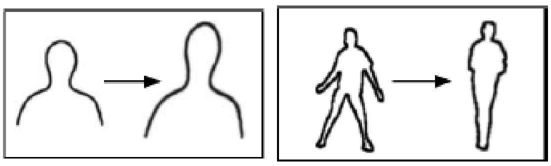
Point Tracking: Objects detected in consecutive frames are represented by points, and a point matching is done. This approach requires an external mechanism to detect the objects in every frame.



Kernel Tracking : Kernel = object shape and appearance. E.g. kernel = a rectangular template or an elliptical shape with an associated histogram. Objects are tracked by computing the motion (parametric transformation such as translation, rotation, and affine) of the kernel in consecutive frames.



Silhouette Tracking: Such methods use the information encoded inside the object region (appearance density and shape models). Given the object models, silhouettes are tracked by either shape matching (c) or contour evolution (d). The latter one can be considered as object segmentation applied in the temporal domain using the priors generated from the previous frames.



Proposed Software Description

In the field of technical computing the various languages are used to implement the various algorithms. As we developing this system so we have to implement high performance environment so that the MATLAB [4] is a high-performance language for technical computing. It integrates computation, visualization, and programming environment. Furthermore, MATLAB is a modern programming language environment: it has sophisticated data structures, contains built-in editing and debugging tools, and supports object-oriented programming. These factors make MATLAB an excellent tool for teaching and research. MATLAB [4] provides many functions for image processing and other tasks. Most of these functions are written in the MATLAB language and are publicly readable as plain text files. Generally the image processing algorithms are developing in MATLAB just because in image processing algorithm most complicated mathematical expressions. To implement these algorithms are MATLAB is the best frame work because in MATLAB framework the mathematical expressions are easily develop. That's why to implement inaccessible algorithm MATLAB is the only easiest way to use this framework for development proposed algorithm.

MATLAB has many advantages compared to conventional computer languages (e.g., C, FORTRAN) [4] for solving technical problems. MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. The software package has been commercially available since 1984 and is now considered as standard tool at most universities and industries worldwide.

Author names and affiliations are to be centered beneath the title and printed in Times 12-point, non-boldface type. Multiple authors may be shown in a two- or three-column format, with their affiliations italicized and centered below their respective names. Include e-mail addresses if possible. Author information should be followed by two 12-point blank lines.

Application

The name of this topic itself is one of the applications of the system. The term surveillance is a most applicable to security system because in the security system, to watch on every suspicious movement in the specific organisation. The advances in the development of these algorithms would lead to breakthroughs in applications that use visual surveillance.. The demand for remote monitoring for safety and security purposes has received particular attention, especially in the following areas:

- Transport applications such as airports, auditorium environments, railways, and motorways to survey traffic [6].
- Public places such as banks, supermarkets, homes, department stores and parking lots.

- Remote surveillance of human activities such as attendance at football matches or other activities [8].

IV. CONCLUSION

This paper has presented the state of development of surveillance systems, including a review of current image processing techniques that are used in different modules that constitute part of surveillance systems. As far as this image processing tasks is concern it has identified research areas that need to be investigated further such as adaptation, data fusion and tracking methods in surveillance system. Thus the artificial neural network is best concept to develop surveillance system.

The growing demand for safety and security has led to more research in building more efficient and intelligent automated surveillance systems. Therefore, a future challenge is to develop a wide-area distributed multi-sensor surveillance system which has robust, real-time computer algorithms able to perform with minimal manual reconfiguration on variable applications. Such systems should be adaptable enough to adjust automatically and cope with changes in the environment like lighting, scene geometry or scene activity. The system should be extensible enough, be based on standard hardware and exploit plug-and-play technology.

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