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A Survey on Data Mining Techniques for Surveillance of Real Time Video Streams

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Abstract

Video Surveillance is the system that includes monitoring of the behavioural activities, or other changing information in the videos, usually of people for the purpose of protecting, influencing, directing, and managing. The development video of surveillance systems have recently captured the interest of both research and industrial worlds due to abnormal instances in industries, society and the increasing safety and security concerns. But it is not possible to monitor the videos twenty four hours for human beings. So there is need of such a system which will be useful for real time automatic object identification, object movement pattern recognition, modelling and detection of normal and abnormal (interesting) events, and recognition of event pattern. Data mining is the application of statistical techniques and programmatic algorithms to find out previously unknown relationships within the available data. On the basis of clustering and modelling normal events a new proposes algorithm will find out whether a segment has normal or unusual events. The existing techniques also compute the degree of abnormality of segment in addition to deciding whether the event is normal or unusual. The degree of abnormality means that to what extent a segment is differ from existing segments in relation with normal events.

Keywords

Video Surveillance, Data mining, Degree of Abnormality, Clustering.

1. Introduction

With the development of software and hardware, video surveillance systems have been not only widely used in the security realm, but also in our daily life in hotels, supermarkets, banks, schools and so on. These applications are used for real-time monitoring and to detect the unusual events. Now video surveillance systems have lower intelligence and need people to operate them. So, it is urgent to extract video content features, and semantic information and there is a need for some kinds of models due to the increasing demands of intelligence. According to the applications of data mining, it is able to find out implicit, useful and knowledge from a large number of video data. Then they can help us understand video solutions automatically, improve intelligence of surveillance applications and make decisions. Video Surveillance is the monitoring of the behavior activities, or other changing information, usually of people for the purpose of influencing, managing, directing, or protecting.

The rest of the paper is organized as follows: Section II focuses on related work to be done until now. Section III discuses about the existing data mining techniques used for Surveillance of video streams. Finally it concludes the paper.

2. Review of Literature

Most of the researchers did the work on the video streams to find out the abnormal activity. Initially researcher's focuses on color feature in order to performed clustering and determine unusual activity. But previously single stationary camera were used which has it many more limitations and only able to focus on the single activity at stationary places. Later on moving camera at the stationary places has been used which has cover large geographical area but still having some lacunas. Previously the focus was on the fundamental classification technique which was unable to produce the accurate results. Each technique which was developed has it merits and demerits. But monitoring of the videos at real time and find out the abnormal activities is really a challenging work for the techno savvy researcher. In the recent years there were a many more clustering algorithms are used such as k- means algorithm, Dynamic Oriented graph, Markow Model but still need a new technique in order to produce the richer output.

3. Existing Techniques

Clustering Segments by K-means Algorithm [1]
The algorithm uses both Background Subtraction and Symmetrical Differencing methods to obtain the moving object or targets. As per the amount of motion occurs in video frames it divides the video into different segments [1]. Then the Video segments are group by using the improved K-Means algorithm. Then it finds the abnormal events, congestions and it retrieve similar situation very effectively. So far as the advantages of this data mining algorithm are concerned, it is used in surveillance of videos of stationary Places. It includes background extraction, moving target detection, video segment and model analysis [1].

Probabilistic Latent Semantic Analysis (PLSA) [2].
The Technique includes Low-level HDP (Hierarchical Dirichlet Process), Higher-level temporal motif, Measure for Abnormality Rating Model Behavior on Synthetic Activities, Abnormality Rating in a Metro Station [2]. This method is not supervised and it uses the long term data to learn the activities. The method is efficient and scalable as well. It can be used to handle the information provided by un-calibrated multiple cameras, jointly learning activities shared by them if in case it happens .An approach can be applied to loosely constrained scenes such as human motion in a metro station**.** The method can not jointly process and not correctly handle multiple cameras with any calibration enabling to monitor automatically larger areas in the metro station [2]. HDP has the advantage that it automatically finds the number of topics that best matches the observed data.

Dynamic Oriented Graph (DOG) [4].
The system obtains the color images from video cameras which is situated at stationary places and applies state of the art algorithms to classify, segment, locate or track moving target or objects [3]. The DOG method observed actions and characterizes the actions by means of a structure of nodes which are unidirectional connected. Each connected node defining a region in the hyperspace of attributes measured from the moving objects which has been observe from stationary video camera and assigned a probability in order to generate an unusual behavior. A new approach to automatically detect and predict abnormal behaviors was presented. It is possible to assign distinct behaviors to different kind of objects performing a similar Path [3]. The DOG classifier demonstrates to be extremely fast, learning, classifying and predicting activities on-line and in a dynamical form. The classifier does not detect danger situations from combinations of multiple objects and their interactions.

Markov model [4].
Initially it will read the next image of the video sequence. Then it will take the difference between this image and image used for the reference. Threshold the difference image and find connected components. Start the new track if the required component has not been track from previous image .For each component that is not already being tracked from previous images, start a new track [4]. The information about the location of the object will be there in track file and its "bounding box" in the image, and an "appearance template" of the object within the bounding box. A "shape template" is then calculated or computed. Perform a cross correlation operation for each tracked object to find the most likely location of the template in the new image. Then update the template image of the object by computing a running average of its image. The accuracy of the model is as high as 94% through a validation process [4]**.** A novel method which can accurately identify different activity types of moving trajectories. Not possible on trajectories of more different types of activities.

Bipartite graph co clustering [5]
An unsupervised technique for detecting unusual activity in a large video set using many simple features. Divide the video into equal length segments and classify the extracted features into prototypes, from which a prototype–segment co-occurrence matrix is computed [5]. Seek a correspondence relationship between prototypes and video segments which satisfies the transitive closure constraint. An important sub-family of correspondence functions can be reduced to co-embedding prototypes and segments to N-D Euclidean space**.** Method can utilize extremely simple features by automatically selecting the important feature signal. The computational solution is efficient and stable**.** It is an efficient, globally optimal algorithm exists for the co-embedding problem [5]. No complex activity models and no supervised feature selections are used.

Total Motion (TM), Object Motion (OM), Camera motion (CM) [6].

First, it measures automatically the overall motion in a shot by using accumulation of quantized Pixel differences among all frames in a shot. As a result, accumulated motions of shot are represented as a two dimensional matrix [6]. Next, it examine each frame in a shot to check whether there are any camera motion changes using the algorithm developed in previous work. If so, it computes the amount of motions and their directions. Using the similar technique to compute TM, It computes Object Motion (OM) by compensating camera motion changes computed by the technique [IO]. Similarly as in the computation of TM, the OM of shot is represented as a two dimensional matrix [6]. Finally, Camera motion (CM) can be computed subtracting OM from TM such that CM =TM - OM. The technique to compute TM or OM is very cost-effective because it uses accumulation of quantized pixel differences, and no need of expensive computation (i.e., optical flow) is required. The matrices representing TM and OM are showing not only the amounts of motions of the object but also show the exact locations of motion of the object. Therefore, it can get more accurate and it gives the specific information of motion contents of shot. The computation cost of the technique for camera motion detection is inexpensive because it does not use whole pixels in frames. Experimental data set has very limited number of shots.

W4 architecture [7].
Initially this method used the background scene modeling and background subtraction. It builds a statistical model for a background scene that allows us to detect foreground regions even when the background scene is not completely stationary. Classify those detected foreground regions as people or other objects, and determine whether a foreground region contain multiple people [7]. To track the isolated person it determine when a new person enters the system's field of view, and initialize motion models for tracking that object. Compute the correspondence between the foreground regions detected by the background subtraction and the people currently being tracked by W4. Employ tracking algorithms to estimate the position of each person and update the motion model used for tracking. W4 employs second order motion models (including a velocity and, possibly zero, acceleration terms) to model both the overall motion of a person and the motions of its parts [7]. Build an appearance model for each person that can be used to recognize people after change in behavior of that person. Detect and track body parts then it determine whether or not a person is carrying an object.

Two-level hierarchical clustering [10].
Motion features are computed directly from 2*D* tensor histograms, while color features are represented by 3*D* color histograms [10]. Cluster validity analysis is further applied to automatically determine the number of clusters at each level. Video retrieval can then be done directly based on the result of clustering.

4. Conclusion

For automatic and accurate analysis of video streams and detection of an abnormal activity above techniques has been used and review. This paper includes review of many more technique which has its own merits and demerits. Some technique only focuses on special activity and others may have the problem if it has to deal with many more objects simultaneously. Apart from this a new technique of clustering is needed in order to overcome the problems in above technique.

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