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Object Detection Avenue for Video surveillance using Hadoop

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Abstract - *Video surveillance system has become a very crucial part of security in our day to day life. Without this system, it would be very difficult to keep the premises safe and under one's sight. This requires training of the staff as well as continuous monitoring of the premises which is cumbersome. During the day, when the colour of the light and its direction changes, it becomes very difficult to detect the object. Use of background subtraction technique supports in the process of object detection. Here for object detection three algorithms are applied to the video frame. If any change in the scene is detected then it is indicated by a red mark on the timeline along with the start time, end time, total time duration of the unethical part of the video by the system. Once the video is stored on Hadoop Distributed File System (HDFS), it is parsed into frames and these frames are served as input to the system for further analysis. For detecting object we have applied object detection algorithms namely, Mean square difference, Colour Histogram, Structural Similarity Index (SSIM). Using Hadoop technology, we reduce the investigation time.*

Key Words: hadoop, hdfs, ssim, color histogram, mean square difference, security, video surveillance.

1.INTRODUCTION

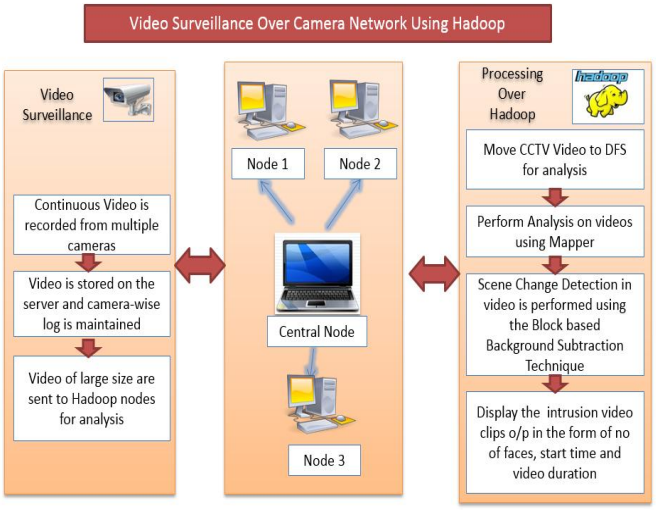
CCTV should not be considered as a magic wand of a fairy to prevent crime. It is just one of the tools used for security solutions. Crime rate is increasing day by day, and will be increasing in near future. To keep safety around us, CCTV cameras can be considered as basic need in our daily activities. Cameras are of two types. First is analog and another one is digital. One disadvantage in analog cameras is that, it requires Digital Video Recorder (DVR) to interface with the Television set. On the other hand digital camera can be interfaced with television set or computer directly. The video recorded by the CCTV is stored on hard disk usually, which is monitored at real time or the stored video is analyzed afterwards. Real-time monitoring is tiresome and requires continuous monitoring of the video footage. The staff for this job requires training and quite a big amount and time is invested by the firm. Even if Money and time are invested, it is not completely reliable as we Humans are prone to errors and Precision of Every human vary. Data storage is also an issue which needs to be considered in this system.

Visual object Detection is the crucial part in the video analytics (VA) in multi-camera surveillance. System Configuration is slightly different from the existing video surveillance system which uses common image information extracted from similar field of view to improve detecting the object. However, this setup may not be easily achieved because of certain limitations, topological issues and economical concerns, etc. Therefore we focus on non overlapping scenario in this system to build a system which uses more reliable and vigorous algorithms for object detection for a particular environment. Automatic object detection is the vital task in a multi-camera surveillance system and Colour Histogram is one of the popular algorithms to detect the scene change based on the Colour difference in the frame. For Colour Histogram, it is invariant to moderate light change, moving background and moving objects. However, it yields unsatisfactory result in some cases hence further analysis is performed using SSIM algorithm and Means Square Difference.

1.1 Related work

The object can be anything. It may be a human, a bag, or even a rat. Best example of Baggage detection can be seen on airports. Video surveillance system was demonstrated with the options like zoom, tilt in the camera. These cameras smartly respond to all the complexities of any of the scene. Also, they automatically capture the high resolution video even if there are only a few people in the scene and lower resolution as well, when the number of people increases. Talking about the cameras, various intelligent cameras which can easily carry out multiple observations are being developed. Detecting the object is a very crucial step for video analysis purpose in many of the vision applications. Object detection is generally performed by background subtraction; hence object detector can be used for the same. For mentioned method Bayesian Kalman filter used for tracking purpose. It uses Simplified Gaussian mixture. But object tracking involves spatial as well as temporal changes. Noise may be present in the images, also object motion and object shapes may be complex. Due to the reasons mentioned above, object tracking becomes a complex task. So there arises a need to overcome these drawbacks.

2. PROPOSED SYSTEM



Proposed method uses an Opencv tool to capture camera images and detect intrusion using comparison - block based motion object detection method. As soon as the comparison is done and an intrusion is found, it saves the streamed video on server. After that video analysis is performed using Hadoop technology.

Application consist of following modules

1. Video Recording

Video recording takes place using a library of programming functions called as OpenCV. Image capturing and comparing with template image takes place. As the difference between template image and current image found then it is observed that intrusion is detected. Finally the malicious video is stored on the server for analysis which is performed using Hadoop technology.

2. Historic CCTV Video

We can apply the Hadoop technology on Historic CCTV Videos which is large size. For analysis these video requires long time on single machine so to overcome this problem we use Hadoop technology.

3. Analysis on videos using Mapper

Scene Change Detection is performed using the block based background subtraction image. Compare the current image and template image if the current image and template image difference is found then Scene change is happened.

4. Processing Over Hadoop Node

For analysis of video using Hadoop the Map-Reduce concept is used. Map-Reduce usually splits the input data into chunks which are independent of each other and are processed by the map tasks in a completely parallel way. In this method we analyze the video and split the video in to number of chunks then it proceed to the different nodes for analysis.

5. Generate output with faces and change timing

Generate a graph and how much time is required for the analyzing video

6. Save the analysis logs into the database

Analysis logs like timing of each node for analysis, number of objects to be tracked, timing etc is stored into the database for security purpose.

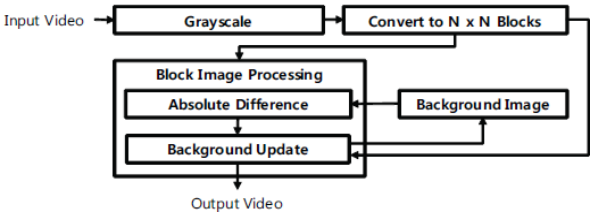
2.1. Algorithms

1. Motion detection using block based background subtraction image.

A. Motional Region Detection Structure:

The new motion detection method we proposed uses a technique like BSM. That is, it uses the subtraction between the current frame image and the background image. The background image used at this time is not a background image prepared in advance. However, it creates the background screen in real-time when video shooting. The motion detection method proposed in this study can divided into three steps:

a. blocking the input image and pre processing the image by block zoning
b. obtaining the difference image between the background image and block zoning
c. Updating the background image.



In Figure, the initial input image is a TV input method proposed in the NTSC standard. This is the YIQ method. It is converted to grayscale using following formula. Herein, F represents the frame image, and r, g, b indicates Red, Green, Blue value, respectively, to the pixel corresponding to the position of x and y.

$$G(x,y) = 0.299 * F_r(x,y) + 0.587 * F_g(x,y) + |0.114 * F_b(x,y) \quad (1)$$

The images obtained after converting to grayscale are segmented into the square block with the entire number of pixels, *N*. Subsequently, the absolute difference image of the block is divided in the front using formula.

$$D_n(x,y) = 1, |W_n(x,y) - B_n(x,y)| > t_T$$
$$D_n(x,y) = 0, Otherwise \quad (2)$$
$$(x,y = 0,1,2,..,N-1 \ |N: Window\ block\ size)$$

In above formula, *n* represents the number of blocks, *W* the block corresponding to the current image, *B* the block corresponding to the background image, and *D* the value of the absolute difference between *W* and *B*.

B. Background Image Update:

Step 1: One-dimensional array is declared to store each difference image luminance change rate by block R(n), and initialized to 0. This step is performed only once during the first run.

Step 2: Integer variable C to calculate the degree of change for the entire block is declared and initialized into 0. Here in, C represents the number of blocks with a change. For the block difference image (Dn). Steps 3 and 4 are performed repeatedly.

Step 3: The number of pixels that have 1 as a value within the block difference image (Dn) is put together. At this time, the sum of pixels represents the change in the luminance within the block. If it is equal to or greater than Δt, it is considered to have a change in the movement in the block, and the value of R(n) increases by 1. In addition, the value of C increases by 1. Conversely, if the sum of the pixels is less than Δt we consider there is no change, the value of R(n) reduces by 1,and all the values of Dn are initialized to 0. The image with no change in the luminance value in the block is initialized into 0 to eliminate noise. Herein, Δt uses an arbitrary threshold value i.e. block size N.

$$R(n) = R(n) + 1, C = C + 1, \sum_{k=0}^{N\wedge 2} Dn(k) > \Delta t \quad (3)$$

$$R(n) = R(n) - 1, Dn = 0, \ldots, 0, , otherwise \quad (4)$$

Step 4: In above formula, if the value of $R(n)$ is less than '-1',the background image of the block is updated. Otherwise, it is not updated and remains as the previous background image.

3. CONCLUSIONS

In this paper, new approach for object detection in camera network which identifies the intruder which is helpful for security purpose. To avoid continuous monitoring of the premises 3 algorithms are used in the video frame. For detecting an object, algorithms namely, Mean square difference, Colour Histogram, Structural Similarity Index (SSIM) are implemented. Using Hadoop technology, reduction in the investigation time is achieved. If any change in the scene is detected then it is indicated by a red mark on the timeline along with the start time, end time, total time duration of the unethical part of the video by the system. For minimizing analysis time, system is implemented over Hadoop. In future system can be implemented for live data.

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