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Video Analytics Based Data Warehousing Using IoT

T.Swetha[1], S.Neethu Shaji[2], J.Vanishree[3], A.R. Sunita [4], V.Swetha[5]

[1]Assistant Professor, Department of ECE, Panimalar Institute of Technology, Chennai.
[2 3]UG Scholar, Department of ECE, Panimalar Institute of Technology, Chennai.
[4 5]UG Scholar, Department of ECE, Panimalar Institute of Technology, Chennai.

Abstract: ***Video accumulations fundamentally have vast information volume. Video investigation attempts to normally discover illustrations and connections present in the substantial volume of video information, which can assist the end-customer with taking educated and savvy decisions and anticipate the future in light of the cases discovered transversely finished space and time. Video investigation help recognize protests in distribution centers. The measure of information is well rich in videos. To decipher and break down the video is troublesome Video examination expect a fundamental part for find cases and partner the recordings which can help end customers to get information and savvy decisions. Video examination perceives inquiries in warehousing. At the center of the item is a propelled question following motor that constantly tracks moving and stationary targets. A lightweight scattered video coding design is shown for video observation applications. Foundation casings and forefront maps are created utilizing a video examination module on the decoder side. A decoded outline is incorporated with the reproduced sub-outlines and the foundation outline. Through a reproduction, the proposed plot is seemed to accomplish better than anything cutting edge coding profitability while diminishing coding multifaceted nature enormously both at the encoder and the decoder. Every tracking method requires an object detection mechanism either in every frame or when the object first appears in the video. Object tracking is the process of locating an object or multiple objects over time using a camera. Once the object is tracked all the collected data's are maintained in a database which is known as data warehousing. Then the collected data's a placed in IoT.***

Keywords: video analytics, data warehousing, Internet of Things (IoT), Object detection and Extraction.

Introduction

There are two main goals: to correctly recognize moving objects of interest, and to track those moving objects throughout their life spans. The problem facing the first task is noise: some of the moving pixels in the image may be due to camera motion or noisy backgrounds that are not of interest. We solve this problem using size constraint to filter out movements that are too small to be part of an object of interest. The problem facing the second task is how to correctly identify the objects of interest in all the image frames. Using motion detection alone to track the targets provides a poor method due to the noisy movements. Template matching alone is not robust against change in object orientation and tends to drift off when targets are in motion. Hence, we use a combination of the two by performing template matching only on the pixels that are moving. Results have shown this to be a robust method in both recognizing the objects as well as tracking them.

1. Object detection and Tracking

The work already done for data warehousing for smartshop by using RFID Technology. By using RFID Data analysis is done. That data is controlled in IoT. The drawbacks in the previous methods are as follows:

- It is difficult to analysis the valuable data and invaluable data. Example: To find out defected product.
- Storage consumption is larger to occupy a smaller data's.
- Time consumption is more.

To avoid the drawbacks the model which is proposed to detect object of interest in querying image frame and locate the object in input image with tracking algorithm. Efficient tracking along with the object and marking of feature points and tracking the object in the video. In preprocessing step the noise in image are removed. In post-processing step, some corrections are made on given binary image via connected component analysis. In tracking with foreground mask step the tracking process is achieved by spatio-temporal information about objects features.
If given object does not meet the specified features then the object will be embedded in the background model. If the feature matches, then it is tracked with a foreground mask by the algorithm.

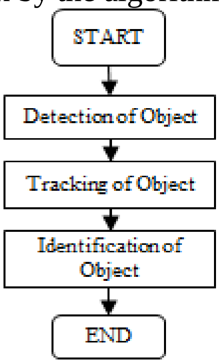


Figure 1: Flow of Process

2.1 Object Detection

Performance of an automated visual surveillance system considerably depends on its ability to detect moving objects in the observed environment. A subsequent action, such as tracking, analyzing the motion or id extraction of the foreground objects, making moving object detection a crucial part of the system. In order to decide on whether some regions in a frame are foreground or not there should be a model for the background intensities. So to handle these problems a method was proposed.

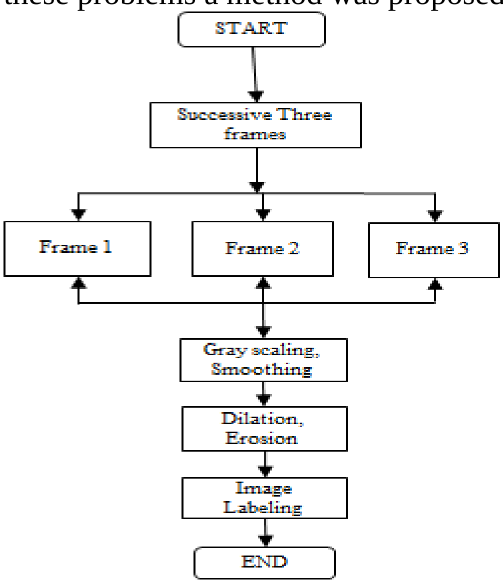


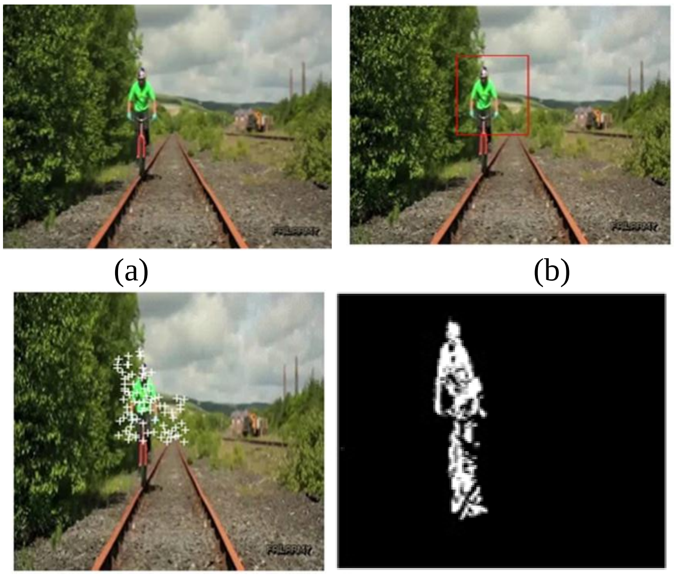
Figure 2: Flow of Object Detection

In the preprocessing phase, the first step of the moving object detection process is capturing the image information using a video camera. In order to reduce the processing time, a grayscale image is used on entire process instead of the color image. Image smoothing is performed to reduce image noise from input image in order to achieve high accuracy for detecting the moving objects. The smoothing process is performed by using a median filter with m × m pixels. The un-stationary background often considers as a fake motion other than the motion of the object interest and can cause the failure of detection of the object. To handle this problem, the resolution of the image is reduced to be a low resolution image. The low resolution image can be used for reducing the scattering noise and the small fake motion in the background because of the un-stationary background such as leaf of a tree.

Next it comes filtering phase. In order to fuses narrow breaks and long gulfs, eliminates small holes, and fills gaps in the contour, a morphological operation is applied to the image. As a result, small gaps between the isolated segments are erased and the regions are merged. To extract the bounding boxes of detecting objects, connected component analysis was used. Morphological operation is performed to fill small gaps inside the moving object and to reduce the noise remained in the moving objects. The morphological operators implemented are dilation followed by erosion. In dilation, each background pixel that is touching an object pixel is changed into an object pixel. Dilation adds pixels to the boundary of the object and closes isolated background pixel. Dilation can be expressed as: f(x; y) = 1; if there is one or more pixels of the 8 neighbors are 1.

In erosion, each object pixel that is touching a background pixel is changed into a background pixel. Erosion removes isolated foreground pixels. Erosion can be expressed as:

$$f(x;y) = \begin{cases} 0; & \text{if there is one or more pixels of the 8 neighbors are 0} \\ 1; & \text{otherwise} \end{cases}$$



(a) (b) (c) (d)

Figure 3: (a) Input Image, (b) Object Region, (c) Interest points, (d) Foreground and background subtraction

- Point is tracking- Tracking can be formulated as the correspondence of detecting objects represented by points across frames.
- Kernel tracking- Performed by computing the motion of the object, represented by a primitive object region, from one frame to the next.
- Silhouette Tracking-It Provides an accurate shape description of the target objects.

2.2 Prediction Methods

An important part of a tracking system is the ability to predict where an object will be next frame. There are four common approaches to predict the objects' positions:

1. Block matching
2. Kalman filters
3. Motion models

2.3 Tracking Method

The tracking method can be described as follows. Firstly, blocks and the tracking area are made only in the area of moving objects to reduce the processing time. The block size is made with 9x9 pixels in the previous frame. The block will search the matching block in each block of the current frame by using correlation value as expressed .In the current frame, the interest moving object is tracked when the object has maximum number of matching blocks. When that matching criteria are not satisfied, the matching process is repeated by enlarging the tracking area (the rectangle with dash line). The blacks still are made in the area of moving objects. When the interest moving object still cannot be tracked, then the moving object is categorized as not interest moving object or another object and the tracking process is begun again from the begin.

A Kalman filter is used to estimate the state of a linear system where the state is assumed to the distributed by a Gaussian. It is estimated the state of a dynamic system. ll. Kalman filtering is composed of two steps. Thus the Kalman filter consists of two steps:

1. The prediction
2. The correction

In the first step the state is predicted with the dynamic model. The prediction step uses the state model to predict the new state of the variables.

$$\bar{X}^t = D\, X^t - 1 + W \quad (1)$$

$$\bar{\Sigma}^t = D\, \Sigma^{t-1} D^t + Q^t \quad (2)$$

Where $\bar{X}^t$ and $\bar{\Sigma}^t$ are the state and covariance predictions at time t. D is the state transition matrix which defines the relation between the state variables at time t and t-1. Q is the covariance of the noise W. Similarly the correction step uses the current observation to update the object state where M is the measurement matrix, K is the Kalman gain. Similarly Kalman filter and extended Kalman filter assumes that the state is distributed by a Gaussian. In the second step it is corrected with the observation model, so that the error covariance of the estimator is minimized. In this sense it is an optimal estimator. Kalman filter has been extensively used in the vision community for tracking.

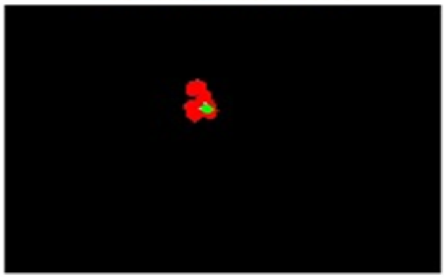


Figure 4: Object detected

2. IoT Data Analytics

Different frameworks object are detected and tracked. Finally the object is saved and maintained by database. To increase the storage capacity of data warehousing, all the collected data's are stored in cloud using Internet of Things (IoT) technology. The cloud which is used by us is Thingspeak. The collected data's are analyzed based on time and data and plotted.

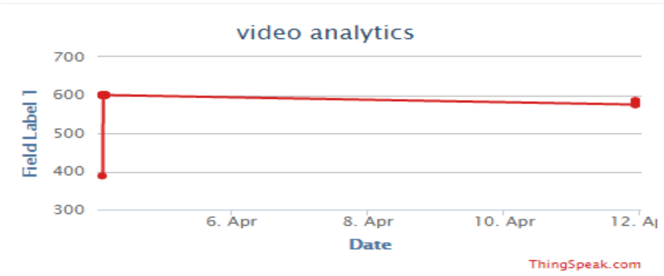


Figure 5: Data Analysis using Thingspeak

3. Conclusion

By using Kalman filter Object detection and tracking method's different objects are taken out from different frameworks and maintained a database. To increase the storage capacity for all the collected data's a cloud using IoT technology is used. By placing all the data's in the cloud, valid data is very much easily accessible with ease of time.

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Author's Profile

T. Swetha received the B.E. degree in Electronics and Communication Engineering from DMI college of engineering in 2011 and M.E, in Communication systems from Sri Venkateswara college of engineering in 2014 respectively. During 2016-2017, she started her career as Assistant professor in Department of Electronics and Communication Engineering in Panimlar engineering college, Chennai. Presently in 2018, she is working as Assistant professor in Dept. of ECE in Panimalar Institute of Technology, Chennai. Her research interests are Communication, Image Processing and Networking.

S.Neethu Shaji, J.Vanishree, A.R.Sunita, V.Swetha are UG scholar's pursuing B.E. in Electronics and Communication Engineering from Panimalar Institute of Technology, chennai, India in 2018.