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A Technical Review on Background Subtraction and Object Tracking on the Detection of Objects

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ABSTRACT: A Closed Circuit Television (CCTV) will be used for detecting and tracking of the moving objects. Initial section of the system is to discover the moving objects within the video. Second section of the system can track the detected object. Background subtraction is that the most well-liked technique used for detecting moving objects from stable cameras. Many various ways are planned over the recent years and each the novice and also skilled one will be confused concerning their edges and limitation. Detection of foreground objects from background object is done by background subtraction. Our paper includes two background subtraction methods such as Running Gaussian Average and Temporal Median Filter. Tracking is done by using Kalman Filter algorithm.

KEYWORDS*:* CCTV, Object Detection, Background Subtraction, Object Tracking, Kalman Filter.

I. INTRODUCTION

The widely used approach for detection of moving objects in videos from static cameras is the background subtraction [1]. The logic within the approach is that of detecting the moving objects from the distinction between the current frame and reference frame, typically referred to as the “background image” or “background model”. As a result, the background image should be an illustration of the scene with no moving objects and should be frequently updated [1].

Several ways for background subtraction have been proposed within the recent literature [2]. All of those ways attempt to effectively estimate the background model from the temporal sequence of frames. However, there is a large style of techniques and each the skilled and also the newcomer to the present space will be confused concerning the advantages and limitations of every technique. This paper provides an intensive review of the most ways (with inevitable exclusions as a result of spew restrictions) and an explicit categorization supported speed, memory needs and accuracy.

Visual surveillance systems are in use to observe security sensitive areas [3]. The supply of high powered computers, high quality video cameras and also the increasing need for machine-controlled video analysis has generated an excellent deal of interest in object tracking algorithms. There are three key steps in video analysis: Detection of fascinating moving objects, tracking of such objects from frame to border, and analysis of object tracks to acknowledge their behavior[4].

Video tracking will be outlined as associate degree action which may estimate the flight of associate degree of an object within the image plane because it moves among a scene. A tracker assigns consistent labels to the tracked objects in numerous frames of a video. Tracking of an object can be done by continuously detecting to localize regions, points or features of an image frame by frame [5].

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II. RELATED WORK

1) BACKGROUND SUBTRACTION

A. Running Gaussian Average

In Running Gaussian Average the background has been severally mounted at every(i,j) pixel[6]. So as to avoid the fitting the probability density function (pdf) from scratch at every new frame time t, a running average is computed as:

$$\mu_t = \alpha I_t + (1-\alpha)\mu_{t-1} \qquad (1)$$

Where I_t, is the pixel's current value

μ_t the previous average

α is an empirical weight.

The other parameter of Gaussian pdf has been computed equally. The advantage of Running Gaussian Average additional to speed is given by low memory requirements for every pixel it consists of two parameters (μ_t, σ_t). Based on every frame t, and I_t pixel value will be classified as foreground or background.

$$|I_t - \mu_t| > k\sigma_t \qquad (2)$$

Koller et al [7] remark that the model in(1) is unduly updated. For such reason they planned to change the model updated as:

$$\mu_t = M\mu_{t-1} + (1-M)(\alpha I_t + (1-\alpha)\mu_{t-1}) \qquad (3)$$

Where the binary value of M is 1 in correspondence of the foreground value, and 0 otherwise. This approach is also known as selective background update.

B. Temporal Median Filter

Various authors have argued that alternative kinds of temporal average perform higher than that shown in (1). Lo and Velastin [8] in planned to use the average of the last **n** frames because the background model. Cucchiara et al.[9] in argued that such a average provides associate degree adequate background model even if the n frames area unit sub-sampled with reference to the initial frame rate by an element of ten. additionally, planned to figure the median on a special set of values containing the last n, sub-sampled frames and w times the last computed average. this mixture will increase the steadiness of the background model.
The main disadvantage of a median-based approach is that its computation needs a buffer with the recent element values. Moreover, the median filter doesn't accommodate for a rigorous statistical description and doesn't provide a deviation measure for adapting the subtraction threshold

2) TRACKING

KALMAN FILTER

Object tracking is accomplished by estimating the object's position from the previous data and creating the existence of object at the estimated position. The observed possibility function and motion model should be mastered by some sample of image order before tracking is performed [13]. The equations for Kalman filters are under two categories they are the time update equations and measurement update equations. The time update equations are responsible to forecast forward the current state and error covariance estimates to get a priori estimate for following time step. The measurement update equations are accountable for feedback. This is used for including a new measurement into the a priori estimate to get an upgraded a posteriori estimate. The time equations are thought as predictor equations and measuring update equations are thought as corrector equations.

In the time update comes the present state estimate ahead in time.

State Prediction: $X_{predk} = A^* X_{k-1} + B^* U_k$ (1)

Where X_{predk} is the vector means predicted process state at time k.

X_{k-1} is vector means process state

U_k is a control vector.

Error Covariance Prediction: $P_{predk} = A^* P_{k-1} {}^* A^T + Q$ (2)

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P_{predk} is the error covariance at time k.

P_{k-1} is a matrix means error covariance in the state prediction at time k-1

Kalman Gain: $K_k = P_{predk} * H^T *(H * P_{predk} * H^T + R)^{-1}$ (3)

H is matrix converting state space into measurement space.

R is measurement noise covariance.

State Update: $X_k = X_{predk} + K_k * (Z_k - H * X_{predk})$ (4)

Error Covariance Update: $P_k = (I - K_k * H) * P_{predk}$ (5)

III. CONCLUSION

In this paper we've got grant a review of the most relevant background subtraction methods. Among the methods reviewed the simple methods like running Gaussian average or the median filter supply acceptable correctness while achieving a high frame rate and having restricted memory needs. A visual surveillance system with moving object detection and tracking capability has been granted. Object tracking of any single moving object has been successfully executed on standard surveillance dataset of PETS [12] and CAVIAR [11] using Kalman filter. The system works on videos of indoor besides as outside atmosphere taken using static camera under average to complicated background condition. The enforced module maybe applied to any computer vision application for moving object detection and tracking.

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