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Moving Object Detection and Extraction Using Intuitionistic Fuzzy Logic

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ABSTRACT

Abandoned object discovery using tracking based approaches are often become unpredictable in complex surveillance videos due to noise, occlusions, lighting changes and other factors. This proposed study presents a new structure to strongly and proficiently detect abandoned objects based on background subtraction. In this proposed system, the background is modeled by Gaussian mixture. In order to hold complex situations, numerous enhancements are implemented for noise removal, rapid lighting transform adaptation, fragment reduction and maintaining a stable update rate for video streams with different frame rates. In order to substantiate this proposed approach the object detection method using Intuitionistic logic based on block matching techniques has been used. The experimental results obtained were tested on benchmark video sequences. The obtained results are very promising in terms of robustness and effectiveness.

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INTRODUCTION

Object detection is the process of identifying and detecting an object in an image or video. The object can be detected through cameras and videos. Various researches have focused on face detection and pedestrian's detection. Object detection can be applied in the area like video surveillance and in image retrieval. Identifying the presence of an object in the image sequence to detect objects in videos involves object detection. To monitor the object in the sequence according to its shape, size to solve the problem, according to its target region in the corresponding frames in closely spaced time. First the object has to be tracked and then it has to be detected. These are related to each other that are repeated detection of objects in image sequences is easy to track and identify objects. (http://en.wikipedia.org/wiki/Object_detection) The process of object detection involves the object presence in the video and locating the object exactly for recognition. Object detection can be done by using the shape, position; size Detection is done by matching the target region in frames of images taken in the time interval. These are used to identify and track the object in the image sequence.

Applications:

Object tracking and detection is mainly used in the application of computer vision in the areas like video surveillance, vision-based control, human-computer interfaces, medical imaging, augmented reality and robotics.

Challenges:

For several years object tracking and detection remain a great problem in research. This difficulty depends on how the objects are being tracked and detected. In considering the visual features like color can be easily represented with the same color as an object. Some other examples like the face of a person which are alike the details of others in poses can be tracked easily and can be detected accurately. The challenge face here is that in a video the object are being moved. Since the images in the video are being moved through the camera to the camera there may be some change. The unevenness happens on the following basis:

- Dissimilarity in target
- Dissimilarity in clarification

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- Partial or full occlusion of the target

Object detection remains the challenge of performance for research remain a strong and great challenge in day to day life. Visual feature and motion movement, we can track the object in the videos. Combining the visual and temporal motion of an object leads to strong analysis approach. An approach to select the color and texture in a region merger with same motion has particular limits. In the literature, many researchers find problem in tracking and detection in a specific situation. To solve these many different techniques was used in different combination for different object (Guo, Z., 2012).

Research Method:

This research work consists of two phases. The first phase is tracking and detecting the object for movable objects and the second phase is for tracking and detecting the object for immovable objects. The first phase consists of two proposed algorithms, namely Optical Flow Techniques uses Bayesian Boosting Algorithm (OFTBB Algorithm) and Block Matching with Intuitionistic Fuzzy Logic (BMIFL Algorithm) for moving objects.

The second phase Consists of Tracking and detecting immovable object for abandoned object.

Pre-processing:

First Stage is the pre-processing stage where the videos are converted into grey scale and then we apply various filtering techniques. After applying it, we get the best video for the various noises, various filters is obtained. According to it for Gaussian Noise Winer filter, Salt and Pepper Noise Median filter and for Periodic Noise 2DFIR filter is best for the video. Depending upon the PSNR and MSE Value the best filters are identified. This is calculated as higher the PSNR value and lower the MSE values (Mihaylova, L., et al., 2007).

Segmentation:

Second stage is the segmentation stage. Segmentation refers to the process of partitioning a digital image into multiple regions (sets of pixels). The main aim of the segmentation is to find the boundaries and to locate the objects.

Frame Difference:

The process of checking the difference between one video to another in frames is called frame difference. When there occurs some change in the image the pixels also change. In case of noise, blur and other movement occurs in threshold. Frame differs upon the condition of light in a room according to its brightness,

The pixel difference of two frames and its absolute difference is stored in sequence is called frame difference. This takes less memory to calculate. In a sequence of frame, we take the present frame and the next frame to calculate the every frame difference till the last frames (Chate1, M., et al., 2011; Prabhakar, N., et al., 2012).

Approximate Median:

Approximate median is calculated as the number of frames in the buffer and the number of median in the frames are calculated with the threshold applied and its background video is detected. The frames stored in the buffer previously are calculated as the background frame of the median frames. The nest step to this is that to the current frames the background frame (previous frame) to find the pixel foreground. In calculating the memory frame buffering of N frames, approximate median is the best techniques to produce the result. Here the first frame is taken as the background frame for further process the pixel is incremented by 1 if the current frame is greater than the background pixel. If it is less than the background pixel it is decremented by 1 (Arif, M., et al., 2012).

Segmentation for Immovable Object:

Gaussian Mixture is based on Background subtraction. Among the high-complexity methods, two methods overlook the literature review; Kalman filtering and Mixture of Gaussians (MoG). Both have their advantages, but Kalman filtering gets forced in all the study for deed object trails that can't be removed. Since it looks like a possible deal breaker for various applications, MoG performs well. MoG is more forceful, as this handles multi-modal distributions. By an example this can be more effective like, a leaf shaking against a blue sky has two modes-leaf and sky. MoG filters out both. Kalman filters effectively track a single Gaussian and these are therefore uni modal: they can filter out only leaf or sky, but not both typically.

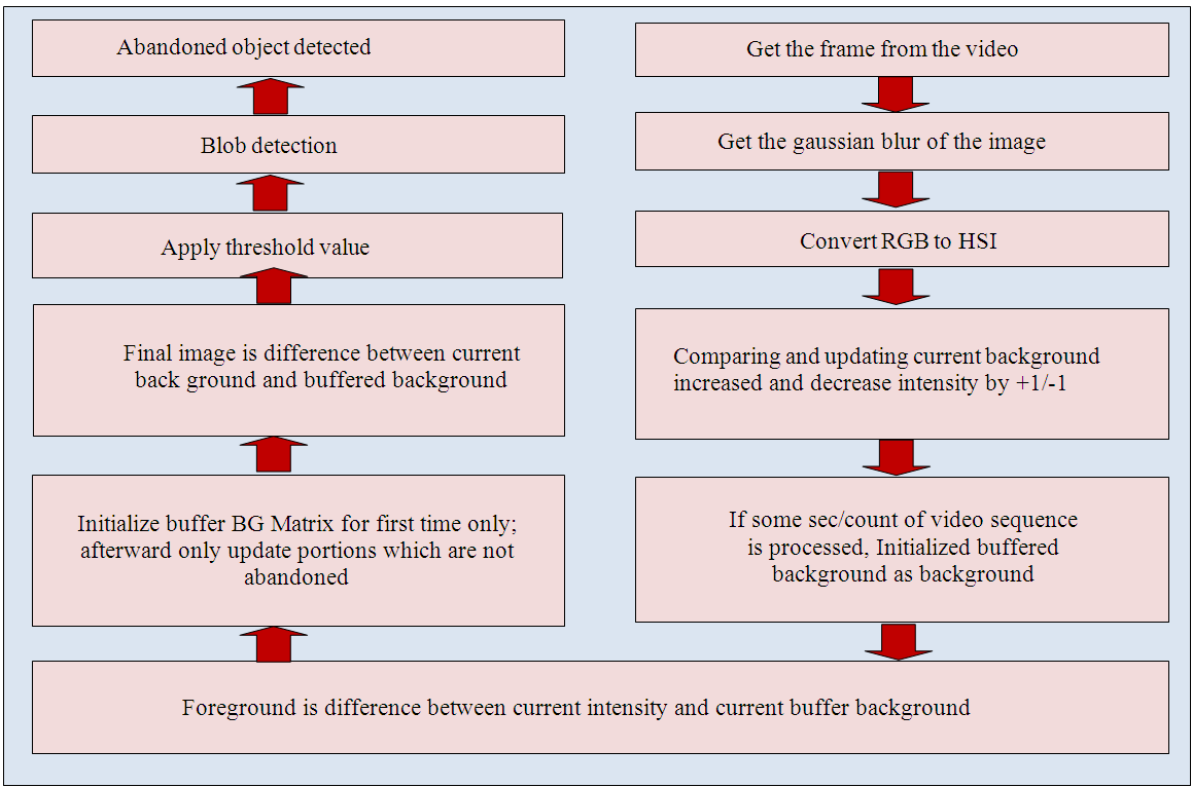

Fig. 1: Architectural Diagram of Proposed System

In MoG, the frame is not the background values. But the background model is Constant. Each pixel location is represented by a number (or mixture) of Gaussian functions that sum together to form a distribution function F:

$$F(i_t = \mu) = \sum_{i=1}^{k} \omega_{i,t} . \eta(\mu, \sigma)$$

The mean u of each Gaussian function (or component), can be thought of as an knowledgeable estimation of the picture element worth within the next frame-pixels are sometimes background is assumed. the weight and normal deviations of every part are measures of assertion in this approximation (higher weight and lower σ = higher confidence). There are usually 3-5 Gaussian components per pixel-the number normally depends on memory limits (Mountney, P., et al., 2010).

Feature Extraction:

Feature Extraction is used to determine the moving object in the sequence of frames. Feature extraction is the quality of source to specify the dataset correctly. While performing the data a major problem arise from variable involved. When performing with large sets of data it requires large memory and large calculating power in performing the training set of data which leads to poor classification of new samples. When combining various variables there arises a problem that leads to insufficient accuracy.

Edge Detection Canny Color:

Canny edge detector is the multi-stage algorithm that detects the edges of the images. This algorithm detects the best boundary in the following:

- Good detection-the algorithm must spot the exact edges of the image
- Good localization-edges noticeable must be as clear then the real image
- Minimal response-a given edge in the image should only be marked once and where possible, image noise should not create false edges (http://en.wikipedia.org/wiki/Canny edge detector).

One of the most powerful processes in detecting edges in forceful approaches uses Canny Edge Detector. It is implemented in the GPU sequence of filters. One of the most powerful processes in detecting edges in forceful approaches uses Canny Edge Detector. It is implemented in the GPU sequence of filters.

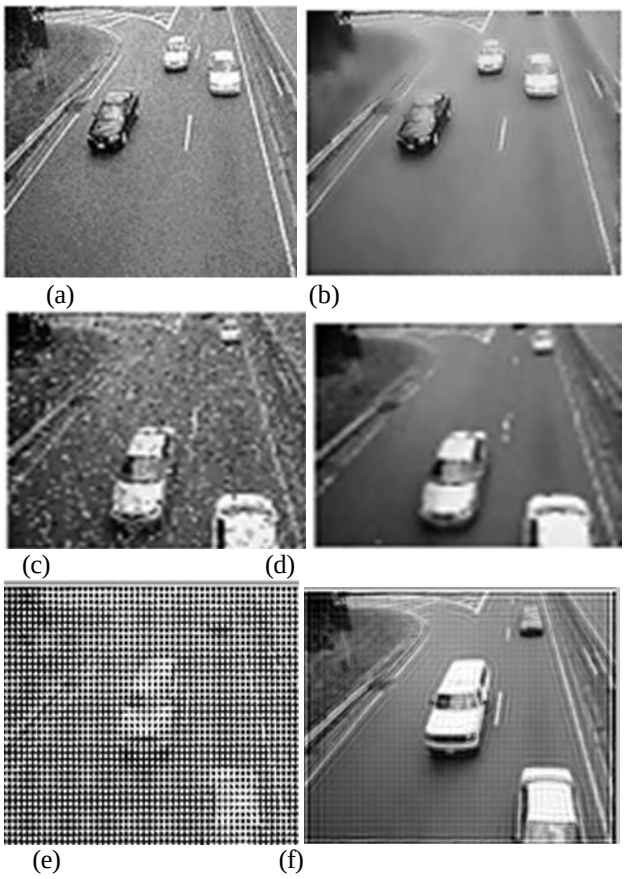

Fig. 2: Preprocessing Stage (a) Gaussian noise (b) Wiener filter (c) salt andpepper noise (d) median filter (e) periodic noise (f)2D FIR filter

There are various steps followed in detecting the edge:

- Noise Reduction
- Computing the Angle
- Setting the threshold

Bounding Box with Color Feature:

Remaining image is viewed in rectangular box with different dimension of the object formed from remaining images. Here the features are extracted by color and intensity. The intensity value of the pixels are stored from all direction like top, bottom, right, left and using these dimension the box is plotted in the limits. (http://en.wikipedia.org/wiki/Minimum_bounding_boxa; http://www.eetimes.com/General/PrintView/4017685)

Detecting Abandoned Objects:

The architectural diagram of proposed system is described in Fig 1. The goal of such detection algorithms is the notification of a human operator about potentially critical events such as unobserved objects placed in public areas.

The operator will then decide how to proceed based on the information provided by the system. This contribution focuses on the automatic detection of abandoned objects, such as suit cases or bags, in areas accessible to the public.

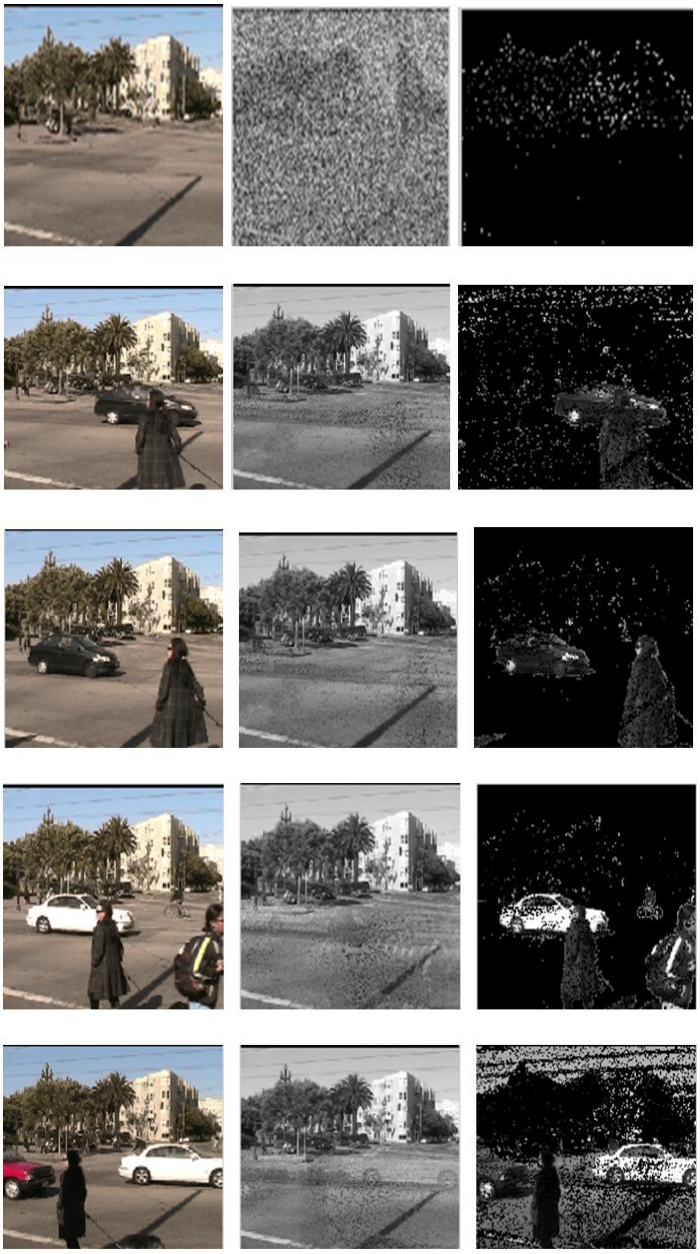

Fig. 3: (a) Original Image (b) Approximate Median (c) Segmented Image for segmentation on background Subtraction.

Whether an object is classified as abandoned or not depends on several factors: First of all, it has to be recognized as an object, i.e., it has to have a minimal extent and a sufficiently large probability of being foreground. In order to be considered as potentially abandoned, such an object has to be still and no humans must be close by. If all these requirements are fulfilled over a certain period of time, the candidate object can be regarded as abandoned and thus a potential security issue. The system should thus trigger a notification. The proposed abandoned object detection algorithm is implemented as a four stage system: People tracking, candidate region extraction, direct verification and alerting. (Kato, H. and M. Billinghurst, 1999).

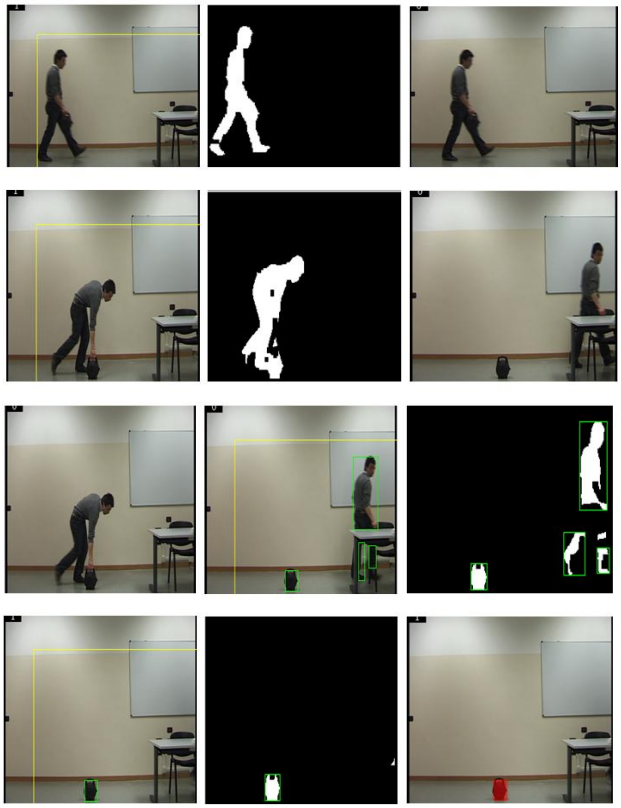

Fig. 4: Detection of Moving object in indoor enviroinment

Object Detection:

Optical Flow:

Optical flow the model of clear action of an object, edges in chart type of scene in relation to motion and the scene. (http://en.wikipedia.org/wiki/Optical_flow)

Block Matching with Intuitionistic Fuzzy Logic:

Block matching is the way of locating the matching block in videos for motion estimation. Motion estimation is that the method of determinant motion vectors that describe the transformation from one 2nd image to another; typically from adjacent frames during a video sequence. it's an downside because the motion is in 3 dimensions however the pictures are a projection of the 3D scene onto a 2d plane.

Intuitionistic Fuzzy logic determines the degree of both member ship and non-membership function of an object. Let us consider the universal set X where it performs the object in the form as:

$A = \{< x, \mu A(x), nA(x) > | x \hat{I} X\}$ Where $0 \leq \mu A(x) + nA(x) \leq 1$

If $nA(x) = 1 - \mu A(x)$ (or) $\mu A(x) + nA(x) = 1$, Then A represents fuzzy set

The function: $PA(x) = 1 - \mu A(x) - nA(x)$ represents degree of hesitancy of the element.

Tracking:

The method is identifying the moving object using the camera in allotted time is called video tracking. These are widely used in the areas like surveillance, video communication, imaging in medical and in editing for video. The main aim of tracking is to consume time in a video. (http://en.wikipedia.org/wiki/Video_tracking)

Velocity:

Velocity is the rate of change of the position of an object, equivalent to a specification of its speed and direction of motion.

Immovable Object:

Proposed Abandoned object detection The present system which is modular in nature and consists of five different modules and each module as follows:

- Capture the video
- Data extraction and conversion unit
- Back ground subtraction using Gaussian mixture

- Object tracking
- Alarm rising and display of detected Abandoned Object

To verify if a pixel is part of the background, then the comparison to the Gaussian works and tracking it. If the pixel value is within the scaling factor of a background component's standard deviation σ, it is considered as a part of the background. Else it is foreground.

The flow of the implementation of the proposed system is shown in Fig 1.

Experimental Results:

The Experimental Results is shown in Fig 3 and Fig 4. The moving object is extraced very efficient mannar.

Preprocessing:

In this Preprocessing stage the video with Gaussian noise, salt and pepper noise and Periodic Noise are taken under consideration. The test was conducted on these videos by applying different noise filters. The result shows. for Gaussian noise the wiener filter most accurately fits, Salt and Pepper noise is effectively removed by Median filter and for the periodic noise 2d FIR filter performs higher than different filters. The result obtained are shown in the below figures.

Segmentation:

The segmentation technique is used to cluster the related objects by performing background subtraction using Average Median. This technique best suited for moving objects segmentation. The result shows the input image and the previous frame and after applying the Average Median and subtracting the background objects the foreground displayed the result in the figures. The result shows that the Moving Object Segmentation can be done best using the average median compared to the frame difference it is revealed that the accuracy of average median is high.

Feature Extraction Using Bounding Box with Color Feature:

The bounding box is simply the coordinates of the rectangle border that absolutely encloses a digital image once it's placed over a page, a canvas, a screen or different similar bi dimensional background.

Object Identification and Object Tracking:

Intuitionistic fuzzy degree is defined as the greater the degree of membership function than the degree of non membership and the degree of hesitation of current block in the present frame. Intuitionistic fuzzy membership value $\mu_A(x)$, Non membership value $\nu_A(x)$ and hesitation value $\pi_A(x)$ for every macro block of the reference frame and current frame. Intuitionistic fuzzy membership value of the macro block of the previous frame is greater than Non membership value $\nu_A(x)$ and hesitation value $\pi_A(x)$ of the macro block of the current frame. Through this we calculate the cost function of IFD till the location for eight. When we obtain the ninth location we attain the origin.

Distance:

We are considering the two fuzzy sets of membership degree m, non-membership degree n and the hesitation degree p in as: $X = \{x_1, x_2. . . x_n\}$.

Let $A = \{< x, \mu_A(x), \nu_A(x) > | x \nu X\}$

And:

$B = \{< x, \mu_B(x), \nu_B(x) > | x \nu X\}$

As the next step we consider the hesitation degree with the interval or range of membership. The interval is due to the hesitation or the lack of membership assigning values. The distance measure is taken into account for hesitation degrees.

Object trailing in video is performed by applying the Block Matching victimisation 3 step approach of Intuitionistic Fuzzy to line the motion vector of the moving objects then finding the threshold of every object and sleuthing and trailing the objects that exceeds the threshold value as moving objects.

Immovable Object:

Input Frames Threshold Abandoned Object Detection:

In figure 3 and 4 the result shows the tracking of objects and identifying the abandoned object. The frame in the left end shows the region of interest and identifies the object of interest. The middle column frames shows the foreground objects movement. The last column identifies the abandoned object by displaying the discovered object in red color. The object identified is normally bounded in the green color boxes.

Conclusion:

In this study we have presented a new framework to robustly and efficiently perceive abandoned objects in complex environments for real-time video surveillance. The mixture of Gaussians background subtraction

method is used to identify both background and static foregrounds by using the same Gaussian mixture model. Our method can handle occlusions in complex environments with crowds.

Moreover, in order to reduce false alarms, we have employed tracking information using Intuitionistic logic based block matching in to provide an additional cue to filter out the impact of spurious and noisy trajectories for abandoned object detection. The testing results that are supported completely different situations have proven that our approach is with success applied in real world surveillance applications.

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