Novel Enhanced Particle Filters Approach for Moving Object Detection in Video Surveillance System

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ABSTRACT

Video tracking is very essential task in many applications of computer vision such as surveillance, vehicle navigation, autonomous robot navigation etc. Object detection and tracking are important and challenging tasks. Video surveillance in a dynamic environment, especially for humans and vehicles, is one of the current challenging research topics in computer vision. It is a key technology to fight against terrorism, crime, public safety and for efficient management of traffic. It contains detection of interesting moving objects and tracking of such objects from frame to frame. Its main task is to find and follow a moving object or multiple objects in image sequences. Normally there are three stages of video analysis; object detection, object tracking, and object reorganization. This paper presents The main objective of the proposed work is to detect the moving objects with less complexity and accuracy using frame differencing method. First background subtraction is detected using recursive technique. Then noises are removed by Morphological filter and YCbCr Color space for foreground object. In order to obtain accurate detection, Novel Enhanced Particle Filters (NEPF) approach is used. Finally the experimental results show that this method can reduce complexity and generate accurate image without any noises

Keyword: - *Object tracking, point tracking, kernel tracking, and Silhouette tracking*

1. INTRODUCTION

Object tracking in video sequences is an essential part in the field of computer vision and various research fields. Object tracking aims at obtaining the trajectory over time of moving object in video sequences [1]. Object tracking has been used in various applications like security, surveillance, clinical applications, education, entertainment, biomechanical applications, human robot interaction etc. Object tracking has two steps namely:

- Object detection: Detection of an object in a given image or video.
- Object tracking: Tracking of object in each frame.

Object tracking complex due to

1. Shapes and Size in each frame may vary.
2. Sudden occlusion of object in a given scenario.
3. Noise and blur in input video.
4. Luminance and intensity changes.
5. Object's abrupt motion

2. BASIC STEPS OF OBJECT TRACKING

Object tracking in video frames is an important topic in the field of computer vision and various research fields. The fundamental steps in object tracking is Fig.1. The first step in the process is to detect what objects are present in the

video frame. Then, to classify these objects depending on what we want to track. Finally the actual tracking takes place. The three steps are defined below and the different techniques used are also listed under each type.

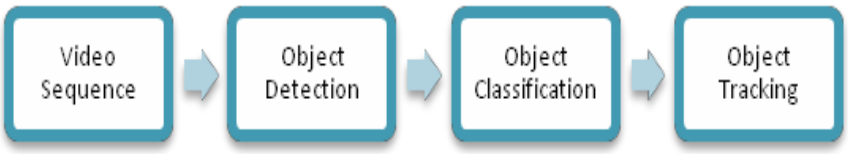

Fig. 1 Flow Diagram of Basic steps in Object Tracking

- Object Detection
- Object Classification
- Object Tracking.

2.1 Object Detection

Object Detection is to identify objects of interest in the video sequence and to cluster pixels of these objects. Object detection techniques are Frame Differencing,Optical Flow and Background Subtraction.

2.2 Object Classification

In the video the moving regions are detected it may matches to different objects in real world such as humans, vehicles etc.The techniques of object classification are Shape-based classification, Motion-based Classification and Color based classification.

2.3 Object Tracking

In video , the object and its position from each frame are detected .Tracking is defined as finding the path of an object from video frame. The techniques of tracking are Point Tracking, Kernel Tracking and Silhouette tracking

3. LITERATURE SURVEY

A wide range of application is there for object detection, tracking and identification in the field of surveillance, transport, physical security, retail shop and this paper point out the general problems regarding the object detection, tracking and identification. To track multipleobjects, different methods are in use such methods have shown very good performance. Many global approaches have been explored to overcome errors occurred during detection. Recently security concerns have grown tremendously, it is important for all to be able to safeguard their property from worldly harms such as thefts, destruction of property etc. As the technology is widely growing in modern world, therefore, it is necessary for the surveillance techniques also to be improved with the changing world. For this improvement many techniques were proposed and provide advantages and disadvantages, This section shows the related work of some researches work we provide it in this literature review.

3.1 Hybrid System of Motion Tracking Using Background Subraction and Frame Difference for Real Time and Recorded Videos.

In this paper [11] analyze the today's competitive generation, the security concerns have grown rapidly. The latest technology used for security concerns is motion detection system. Motion detection is broadly used in many computer vision tasks like pose estimation, human tracking, and human in danger and face recognition. It is a basic part for many computer vision tasks. By using these technologies, it is possible to monitor and capture every motion by inch and second of the area of interest. As motion detection system is real time and it is implemented widely, system is used to detect any motion in a real time video and once motion has been detected in the real time. We have even provided the provision of human identification using recorded video. Both the methods employed to detect the motion are background subtraction method and frame difference method. The proposed method makes background image using previous consecutive frames. This method detects the motion via a standard webcam in real-time YUY2_640x480 resolution. Experimental results showed that the proposed method is more robust in nature as it can avoid the noise in motion detection due to camera flicker and useful to reduce the number of false positive alarms. We additionally use the variant of MATLAB i.e. SIMULINK. It is efficient enough to track the human with its boundary condition.

3.2 An Improved Motion Detection Method for Real-Time Surveillance by Nan Lu, Jihong Wang

In this paper [12], analyze the Real-time detection of moving objects is very important for video surveillance. In this paper, a novel real time motion detection algorithm is proposed. The algorithm integrates the temporal differencing method, optical flow method, double background filtering (DBF) method and morphological processing methods to achieve better performance. The temporal differencing is used to detect initial coarse motion areas for the optical flow calculation to achieve real-time and accurate object motion detection. The DBF method is used to obtain and keep a stable background image to cope with variations on environmental changing conditions and is used to eliminate the background interference information and separate the moving object from it. The morphological processing methods are adopted and combined with the DBF to get improved results. The most attractive advantage of this algorithm is that the algorithm does not need to learn the background model from hundreds of images and can handle quick image variations without prior knowledge about the object size and shape. The algorithm has high capability of anti-interference and preserves high accurate rate detection at the same time. It also demands less computation time than other methods for the real-time surveillance. The effectiveness of the proposed algorithm for motion detection is demonstrated in a simulation environment and the evaluation results are reported in this paper.

3.3 Detection of Surveillance Video Sequence by Kuihe Yang, Zhiming Cai, Lingling Zhao

In this paper [13], a study the video surveillance, there are many interference factors such as target changes, complex scenes, and target deformation in the moving object tracking. In order to resolve this issue, based on the comparative analysis of several common moving object detection methods, a moving object detection and recognition algorithm combined frame difference with background subtraction is presented in this paper. In the algorithm, we first calculate the average of the values of the gray of the continuous multi-frame image in the dynamic image, and then get background image obtained by the statistical average of the continuous image sequence, that is, the continuous interception of the N-frame images are summed, and find the average. In this case, weight of object information has been increasing, and also restrains the static background. Eventually the motion detection image contains both the target contour and more target information of the target contour point from the background image, so as to achieve separating the moving target from the image. The simulation results show the effectiveness of the proposed algorithm.

3.4 Real Time Motion Detection Using Background subtraction Method and Frame Difference

In this paper [14] scrutinize today's competitive generation, the security concerns have grown rapidly. The latest technology used for security concerns is motion detection system. Motion detection is broadly used in many computer vision tasks like pose estimation, human tracking and face recognition. It is a basic part for many computer vision tasks. By using this technologies, it is possible to monitor and capture every motion by inch and second of the area of interest. As motion detection system is real time and it is implemented widely, system is used to detect any motion in a real time video and once motion has been detected in the real time, the warning system will activate by means of an alarm and capture the real time video. The methods employed to detect the motion are background subtraction method and frame difference method. The purposed method makes background image using 4 previous consecutive frames. This method detects the motion via a standard webcam in real-time YUY2_640x480 resolution. Experimental results showed that the proposed method is more robust in nature as it can avoid the noise in motion detection due to camera flicker and useful to reduce the number of false positive alarms.

3.5 Moving Object Tracking using Background Subtraction Technique and its Parametric Evaluation

In this paper [15] proposes efficient motion detection and people counting based on background subtraction using dynamic threshold approach with mathematical morphology. Here these different methods are used effectively for object detection and compare these performance based on accurate detection. Here the techniques frame differences, dynamic threshold based detection will be used. After the object foreground detection, the parameters like speed, velocity motion will be determined. For this, most of previous methods depend on the assumption that the background is static over short time periods. In dynamic threshold based object detection, morphological process and filtering also used effectively for unwanted pixel removal from the background. The background frame will be updated by comparing the current frame intensities with reference frame. Along with this dynamic threshold, mathematical morphology also used which has an ability of greatly attenuating color variations generated by background motions while still highlighting moving objects. Finally the simulated results will be shown that used approximate median with mathematical morphology approach is effective rather than prior background subtraction methods in dynamic texture scenes and performance parameters of moving object such sensitivity, speed and velocity will be evaluated

4. PROPOSED WORK

In this paper, an algorithm of feature-based using Kalman filter motion to handle multiple objects tracking is proposed. The system is fully automatic and requires no manual input of any kind for initialization of tracking. Through establishing Kalman filter motion model with the features centroid and area of moving objects in a single fixed camera monitoring scene, using information obtained by detection to judge whether merge or split occurred, the calculation of the cost function can be used to solve the problems of correspondence after split happened. The algorithm proposed is validated on human and vehicle image sequence this result shows that the algorithm proposed achieve efficient tracking of multiple moving objects under the confusing situations. This paper presents a new algorithm for detecting moving objects from a static background scene based on frame difference. Firstly, the first frame is captured through the static camera and after that sequence of frames is captured at regular intervals. Secondly, the absolute difference is calculated between the consecutive frames and the difference image is stored in the system. Thirdly, the difference image is converted into gray image and then translated into binary image. Finally, kalmanfilter is used to track the object. Then morphological operations are done to detect the object perfectly.

5. METHODOLOGIES

5.1 Preprocessing

A new method is proposed which is a combination of both background subtraction method and consecutive frame subtraction method. In this method background image is formed by taking the mean value of previous consecutive frames and then current image is compared pixel wise with the background image to detect motion. The different approaches used in detection of motion are background subtraction method, consecutive frames and threshold comparison method. The main focus of this work is to obtain a background image from previous consecutive frames in real time by trigger method. Where the current image is compared pixel wise (pixel by pixel) or subtracted from background image to detect any motion. The image obtained after subtraction is called Difference Image. Values of pixels can be either positive or negative in difference image. Therefore implicit of difference image is taken and then values of pixels in difference image is compared with threshold value, then if the pixel value is more than threshold value then it means there is motion in the area being monitored and motion is detected. This method continuously keep making background image using previous frames in real time.

5.2 Object Detection

From the observations only person have the large intensity than threshold. Varying person is having the double threshold other persons. Here Novel Enhanced Particle Filters (NEPF) approach is used, which is a statistical data analysis technique that minimizes the within-cluster sum of distance to partition a set of data into groups and image is converted into three or more clusters. The cluster with the lowest average intensity value is considered to be person, while the other clusters are considered other nearest person. So the classification is done and pixels are detected. This algorithm is faster and less restricted by the initial contour.

Novel Enhanced Particle Filters (NEPF) approach (node n = (s1, ...,sk), Sn , In)

Begin
Stemp = φ.
Itemp = φ.
For each (i Sn)
if ((s1, ..., sk , {i}) is frequent)
Stemp = Stemp {i}
For each (i Stemp)
DFS-Pruning((s1,……..,sk,{i}),Stemp, all elements in Stemp greater than i)
For each (i In)
if ((s1, ... , sk » {i}) is frequent)
Itemp = Itemp {i}
For each (i Itemp)
DFS-Pruning ((s1, ...,sk {i}), Stemp, all elements in Itemp greater than i)

End

This algorithm is able to detect the weak connections between floes and ensures that detected boundary area is closed to the initial contour does not need to be as close to the true boundary as for in the traditional snake algorithm. The distance transform of a binary image is the minimum distance from every pixel in an object to the background.

5.3 Background Subtraction

In moving object detection, background subtraction is a frequently-used detection method, which carries out difference calculation by the current image and background image to detect the area of the moving object. Image subtraction is one of the popular techniques in image processing and computer vision technology. This object detection based on the codebook model is based on vector quantization and clustering.

Figure 2: Background subtraction

It works well only in the presence of stationary cameras. The subtraction leaves only non-stationary or new objects, which include entire silhouette region of an object. This approach is simple and computationally affordable for real-time systems, but is extremely sensitive to dynamic scene changes from lightning and extraneous event etc. Therefore it is highly dependent on a good background maintenance model. By using the quantization and clustering idea, the changed pixel after image sequence analysis is classified and the code word set in a pixel called codebook.

5.4 Consecutive frame difference method

Detection of moving object from a sequence of frames is captured from a static camera which is widely performed by frame difference method. The task of this approach is to detect the moving objects from the difference between the current frame and the reference frame. The frame difference method is commonly used method for detection of motion. This method adopts pixel by pixel based difference to find the moving object.

5.5 Filter Approach

Kalman filer is an estimator that predicts and corrects the states of wide range of linear processes. It is not only efficient practically but attractive theoretically as well Precisely, the optimal state is found with smallest possible variance error, recursively. However, an accurate model is an essential requirement. In Kalman filer, we consider a tracking system where xk is the state vector which represents the dynamic behavior of the object, where subscript k indicate the discrete time. The objective is to estimate x_k from the measurement z_k . Following is the mathematical description of Kalman filer, which for understanding we have sectioned into four phases. Here we provide Kalman filter algorithm**.**

5.6 Noise reduction using morphological filter

The video capture device may provide noisy data. In order to get improved results, noise removal is a crucial step. So to eliminate that morphological operations, erosion and dilation, are applied to the foreground pixel map in order to remove noise that is caused by the first three of the items listed above. By applying these operations is removing noisy foreground pixels that do not correspond to actual foreground regions and to remove the noisy background pixels near and inside object regions that are actually foreground pixels.

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6. RESULT AND DISCUSSION

This section demonstrates some of the tested image sequences that are able to highlight the effectiveness of the proposed detection system. To fulfill our proposed work, we have used computing software called MATLAB,

because MATLAB provides Image Acquisition and Image Processing Toolboxes which facilitate us in creating a good GUI and an excellent code. Using a video input object, live data is acquired and analyzed to calculate any motion between two adjacent image frames. These experimental results are obtained using the proposed detection and tracking algorithm.

Figure 4 : Input Video

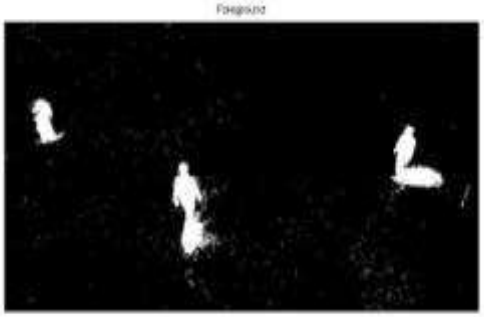

Figure 5: Background Subtraction

Figure 4 shows the video sequence on which we superimposed the contour of the detected objects and the image for the corresponding frames, respectively. Obviously all the pixels above this line do not belong to the ground plane. Figure 5 is the result of subtracting the frame from the reference or background frame. The background subtraction is done from the clean original image by using distortion of color and brightness.

Figure 6 : Tracking

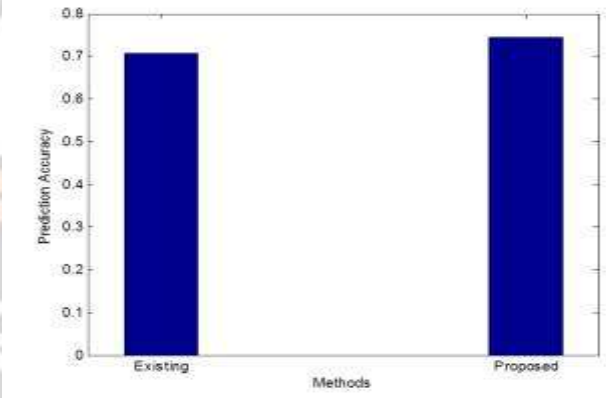

Fig 7 Accuracy

The result of comparing the appearance-based approaches with that of incorporating motion and appearance demonstrates that, motion can provide higher discriminative power than using appearance cue alone, which can improve the robustness to the outliers from the image registration, yet modeling motion and appearance cues jointly is vulnerable towards these outliers from either cue, since these outliers may be introduced into the joint kernel function, which will deteriorate its accuracy. The detection results are presented qualitatively and quantitatively. The parameters for each algorithm were determined experimentally. For each sequence, several representative frames, the ground truth and detection results produced by each algorithm are presented. The detection results are shown as black and white images where white pixels represent foreground objects while black pixels represent background. The performance of each approach is also evaluated quantitatively using the traditional pixel wise evaluation metrics (precision, recall, F-measure) which are used commonly in evaluating background subtraction approaches and b) the component-based evaluation metrics which are designed from the perspective of object detection, here we use the correct detection rate, miss detection rate and false alarm rate

As shown in figure 7 shows the accuracy of our proposed system compared with existing one. Detection results form single object and multiple objects from video frames. Results from proposed detection system, the detection result

we can see that, the algorithm determine the legitimate region(s) as well as it extract all information of moving object.

7. CONCLUSIONS

The paper presented an efficient motion detection basedon background subtraction using frame difference with thresholding and mathematical morphology. It will been enhanced with futures of connected component analysis and morphological filtering for tracking and counting moving objects. After the foreground detection, the parameters like Count, velocity of the motion was estimated and performance of object detection will be measured with sensitivity and correlation using ground truth. Finally the proposed method will be proved that effective for background subtraction in static and dynamic texture scenes compared to prior methods. It then allows the pictures by eliminating the background and analyze the object exactly. In a further different frame activity has captured to analyze the varying objects in the video then the difference image is converted into gray image and then translated into binary image. Finally, kalman filter is used to track the object. Then morphological operations are done to detect the object perfectly.

8. REFERENCES

[1] Zhengjie Wang, YuanZhao, JifenZhang, YinjingGuo, Research on Motion Detection of Video Surveillance System, 3rd International Congress on Image and SignalProcessing, vol.1, pp. 193-197, October 2010

[2] M. H. Ali, Fadhan Hafiz, A. A Shafie, Motion Detection Techniques using Optical Flow, World Academy of Science, Engineering and Technology, vol. 32 pp 559-561, 2009.

[3] Dar-Shyang Lee. Effective gaussian mixture learning for video background subtraction. IEEE Transactions on Pattern Analysis and Machine Intelligence, 27(5):827–832, 2005.

[4] Jeisung Lee and Mignon Park*, (2012), An Adaptive Background Subtraction Method Based on Kernel Density Estimation

[5] K.Kavitha, A.Tejaswini, Background Detection and Sub traction for Image Sequences in Video, International Journal of Computer Science and Information Technologies, vol.3, Issue 5, pp. 5223-5226, 2012

[6] K. Suganya Devi, N. Malmurugan, M. Manikandan, Object Motion Detection in Video Frames Using Background Frame Matching, International Journal of Computer Trends and Technology, Vol.4, Issue 6, pp 1928-1931, June 2013.

[7] Nan Lu, Jihong Wang, Q.H Wu, Li Yang, An Improved Motion Detection Method for RealTime Surveillance, International Journal Of Computer Science, vol.1, Issue 6, 2008.

[8] Richard J. Radke, SrinivasAndra, Omar AlKofahi, and BadrinathRoysam. Image change detection algorithms: A systematic survey. IEEE Transactions on Image Processing, 14(3):294–307, 2005.

[9] Background Subtraction for the Detection of Moving and Static Objects in Video Surveillance,2014.

[10] Broida, T. J. and Chellappa, R. (1986). Estimation of object motion parameters from noisy images. Pattern Analysis and Machine Intelligence, IEEE Transactions on, PAMI-8(1):90–99. DOI: 10.18535/ijecs/v6i8.01

[11] Ms.D.NagamaniAbirami ―Hybrid System of Motion Tracking Using Background Subraction and Frame Difference for Real Time and Recorded Videos.

[12] .Nan Lu, Jihong Wang, ―An Improved Motion Detection Method for Real-Time Surveillance.

[13] Kuihe Yang, ZhimingCai, LinglingZhaoAlgorithm Research on Moving Object , Detection of Surveillance Video Sequence.

[14] Lavanya M P, ―Real Time Motion Detection Using Background Subtraction Method and Frame Difference‖

[15] Bhuvaneswari, T. Siva Kumar, ―Moving Object Tracking using Background Subtraction Technique and its Parametric Evaluation‖.

[16] Asad Abdul Malik, ― Object Detection and Tracking using Background Subtraction and Connected Component Labeling‖.

[17] D.Mohanapriya,Dr.K.Mahesh "A novel foreground region analysis using NCP-DBP teture pattern for robust visual tracking" , Springer Multimedia Tools and Appications –An International Journal, Volume: 76 Issue No: 24, December 2017. pp:25731-25748.

[18] D.Mohanapriya, Dr.K.Mahesh,"Robust Video Tracking System with shadow suppression based on Feature Extraction",Australian Journal of Basic and Applied Sciences, Vol.10, No.11 (July), 2016 pp 307-311.

[19] D.Mohanapriya and Dr.K.Mahesh, "A video target tracking using shadow suppression and feature extraction," IEEE Xplore Digital Library.

[20] D.Mohanapriya, Dr.K.Mahesh "Robust Visual Target Tracking Via Nearest Sequential Boundary Pattern" International Journal of Pure and Applied Mathematics Volume 118 No. 7 2018, 207-213.

[21] K.Rajalakshmi, Dr.K.Mahesh, "Video Steganography Based on Embedding the Video Using PCF Techniqu "Proceedings of IEEE Conference (ICICES 2017) 978-1-5090-6135-8/17 ©2017 IEEE.

[22] K.Rajalakshmi, Dr.K.Mahesh,"ZLBM:Zero Level Binary Mapping Technique for Video Security" Multimedia Tools And ApplicationsSpringer, DOI 10.1007/s11042-017-4942-0, ISSN:1380-7501,Online:13 July 2017.

[23] K.Rajalakshmi, Dr.K.Mahesh "An Innovative Video Data Embedding Method for Video Security" International Journal of Pure and Applied Mathematics Volume 118 No. 7 2018, 215-219.

[24] D.Mohanapriya, Dr.K.Mahesh, "Video Tracking System by suppressing shadow and Feature Extraction- A Review", International Journal of Computer Engineering and Applications(IJCEA), Vol.10, No 6 ,June , 2016.