

Object Tracking for Video Surveillance System Based On Cellular Automata Segmentation

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ABSTRACT: Video object segmentation and tracking framework for smart visual surveillance cameras is proposed with two major contributions. First, motion detection algorithm is proposed for video object segmentation. Second cellular automata segmentation is proposed for video object tracking. The edges of the image are determined using Sobel and canny method. The Canny edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images. The Sobel operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical direction and is therefore relatively inexpensive in terms of computations. In motion segmentation optical flow measurement is used for tracking object from video. Mathematical Morphology (MM) is a tool for extracting image components that are useful for representation and description. Morphological technique removes unwanted motions in the video and enhances the segmentation result. Morphological opening is used to remove small object and morphological closing is used to fill the holes. Cellular automata is the graphical cut method. It is used to tracking a particular object from video. In this paper focused on improving the accuracy of image segmentation by using optical flow method, hence it improves the segmentation performance.

KEYWORDS: Surveillance, Morphology, Cellular automata., Image Segmentation

1 INTRODUCTION

Object tracking can be defined as the process of segmenting an object of interest from a video scene and keeping track of its motion, orientation, occlusion etc. in order to extract useful information. Object tracking in video processing follows the segmentation step and is more or less equivalent to the 'recognition' step in the image processing. Detection of moving objects in video streams is the first relevant step of information extraction in many computer vision applications, including traffic monitoring, automated remote video surveillance, and people tracking. Video motion detection (VMD) is a way of defining activity in a scene by analysing image data and differences in a series of images. The functionality can either be built-in into a network video product or made available with video management software. In-picture alarm programming allows you to define areas of a screen where you want to detect any visual changes. Object tracking in real time application such as traffic monitoring, surveillance system becomes a critical task. Several methods are implemented for efficient tracking of the moving object. Object tracking can be defined as the process of segmenting an object of interest from a video scene and keeping track of its motion, orientation, occlusion etc., in order to extract useful information. Detection of

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization

Volume 4, Special Issue 11, September 2015

National Conference on Emerging Trends in Computing, Communication & Control Engineering [NCET 2K15]

On 4th September, 2015

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moving objects in video streams is the first relevant step of information extraction in many computer vision applications, including traffic monitoring, automated remote video surveillance, and people tracking.

II. RELATED WORKS

Moving object detection from a video finds important application in many fields. Most previous works on moving object detection are reviewed. In [1], a fast video segmentation algorithm is proposed and it operates on four modes such as baseline mode, baseline mode, shadow cancellation mode, global motion compensation mode and adaptive threshold mode. With change detection and background registration techniques, this algorithm can give satisfying segmentation results with low computation load. Shadow cancellation mode can deal with light changing effect and shadow effect. Baseline mode can operate in still camera situation. Global motion compensation mode can deal with slight camera situation. Adaptive threshold mode can operate well in all the modes.

The main drawback in this paper is switching of modes are done manually. Shadow cancellation cannot deal with strong light source. In paper [2], tracking an object is based on descriptors. It automatically tracks an object by using a compact piece of information about region and objects. In this shadow is tracked as a new object because no shadow cancellation technique is used. In [3], background registration; preprocessing is done by gradient filter. Shadow cancellation cannot deal with strong light source. In paper [2], tracking an object is based on descriptors. It automatically tracks an object by using a compact piece of information about region and objects. In this shadow is tracked as a new object because no shadow cancellation technique is used. In [3], background registration; preprocessing is done by gradient filter. Benefits of gradient filter reduce if shadows appear in strong texture, some information will loss if object has weak edges. In [4], Adaptive filter algorithm is used. Main problem occurs due to background clutter. In [5], Differential earth distance algorithm is used in this large object motions cannot be handled well and occur local minima problem. In [6], color information is used for background subtraction and shadow detection. This method fails to adapt dynamic background situation. In [7]. Segmentation result is inaccurate when the objects are in large motion. In the proposed method two techniques are used such as morphological technique which enhances the segmentation result. Cellular automata based segmentation is proposed to track a particular object from the video.

III. PROPOSED MODELS

The aim of the work is to detect a moving object from a video. In the proposed method object tracking is done efficiently by using cellular automata based segmentation.

Preprocessing: The aim of pre-processing is an improvement of the image data that suppresses unwanted distortions or enhances some image features important for further processing. The preprocessing step includes noise gray scale conversion. Gray scale conversion is used to convert the true color image RGB to the grayscale intensity image. The image processing tool, `rgb2gray` is used to convert RGB images to grayscale by eliminating the hue and saturation information while retaining the luminance. If `I` is an RGB image, it can be of class `uint8`, `uint16`, `single`, or `double`. The output image is the same class as the input image. If `I` is a color map, the input and output color maps are both of class `double`

Noise Removal: Noise removal is the process of removing noise from a signal. Wiener filter method is used for noise removing. The Wiener filter minimizes the mean square error between the estimated random process and the desired process. The goal of the Wiener filter is to filter out noise that has corrupted a signal. The Wiener filter can be used in image processing to remove noise from a picture.

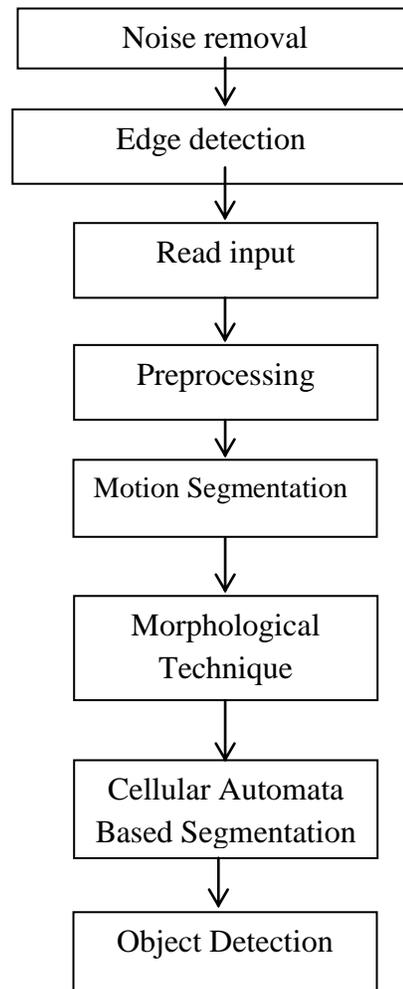


Fig. 1 Block Diagram of proposed model

Wiener filter takes the different approach as the knowledge of the spectral properties of the original image and the noise, also linear time invariant filter whose output would come as close to the original signal as possible. Image processing, one very important task is to remove white noise, all the while maintaining salient edges. Additive white Gaussian noise (AWGN) is the noise type. It is a channel model in which the only the linear addition of white noise with a constant spectral density and a Gaussian distribution. It is a continuous function which approximates the exact binomial function of event. Wiener filter consists of inverse filter and smoothing filter. Inverse filter restores a blurred image perfectly from an output of a noiseless linear system.

Edge Detection: Edge detection is used to improve the image quality and accuracy of the input video frame. Edge detection is the name for a set of mathematical methods which aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. The points at which image brightness changes

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sharply are typically organized into a set of curved line segments termed edges. Edge detection is a fundamental tool in image processing, machine vision and computer vision, particularly in the areas of feature detection and feature extraction. The purpose of detecting sharp changes in image brightness is to capture important events and changes in properties of the world. It can be shown that under rather general assumptions for an image formation model, discontinuities in image brightness, discontinuities in depth, and discontinuities in surface orientation, changes in material properties and Variations in scene illumination. Thus, applying an edge detection algorithm to an image may significantly reduce the amount of data to be processed and may therefore filter out information that may be regarded as less relevant, while preserving the important structural properties of an image. If the edge detection step is successful, the subsequent task of interpreting the information contents in the original image may therefore be substantially simplified. Edges extracted from non-trivial images are often hampered by fragmentation, meaning that the edge curves are not connected, missing edge segments as well as false edges not corresponding to interesting phenomena in the image – thus complicating the subsequent task of interpreting the image data.

Method for segmentation: Motion segmentation is mainly done to obtain motion vectors. In this method optical flow measurement is done to denote the object motion in a video. It is an iterative method and it uses Taylor series expansion. Block matching algorithm is used for accurate motion detection. Segmentation algorithm is to change detection in a video. Moving object region is separated from other part of the scene by the motion information. By using optical flow method, object motion regions are extracted in the first frame, and closed initial contours near the boundaries of object regions are constructed. In the first frame, we apply optical flow to detect motion regions whose boundaries are used as the initial contours. The optical flow for each pixel is represented by (u, v) , where u and v are the optical flow velocity vector components in the x and y directions respectively. For a pixel whose optical flow magnitude is less than a threshold its optical flow is set to $(0, 0)$, it is assigned as background. A rectangle shape is moved over the image and its size is changed to detect the motion region.

Initial Object Mask: Initial Object Mask is created to denote the foreground object. In this a rectangular shape is moved over the object, which specifies the moving object. Due to camera noise and irregular object motion there exists some noise region in the initial object mask.

IV. MORPHOLOGICAL OPERATION

Morphological operation is done to remove noise regions and to filter out smaller regions. This method is used to enhance the segmentation result. In this two operations were performed they are opening and closing. Morphology is a tool for extracting image components that are useful in the representation and description of the region shape, such as boundaries, skeletons etc. This technique is used for both pre and post processing. Opening operation generally smoothes the contour of an object and eliminates thin protrusions. In opening operation extra added pixel is removed. Morphology is formulated in terms of set theory. Sets represent object in an image; for instance, the set of all white pixels in a binary image is a complete morphological description of an image. In binary images, the sets are members of the 2D integer space. Where each element of a set is a 2D vector whose coordinate are the (x, y) coordinates of a white pixel in the image. Erosion shrinks object and is used to remove image components. Closing operation is done to eliminate small holes and filling gaps in the contour. In simple it is done to fill holes in the background region.

The two basic operations in mathematical morphology are erosion and dilation. Both of these operators take two pieces of data as input: an image to be eroded or dilated, and a structuring element. The two pieces of input data are each treated as representing set of coordinates in a way that is slightly different for a binary or gray scale images. Opening and closing are two important operators from mathematical morphology. They are both derived from fundamental operations of erosion dilations. Like those operators they are normally applied to binary images, although there are also gray level versions. The basic effect of an opening is somewhat like erosion in that it tends to remove some of the foreground pixels from the edges

of regions of foreground pixels. However it is less destructive than erosion in general. As with other morphological operators, the exact operation is determined by a structuring element. The effect of the operator is to preserve foreground regions that have a similar shape to this structuring element, or that can completely contain the structuring element, while eliminating all other regions of foreground pixels.

V. CELLULAR AUTOMATA SEGMENTATION

Cellular automata segmentation is the graphical cut method which is used to find the position of the particular object. Initial mask creation is one of the important process in cellular automata segmentation in which the seed point behind the object can be found out first after that the mask is created over the object. Finally, the position of a particular object can be found. The advantage of this method is, tracking a particular object among multiple objects from the video. Cellular automata is the graphical cut method. It is used to tracking a particular object from video. A cellular automaton consists of a regular grid of cells, each in one of a finite number of states, such as on and off (in contrast to a coupled map lattice). The grid can be in any finite number of dimensions. For each cell, a set of cells called its neighborhood is defined relative to the specified cell. An initial state (time $t=0$) is selected by assigning a state for each cell. A new generation is created (advancing t by 1), according to some fixed rule (generally, a mathematical function) that determines the new state of each cell in terms of the current state of the cell and the states of the cells in its neighborhood. Typically, the rule for updating the state of cells is the same for each cell and does not change over time, and is applied to the whole grid simultaneously, though exceptions are known, such as the stochastic cellular automaton and asynchronous cellular automaton.

VI. RESULT AND DISCUSSION

The proposed system is to track a moving object from a video. It operates in multi object moving background situations.



Fig.3 Read The Input Video Frame.

Object tracking find its important application in many such as traffic monitoring, people detection, surveillance system etc. Input Video: Read any surveillance video as input. In proposed system, Read video frames and audio samples from video file by using vision reader. This comment is also used to convert the video into frames. Vision video reader is used for sequentially reading video frames and/or audio samples from a video file.

Gray Scale Conversion: The aim of pre-processing is an improvement of the image data that suppresses unwanted distortions or enhances some image features important for further processing. The preprocessing step includes noise gray scale conversion. Gray scale conversion is used to converts the true color image RGB to the grayscale intensity image. The image processing tool, `rgb2gray` is used to converts RGB images to grayscale by eliminating the hue and saturation information while retaining the luminance. The output of the gray scale conversion is shown below.

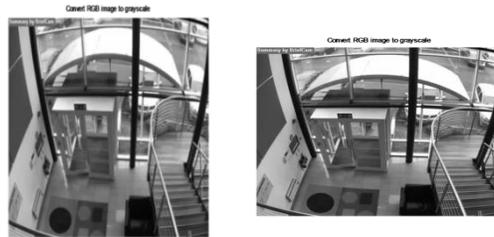


Fig4 Output Of Gray Scale Conversion.

Noise Removal: Noise removal is the process of removing noise from a signal. Wiener filter method is used for noise removing. The Wiener filter minimizes the mean square error between the estimated random process and the desired process. The goal of the Wiener filter is to filter out noise that has corrupted a signal. The Wiener filter can be used in image processing to remove noise from a picture. Wiener filter takes the different approach as the knowledge of the spectral properties of the original image and the noise, also linear time invariant filter whose output would come as close to the original signal as possible. Wiener filter consists of inverse filter and smoothing filter.

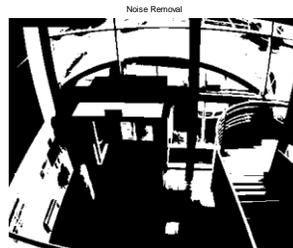


Fig.5 Output Of Noise Removal

Edge Detection: The edges of the image are determined using Sobel and canny method. The Sobel operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical direction and is therefore relatively inexpensive in terms of computations. The Canny edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images. After the grayscale conversion the edges of the image are determined using edge detection method. Output of edge detection method is shown below.

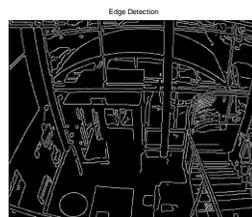


Fig.6 Output Of edge Detection

Optical Flow Measurement: Motion segmentation is mainly done to obtain motion vectors. In this method optical flow measurement is done to denote the object motion in a video. It is an iterative method and it uses Taylor series expansion. Block matching algorithm is used for accurate motion detection. Segmentation algorithm is to change detection in a video.

On 4th September, 2015

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Moving object region is separated from other part of the scene by the motion information. By using optical flow method, object motion regions are extracted in the first frame, and closed initial counters near the boundaries of object regions are constructed. In motion segmentation optical flow measurement is used for tracking object from video. Optical flow is the pattern of apparent motion of objects, surfaces, and edges in a visual scene caused by the relative motion between an observer (an eye or a camera) and the scene. The output of optical flow measurement is shown below

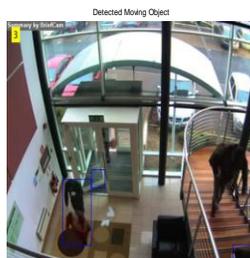


Fig7 Output of Optical Flow

VII. CONCLUSION AND FUTURE WORK

In this project, I have proposed object tracking for video surveillance system. First, the video is read by using matlab function. Afterwards the video is converted into frames using image processing tool box. In preprocessing, the input video frame is converted into grayscale image and the edge detection is applied to the input video frame. Edge detection is used to improve the image quality and accuracy of the input video frame. Optical flow measurement is used for segmentation of video frame. In this paper focused on improving the accuracy of image segmentation by using optical flow method, hence it improves the segmentation performance.

In future, cellular automata segmentation is used to track the position of a particular object in the video. By using this method, we can view a particular moving object's position from a video. After using motion segmentation algorithm(optical flow measurement), mathematical morphology can be applied to remove shadows from the video. It can be used to improve the performance of the cellular automata segmentation. Opening and closing are two important operators from mathematical morphology.They are both derived from fundamental operations of erosion dilations. Opening generally smoothies a contour in an image and eliminating thin protrusions. Closing tends to narrow smooth sections of contours, fusing narrow breaks and long thing gulfs, eliminating small holes and filling gaps and contours. Cellular automata segmentation is the graphical cut method which is used to find the position of the particular object. Initial mask creation is one of the important process in cellular automata segmentation in which the seed point behind the object can be found out first after that the mask is created over the object. Finally, the position of a particular object can be found. The advantage of this method is, tracking a particular object among multiple objects from the video.

REFERENCES

- [1] S.-Y.Chien, Y.-W.Huang, B.-Y.Hsieh, S.-Y.Ma and L.-G.Chen., "Fast video segmentation algorithm with shadow cancellation, global motion compensation, and adaptive threshold techniques", IEEE Trans Multimedia, vol.6, no.1, pp.732-748, Oct.2004.
- [2] A. Cavallaro, O.Steiger, and T. Ebrahimi., "Tracking video objects in cluttered background", IEEE Trans. Circuits Syst. Video Technol, vol. 15, no. 4,pp. 732-748,Oct. 2004.
- [3] S-Y chien, S-Y Ma, and L-G Chen., "Efficient moving object detection algorithm using background registration technique", IEEE Trans. Circuit syst. Video Technol,vol. 12, no. 7, pp. 577-586, Jul. 2002.
- [4] E. Maggio, F. Smerladi, and A. Cavallaro, "Adaptive multifeature tracking in a particle filtering framework", IEEE Trans.Circuit syst. Video Technol,vol. 17, no.10, pp. 1348-1359, Oct. 2007.

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization

Volume 4, Special Issue 11, September 2015

National Conference on Emerging Trends in Computing, Communication & Control Engineering [NCET 2K15]

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- [5] Q. Zhao, Z. Yang, and H. Tao., "Differential earth mover's distance with its applications to visual tracking", IEEE Trans. Pattern Anal. Mach. Intell, vol.32, no.2, pp.274-287, Feb 2010.
- [6] R. Cucchiara, C. Grana, M. Pioccardi, and A. Prati., "Detecting moving objects, ghosts, and shadows in video streams", IEEE Trans. Patter Anal. Machine Intell, vol. 25, no. 10, pp. 1337-1342, Oct. 2003.
- [7] D. Comaniciu, V. Ramesh, and P. Meer., "Kernel based object tracking", IEEE Trans. Patter Anal. Machine Intell, vol. 25, no. 5, pp. 564-577, May 2003.
- [8] P. Kumar, S. Ranganath, K. Sengupta, and W. Huang, "Cooperative multi-target tracking with efficient split and merge handling", IEEE Trans. Circuit Syst. Video Technol., vol. 16, no. 12, pp. 1477-1490, Dec 2003.