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RESEARCH ARTICLE

Video Object Segmentation Applying Spectral Analysis and Background Subtraction Using Watershed

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Abstract: This paper proposes an video object segmentation in semi automatically. This study is to contains lack of semantic information of video object segmentation. An initial spatial partition of each frame is obtained by a fast, on the surface to implementation of the watershed technique. Manual & video segmentation is not effective by human of large size. It is used to scribbled based method, these method between the foreground & Background. The present and following frame uses performed by applying background subtraction algorithm. The video segmentation we use the spectral analysis and background subtraction is very effective. This section is measured by mean square error .The catchment basins are well known in watershed. It is divided single basins. Video data may be interpreted is a topographic surface where the gradient image gray levels represents attitudes. The catchment basins is then defined as the set of pixels for which defined their respective down stream paths all end up in the same attitude minimum the experiment results demonstrate the high precision of video object segmentation.

Keywords: Segmentation, Alpha Matting, Background Subtraction, watershed

1. INTRODUCTION

The demand of video editing applications (such as video segmentation and video compositing) increases rapidly due to the advent of digital video standards such as Digital Television (DTV) in America, Digital Video Broadcasting – Terrestrial (DVB-T) in Europe and Integrated Services Digital Broadcasting-Terrestrial (ISDB-T) in Japan. It occurs since the video object segmentation in editing applications play an important role in the operation of movie production, news and advertising. Various applications such as object extraction, image recognition, augmented reality and motion understanding can be performed with the object-based technology. The fundamental issue in video object segmentation is an ill-posed problem, namely the video object with no semantic information [1].Therefore, the semantic information of the video object can only be identified by the human eyes by considering the video context so that the objects' withdrawal process in video editing is performed by manual segmentation. However, it is not an effective way to handle a video that has a large size. Many algorithms associated to the video object segmentation are developed to overcome this problem. The algorithms are classified into two categories, they are automatic object segmentation [2] and semi-automatic object segmentation [3] [4]. The parameters in the automatic segmentation are the specific characteristics such as color, texture and movement which are performed without human intervention. The difficulty in semantic relevant object separation is the main problem of the automatic segmentation. So there is no guarantee that the results of the automatic segmentation will be satisfactory, because the semantic object has a lot of color, texture and movement [5] [6] [7]. Several semi-automatic segmentation method which is a combination of manual and automated methods is proposed for that reason. Which in essence, the approach is a technique to withdraw the object involving human intervention on multiple frames in the segmentation process. Since semantic information can be directly made by human's assistance, the object segmentation process in the subsequent frames is performed using a tracking mechanism with temporal transformation. In previous study, several methods related to tracking mechanism had been developed. In a region-based method, parameters of movement, texture and color were applied to keep track to the object semantics. However, this method has a very complex tracking mechanism in maintaining the relationship between the areas consist of semantic objects [8]. The contour-based methods such as snake [3] would be robust when it was applied to the track on object contours, but it did not represent the whole of the object pixels, so this method might not work properly to follow the feature and the impact between edges were not connected to each other. While the model-based method applied a priori knowledge of the object shape. The shortcoming of this approach was not acceptable on the generic semantic video object segmentation since the detail required information about the object geometry [9]. Keyframe was created from one of the frames selected and considered as a still image. Matting techniques were applied to pull object of this frame.

2. Related Work

To distinguish the foreground and background object, interactive matting was applied using a scribble technique as an interface [10]. Hereinafter, the object segmentation on the subsequent frames was performed by using the background subtraction algorithm. the Watershed descriptor and provides an improvement of using with Watershed descriptor in describing a boundary. We define a variable R to represent the ratio of the number of original terms K to the number of compressed terms P in Watershed. Note that $R = P/K$. The Watershed description is a method to descript boundary by using WATERSHED to the Video as x-axis becomes real part and y-axis becomes imaginary part. We assume that there are several boundary of point, $(x_0, y_0), (x_1, y_1), ..., (x_{k-1}, y_{k-1})$. These coordinates can be expressed in the form $s(k) = [x(k), y(k)]$, k=0,1,2,…,K-1.

2.1. KEYFRAME DESIGN

The initial step of a video segmentation process was performed by designing the selected frame of the sequences scene which became a keyframe. Since the object had no semantic information, human assistance was required to give scribble as a label to distinguish regions representing foreground and background object (white for foreground and black for background).A. General Compositing Equation Alpha channel [10][11][12] was applied to control the linear interpolation in the foreground and background which were depicted in matting algorithm by assuming that each pixel in the input image Ii was a linear color combination of foreground Fi and background Bi.

$$I_i=\alpha_i F_i + (1-\alpha_i) B_i, \quad (1)$$

where $0 \leq \alpha \leq 1$

Based on compositing equation Eq. (1) of each pixel, it was assumed to be a convex combination of layers K image denoted as

$$I_i=\sum^{k}_{k=1}\alpha_i^k f_i^k \quad (2)$$

each pixel was determined by the vector K of α, a component of image matting.

2.2. Spectral Analysis

Spectral segmentation method was associated with the affinity matrix. For example, the image A, size N x N was assumed as

$$A_{(i,j)} = e^{-d_{ij}/\sigma 2}$$

and$_{ij}$ .In which $d_{ij}$was the space among pixels (e.g. color and geodesic space), defined as

$$L = D – A \ (3)$$

While D was matrix degree from graph.

$$G = (V, E) \text{ with } V = n \ (4)$$

with diagonal matrix D for G as rectangular matrix size n x n . So L was a symmetric positive semi-definite matrix with eigenvector which was able to capture a lot of image structure. Furthermore, the image was the composition of some different clusters or connected components which was captured by affinity matrix A . Subset C in image pixel was the connected component of image
Spectrum analysis in terms of a spectrum of frequence or related quantities such as energier eignvalues,etc., In specific arrear it may refer to spectroscopy in chemistry.

2.3.Matting Laplacian
In order to evaluate the quality matte without considering colors of foreground and background, Matting Laplacian was applied by using a local window w forming two different pathways in the RGB domain as denoted in Eq. Furthermore, α in w is expressed as a linear combination of color channels.

2.4. Linear Transformation:
The linear transformations track in eigenvector would produce a set of vector in which the value was adjacent to a binary. The equation denoted as $E=[e^1,...,e^k]$ is was converted to matrix N x K of eigenvector. Next, to locate a set of linear combination K, vector Y^k minimized

$$\sum_{i,k} |\alpha_i^k|^{\gamma} + |1-\alpha^k_i|^{\gamma} \quad \text{where} \quad \alpha^k = Ey^k$$

2.4.Grouping Component:
The complete results of matte extraction of the foreground object were determined by a simple summation on the foreground. For example,$\alpha^k_1,....,\alpha^k_n$ is designed as a component of the foreground, so that

$$\alpha=\alpha^k_1+.....+\alpha^k_n$$

the binner vector of K-dimensional indicating the chosen component.

3. Our Contribution

3.1.Background Subtraction
Background subtraction [18] was applied to identify differences in the intensity of the current image with the background. Frame difference was the technique applied in the background subtraction which was a non-recursive techniques. This model was assumed as !", a binner value of foreground image.

$$BF(x,y,n)=\{^{1,\text{if} |I(x,y,n)-I(x,y,n)-1| \geq \alpha}_{0,\text{otherewise}}$$

The threshold α was applied to classify the foreground and background. Here, Otsu algorithm was applied to generate the threshold value. Background subtraction, also known as Foreground Detection, is a technique in the fields of image processing and computer vision wherein an image's foreground is extracted for further processing (object recognition etc.). Generally an image's regions of interest are objects (humans, cars, text etc.) in its foreground. The purpose of our work is to obtain a real-time system which works well in indoor workspace kind of environment and is independent of camera placements, reflection, illumination, shadows, opening of doors and other similar scenarios which lead to errors in foreground extraction. The system should be robust to whatever it is presented with in its field of vision and should be able to cope with all the factors contributing to erroneous results.
Background subtraction is a class of techniques for segmenting out objects of interest in a scene for applications such as surveillance. There are many challenges in developing a good background subtraction algorithm. First, it must be robust against changes in illumination. Second, it should avoid detecting non-stationary background objects and shadows cast by moving objects

3.2.Thresholding

3.2.1.Basic Global Thresholding

As the fact that we need only the histogram of the Video to segment it, segmenting Videos with Threshold Technique does not involve the spatial information of the Videos. Therefore, some problem may be caused by noise, blurred edges, or outlier in the Video. That is why we say this method is the simplest concept to segment Videos. When the intensity distributions of objects and background pixels are sufficiently distinct, it is possible to use a single(global) threshold applicable over the entire Video.

3.2.2. Otsu Threshold

Thresholding may be viewed as a statistical-decision theory problem whose objective is to minimize the average error incurred in assigning pixels to two or more groups. Optimal threshold was obtained from intensity differences of the pixels, so that it could be applied for separating groups. The information obtained from the histogram was the amount of the intensity difference (denoted by L).

3.2.3.Video partitioning

One of the simplest approaches to variable threshold is to subdivide an Video into nonoverlapping rectangles. This approach is used to compensate for non-uniformities in illumination and/or reflection. Video subdivision generally works well when the objects of interest and the background occupy regions of reasonably comparable size. When this is not the case, the method typically fail.

4. Watershed Technique

Watershed is the area of land where all of the water that is index it or a order drains off of it goes into the same place. image processing a watershed of a gray scale image based on catchment basins of heightmaps.
The watershed transform is a broadly used technique for image segmentation. The watershed transform can be classified as a region-based segmentation approach. The intuitive idea underlying this method comes from geography: it is that of a landscape or topographic relief which is flooded by water, watersheds being the divide lines of the domains of attraction of rain falling over the region. the watershed is applied to the image gradient and the watershed lines separate homogeneous regions, giving the desired segmentation result. The gradient image for the transform is often found using the morphological gradient. The watershed transform [7] is a morphological based tool for image segmentation. In grey scale the mathematical morphology watershed transform for segmentation is originally proposed by Digabel and Lantuejoul in1977 and later improved by Li et Al in 2003.

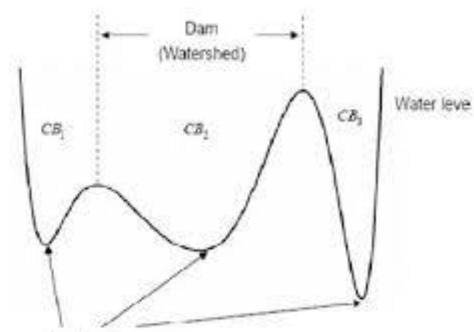


Fig. 1 Illustration of immersion process of watershed transforms. (CB: Catchment basins)

The watershed transform can be classified as a region-based segmentation approach. Fig. 1 Illustration of immersion process of watershed transforms. (CB: Catchment basins).The idea [8] of watershed can be view as a landscape immersed in a lake; catchment basins will be filled up with water

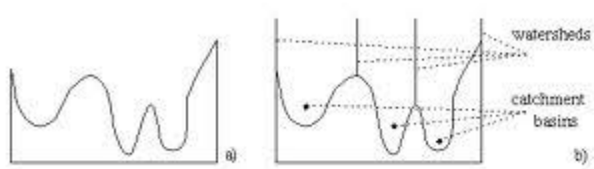


Figure 5.47 *One-dimensional example of watershed segmentation. (a) Gray level profile of image data. (b) Watershed segmentation – local minima of gray level (altitude) yield catchment basins, local maxima define the watershed lines.*

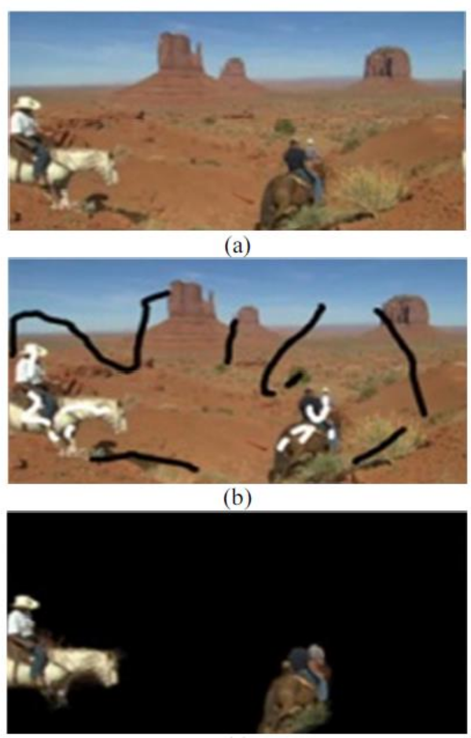
Separating touching objects in an image is one of the more difficult image processing operations. The watershed transform is often applied to this problem. The watershed transform finds "catchment basins" and "watershed ridge lines" in an image by treating it as a surface where light pixels are high and dark pixels are low. Segmentation using the watershed transform works better if you can identify, or "mark," foreground objects and background locations. Marker-controlled watershed segmentation [10] follows this basic procedure:

1. Compute a segmentation function. This is an image whose dark regions are the objects you are trying to segment.
2. Compute foreground markers. These are connected blobs of pixels within each of the objects.
3. Compute background markers. These are pixels that are not part of any object.
4. Modify the segmentation function so that it only has minima at the foreground and background marker locations.
5. Compute the watershed transform of the modified segmentation function.

5. Experimental Result

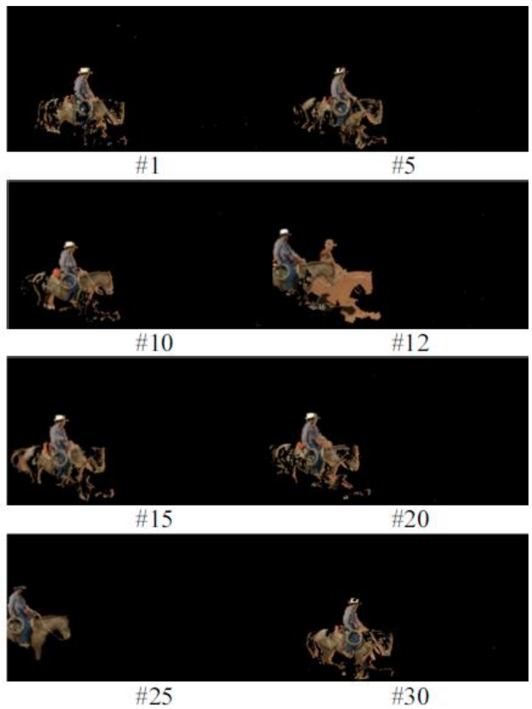
The process of object segmentation process for video data was performed in the steps.

The selection frames of video sequences was considered as a still image treated as a keyframe. In order to create a keyframe, a new approach to the closed-form solution [10] with scribble-based technique was applied. After the separation object from the background, the subtraction operation between the current and subsequent frame was performed by applying a background subtraction algorithm. The value of difference subtraction process was used as a label for the object separation process in subsequent frames. This operation is performed repeatedly until the end frame of the video sequences. we evaluated our proposed algorithms using standard test video sequences obtained from the UCF Sports Action Data Set (i.e.riding horse, lifting, skateboarding and foreman),30 frames respectively. Initial stages, the first frame of the video sequence was considered as a still image (shown in Fig.1 (a)). In our experiments, the selected frame considered as a keyframe was a frame which had intact object of the entire video sequence. Semi-automatic technique was performed by giving scribble (as a label) to distinguish areasof foreground and background (illustrated in Fig.1(b)). Scribble image used background brush (blackscribble in our examples) to show the background pixels (α = 0) and foreground brush (white scribble)to show foreground pixels (α = 1). In order to separate the foreground object from the whole image, a matting technique [10][12] was applied as depicted in (Fig. 2(c)).



(a) (b) (c)

Furthermore, to extract object on the subsequent frames, we applied background subtraction technique Eq. (16) to obtain difference binary value between current and previous frame. Binary value of 1 was assumed as label for foreground and 0 for the background. Later on, the value is then used to replace the role of scribble and used in the process of matting in subsequent frames. The example of segmentation results of the video data is shown in Fig. 5. To measure the accuracy of object segmentation, we evaluated using the Mean Square Error(MSE).



6. CONCLUSION

In this paper used a video object segmentation used by spectral analysis and background subtraction .we proposed by a watershed technique and algorithms to segment the object. From our experiments on the 4 video datas,35framesforeach, the “lifting” video datas called for that segmentation accuracy of the tracking was the most stable, since it consists of most sensitive target motion. While the "foreman" video data, segmentation to the increase the quality level of the tracking seemed rough on some frames, because there were objects that moved faster and all of a sudden. In future work to improve the accuracy and intensity of the results in video image.

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