Real-time Foreground Segmentation and Boundary Matting for Live Videos using SVM technique

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ABSTRACT

Segmentation is nothing but to simplify and change the representation of video into something that is more meaningful and easier to analyze. Foreground segmentation is nothing but the extraction of desired foreground object from input videos. Large amount of efforts are taken on this topic but there is still lack of significant algorithm that work on live videos of object with fuzzy boundaries captured by movable camera. This paper presents an algorithm that can work in real-time for freely moving cameras. In this we use two competing one class support vector machine at each pixel location they can work according to local color distribution for both foreground and background. By using this machine learning method and addressing foreground seg mentation and boundary matting in integrated manner this algorithm gives complete extraction of foreground object at processing a wide range of videos with complex background from freely moving cameras in real-time. In this also calculate the real-time processing speed in the form of frames per seconds as well as graph frames.

Keyword : -*Segmentation, Foreground segmentation, Video matting, C-1SVM, Graph frames.*

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1. INTRODUCTION

Video segmentation is the process of partitioning the video into multiple segments (Set of pixels also known as subpixels). The motive of segmentation is to simplify and change the representation of video into something that is more meaningful and easier to analyze. Segmentation is more used to locate the object & boundaries. Se gmentation is the process of assigning a label to every pixel such that pixel with the same label share the same characteristics.

Segmentation techniques are as follow:

1. Foreground Segmentation

2. Background Segmentation

1.1. Foreground Segmentation:

Foreground segmentation as video clips cutout, reports how to draw out objects of interest from input video clips. It is a fundamental problem in computer vision and sometimes provides as a pre-processing action with regard to additional video examination chores such as surveillance, video teleconferencing, action identification and retrieval. Foreground segmentation is the extraction of the object which is at minimum distance from user or the object which is at the front. There are two approaches for foreground segmentation such as Unsupervised and supervised approach. In unsupervised approach attempt to build background automatically and detects outliers of the model as foreground while supervised method allows user to provide training example for both foreground and background and then use them to learn classifiers. So this paper comes under supervised learning method.

1.2. Video Matting:
Upto there are multiple algorithm for foreground segmentation and background segmentation but no one gives complete extraction of foreground object. Video matting is the technique used to extract fuzzy boundaries along foreground objects. It can be happen using batch processing and online processing approach. In batch learning process is the learning method in which data becomes available in batches while in online learning data becomes available in sequential order and each step is used as data for previous. In the matting uses online learning method. Using this matting complete extraction of foreground object takesplace. This provides soft extraction while others requires extra action to like lustrous trimaps. Colors of background for each frame, prolonged computational time or process in batch manner.
Most existing algorithms are generally computationally too strenuous to be controlled in real-time. While some techniques are insufficient to sequence seized by standing video cameras, while some requires sufficient number of training cases or requires large amount of user interaction. So there is still lack of well-organized and powerful algorithm capable of processing challenging real time video scenes with minimum user interactions. Here present a novel integrated foreground segmentation and boundary matting for live videos in real-time, this can be an extension to previous work[9]. In this SVM technique is used for both foreground and background for local color distribution. SVM is nothing but Support vector machine is the supervised learning models with associated learning algorithms that analyze data and recognize patterns, used for classification of pixels and analysis through the regression. In this uses C-1SVM instead of binary SVM because comparison among a binary SVM and C-1SVMs under two situations. White colored circle region and black dots signify the foreground and background training set respectively, although reddish dot denotes a invisible case in point. The straight line indicates the decision boundary of the binary SVM, whereas the ellipsoids demonstrates the boundaries of the two C-1SVMs. Where binary SVM characterize the test example as foreground, whereas C- 1SVMs marks it as obscure, following neither of the 1SVMs acknowledges it as inliers. Binary SVM can not confidently classify the test example since it is too close to the decision boundary but C-1SVM is label it as background with confidence so only background 1SVM accepts it as inlier.

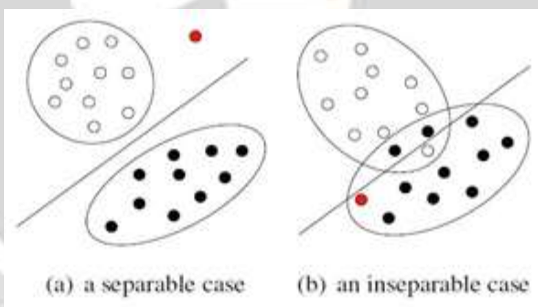

Fig: Comparison of Binary SVM with C-1SVM

Vector Machines (1SVMs) capture the native foreground and background color densities severally, however make sure the correct label for the pixel together. By iterating between coaching native C-1SVMs and applying them to label the pixels, the algorithmic program effectively propagates initial user labeling to the whole image, still on consecutive frames through a simple train-relabel matting procedure. Then provides integrated foreground segmentation and boundary matting for live videos. To scale back the computational cost several techniques are proposed. Also by exploiting the parallel structure of the proposed algorithm real-time processing speed calculated.

2. LITERATURE SERVEY

A. Foreground segmentation:
Previous work on foreground segmentation can be categorized into Unsupervised and supervised approach. In unsupervised learning no datasets are provided, instead the data is clustered into different classes. since there is no

desired output in this case that is provided therefore categorization is done so that the algorithm differentiates correctly . While in supervised learning, the output datasets are provided which are used to train the machine and get the desired

L Cheng and M. Gong, In Real-time Background Subtraction from Dynamic Scenes[2] The projected approach is meant to figure with the extremely parallel graphics processors (GPUs) to facilitate real-time analysis. In this the input videos are captured by stationary cameras and model background color at each pixel location using non-parametric method. Unsupervised segmentation takesplace does not handle changing camera motion.

L. Cheng, M. Gong, D. Schuurmans, and T.Caelli, Real-time discriminative background subtraction,[3] This provides the problem of background subtraction and novelty detection. In this uses a class of online discriminative algorithm i.e. ILK using kernels to specifically address the problem. But in this no complete extraction. Some amount of noise at the output.

A. Criminisi, G. Cross, A. Blake, and V. Kolmogorov, Bilayer segmentation of live video,"[5] Its the supervised learning methodology. This presents an algorithm capable of real-time detachment of foreground from background in monocular video sequences. Layer segmentation from images or sequences can be takes place in this. Bilayer segmentation of live videos utilized in video conferencing. It is not used for real-time tracking files.

V. Kolmogorov, A. Criminisi, A. Blake, G. Cross, and C. Rother, Bi-layer segmentation of binocular stereo video[11] This paper has addressed the important problem of segmenting stereo sequences. Disparity-based segmentation and color-based segmentation alone are prone to failure. LDP and LGC are algorithms capable of fusing the two kinds of information with a substantial consequent improvement in segmentation accuracy.

Y. Sheikh, O. Javed, and T. Kanade, Background subtraction for freely moving cameras, [16] These algorithm assumes a stationary cameras, and identify moving objects by detecting areas in the videos that change over time.

B. Video matting:

Video matting is nothing but the extraction of complete foreground object. An online system handles transactions when the occur and provides output directly to users. Because it is interactive, online processing avoids delays and allows a constant dialog between the user and the system. While batch processing Data is processed in groups or batches. Batch processing is typically used for large amounts of data that must be processed on a routine schedule, such as paychecks or credit card transactions.

Y. Chuang, B. Curless, D. H. Salesin, and R. Szeliski, A Bayesian approach to digital matting, [4] This paper developed a Bayesian approach to solving several image matting approach. But using Bayesian approach does not get complete alpha matte, so due to this plan to augment this work to video matting with dedicated boundaries.

J. Wang and M. F. Cohen, An iterative optimization approach for unified image segmentation and matting,[17] Separating a foreground object from the background in a static image involves determining both full and partial pixel coverages, also known as extracting a matte.

3. PROPOSED SYSTEM

In our previous system there are some disadvantages such as handling novel foreground color, handling row resolution images, handling illumination changes to overcome this disadvantages this proposed system. Real-time foreground segmentation and boundary matting for live videos using SVM gives the complete extraction of foreground objects. Real-time is a term often used to distinguish, reporting depicting or reacting to the events at the same time as they unfold, rather than compressing a depiction or delaying a report or action. In this the foreground subtraction and boundary matting takesplace in real-time. The core of this approach is train-relabel-matting procedure. For this purpose uses SVM technique. Support vector machine is the supervised learning models with associated learning algorithm that analyze data and recognize pattern, used for classification and regression analysis.

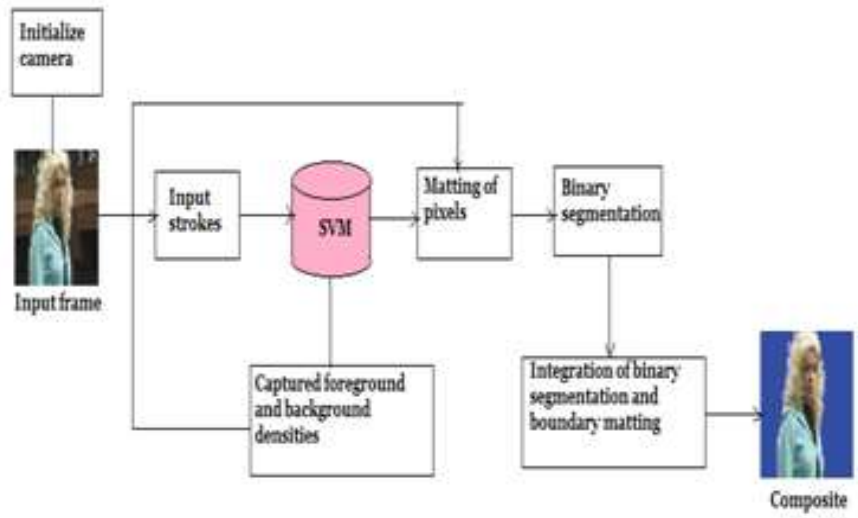

Fig: System Architecture

The System can be divided into:

A. **Train local C-1SVMs at every pixel area**

After initializing camera it starts to take a video. On the first frame some strokes are given by user. The strokes are given such that it covers maximum area for foreground and background. Utilizing this strokes labeling information can takesplace across the image. Then two competing 1SVMs Fp for foreground and Bp for background are trained locally for each pixel p according to the labeling information.

B. Relable each pixel using learned C- 1SVM

Once Fp and Bp are trained, then they are used jointly to classify the pixel. Going to check the pixels that it is of foreground or background if the pixel is of background it becomes black and if the pixel is of foreground it becomes white like this gives the relabeling to the pixel. The pixels can be divided into foreground, background and unknown. The pixels which are not on foreground as well as backgroundare given the labeling of unknown.

C. Perform matting along foreground boundary

Both movement obscure and fuzzy foreground object such as hair strands might bring about pixels near a foreground boundary having mixture of foreground and background colors. In the current methods do not perform matting to resolve mixed pixels at object boundaries into their foreground and background components. In this the complete alpha matte takesplace. In this the pixel which are unknown are comparing with there neighboring pixels. If the neighboring pixel is foreground then the pixel is foreground pixel and if the neighboring pixel is of background then the unknown pixel is act as background and the pixels which are neither of foreground as well as background is the pixel of boundary. Once the tangling pixels are determined, a nonlinear conjugate gradient technique is applied to these pixels in parallel and ascertains alpha matte.

$$I = \propto F + (1 - \propto) B$$

Where $\propto \in [0,1]$ is the alpha matte F and B are the real foreground and the background colors for the pixel.

D. Apply global optimization

There could be pixels within the frame with colors that are not seem to be recognized by either foreground and background 1SVMs attribute to users provide foreground and background examples victimization solely few strokes. As well as situation occurs where foreground and background color arise up in the frame due to motion. These pixels are named as obscure after train-relabel-tangling process. So our undertaking is to offer marking to these So our undertaking is to offer marking to these pixels, so for this reason clean binary segmentation can be generated. Binary segmentation is the technique used for noise suppression, runlength encoding, component labeling, contour extraction, filtering, feature extraction. Here compute binary segmentation using graph cut method through Markov random field. Using binary segmentation and boundary matting gives the composite frame.

E. Deals with incoming frames

If there are some changes in first frame then next frame is taken as input next the updated *F* and *B* to mark the new frame *t+1*. At that point utilizing C-1SVMs prepared from the past frame. Then integrated foreground segmentation and matting takes place for *L(t+1)*. Like this the output is taken as in the sequential form in the real-time.

4. ALGORITHMS

1. Initialize camera
2. Start to take video
3. Take initial frame of video with few strokes from use
4. Train C-1SVMs using frame and I^t label L^t .
5. Estimate foreground and background colors *F* and *B*
6. Relable input frame I^t using *F* and *B* and update L^t
7. Update the matting pixel set *M*.
8. Estimate $\propto^t, F^t, B^t$ for $p \in M$
9. Until there are no more changes in L^t
10. Find optimal binary segmentation G^t using graph cuts.
11. Combining the binary segmentation with boundary matting gives a blue screen composite.

5. Results

The main motive of my paper is foreground segmentation and boundary matting in real-time videos. In this paper we also worked on uploaded videos.

Fig: Before Segmentation

Fig: After Foreground segmentation

Also calculate the processing speed per frame in our previous system processing speed is 14 frames/sec for matting while in proposed system the processing speed is 30 frames/sec. In this we also proposed graph frame method for calculating processing speed.

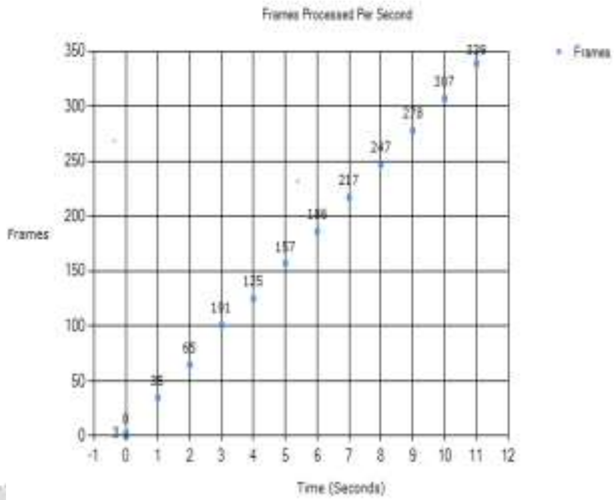

Fig: Frames Processed Per Second

6. CONCLUSION

In previous system it is difficult to work in real-time for foreground segmentation and boundary matting. The number of this conjointly needs long computational time or process all frames in batch manner, therefore it's hard to be applied in real-time video processing. In this system doing foreground segmentation and boundary matting in real-time with only few strokes. It provides comparable and superior performance. It also calculate real-time processing speed. In our this system we also minimizes the disadvantages of previous system like handling low resolution, Handling illumination changes. In future work as we gives the strokes it provides matting.

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