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VIDEO SEGMENTATION USING FUZZY C-MEANS CLUSTERING ALGORITHM

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Abstract: In digital media processing, pattern recognition, and computer vision, segmentation plays a significant role. In many application areas, the challenge of video segmentation occurs, such as video-on-demand, digital video archives, distance education, geographical information systems, etc. Segmentation is based on a method of increasing the basic region and uses pixel membership grades to classify pixels into approximate segmented pixels. The key challenge involved in retrieving and storing video data is the motion capture and clustering of video segmentation. In this work, Fuzzy c-means clustering approach is implemented for a video segmentation. A framework for characterizing scene transitions by soft decisions is given by the fuzzy theoretical scheme. Since the membership functions correctly split the data space. The proposed approach providing high precision with a low error rate.

Index Terms - Video segmentation , clustering and Fuzzy C Means

I. INTRODUCTION

Video is the most difficult among various forms of media, e.g. text, graphics, images, audio, and video because its content is rich and requires broad storage space. However, digital video is becoming available at an ever growing pace due to the declining cost of storage devices, evolving encoding techniques, and the advent of high-speed networking [1]. The quality and efficacy of querying video databases is one of the main research topics on video [2]. Video segmentation is a crucial move towards organized video representation, which facilitates visual data interpretability and manipulability [3]. A video stream is a temporary medium where changes in content occur due to motion, cuts, and special effects of the camera or object. Temporary video segmentation refers to splitting the input video into temporal segments of uniform content, which is the first step in content-based video analysis [4].

The goal here is to segment the video sequence into shots in which each shot is a sequence of frames of the same content. Once shots are detected, for indexing, main frames are extracted from each shot [5]. Video segmentation techniques have to accurately identify shot changes in order to find the correct number of shots and choose the best set of main frames from each shot. There are two styles, abrupt and gradual, of shot alterations. It is normally easy to detect a brief shot shift resulting from editing cuts. It is usually difficult to detect gradual shot changes resulting from chromatic edits, spatial edits, and mixed edits [6].

Clustering is characterized as the classification of similar objects into different groups or, more specifically, the division of a data set into subsets (clusters), so that the data share some common trait in each subset, often proximity according to some defined measure of distance. Many clustering schemes, such as the hard clustering scheme and the soft (fuzzy) clustering scheme, are classified based on their unique characteristics. In general, clustering techniques are used to arrange data according to pre-assigned parameters and categorize it. The most noticeable algorithms for clustering is Fuzzy C-Means clustering.

The structure of the paper is organized as follows: Section 2 discusses about concept of video segmentation. Section 3 elaborates the Fuzzy C-Means algorithm in detail. The experimental results of the proposed approach are presented in section 3 . Finally, the conclusion are given in section4

II. VIDEO SEGMENTATION

Video segmentation is an ongoing trend of existing applications worldwide. For object recognition, occlusion boundary estimation inside motion, or stereo method, a segmentation technique could be used. Researchers have recently implemented the Fuzzy C-means (FCM) algorithm to improve video segmentation efficiency.

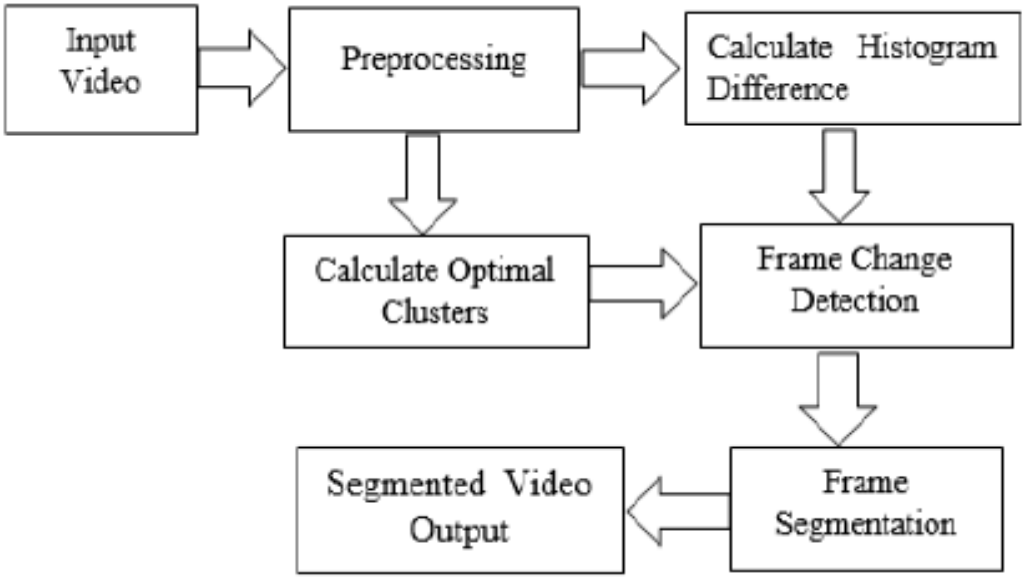


Figure 1:Block diagram of video segmentation.

First of all, on input video, preprocessing has been completed. It is then possible to transform frames into colored images. We measure the optimum clusters of each frame and also calculate the difference in the histogram. If optimal clusters of two consecutive frames differ, then segmentation is applied directly to both frames, otherwise the histogram difference is checked. If the difference in the histogram is less than a threshold, then we skip the frame.

III FUZZY C-MEANS ALGORITHM

In Fuzzy C-Mean, the data has to be processed by giving each pixel in the image a partial membership value. The membership value of the fuzzy set is in the 0 to 1. range. Basically, in fuzzy clustering, a member of one fuzzy set in the same picture may also be a member of other fuzzy sets. For an overlapping area and data point that belongs to one or more clusters, FCM provides better performance.

Step (1): Compute the cluster prototypes (means):

$$V_i^{(j)} = \frac{\sum_{k=1}^{N} (\mu_{ik}^{(j-1)})^m Z_k}{\sum_{k=1}^{N} (\mu_{ik}^{(j-1)})^m}, \quad 1 \le i \le c \tag{1}$$

Step (2): Compute the distances:

$$D_{ikA}^2 = (Z_k - V_i^{(j)})^T A (Z_k - V_i^{(j)}), \quad 1 \le i \le c, \ 1 \le k \le N \tag{2}$$

Step (3): Update the partition matrix:

$$\mu_{ik}^{(j)} = \frac{1}{\sum_{n=1}^{c} (D_{ikA}/D_{nkA})^{2/(m-1)}}$$

If $D_{ikA} > 0$ for $1 \le i \le c, 1 \le k \le N$ (3)

Otherwise

$$\mu_{ik}^{(j)} = 0 \text{ if } D_{ikA} > 0, \text{ and } \mu_{ik}^{(j)} \in [0,1] \text{ with } \sum_{i=1}^{c} \mu_{ik}^{(j)} = 1 \quad (4)$$

Until,

$$\| U^{(j)} - U^{(j-1)} \| < \varepsilon. \quad (5)$$

Stop; else return to step 2.

IV SEGMENTATION PROCESS

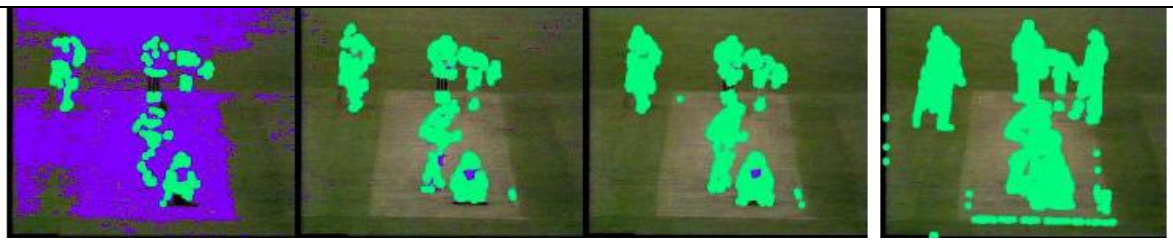
Step 1:Zoning the shots(grouping of similar shots)
Step 2: FCM based object identification and extraction
Step 3: Track frame sequence assortment
Step 4: Frame difference algorithm for foreground segmentation
Step 5: Foreground segmentation using frame intersectional algorithm
Step 6: Hybridization of segmented results

Shot zoning is one of the video decomposition techniques which aim to partition a video sequence into shots . In this shot segmentation similar shots are grouped together for improving the performance of the segmentation. After performing shot segmentation, the track frames of the every shot are identified using the objects of their key frame. This track frame selection process reduces the computational time of segmentation. The Extraction of all the individual objects from the frame is the most critical issue in the video segmentation. The proposed video segmentation technique concentrates more on extraction of objects from each frame.

The motion segmentation process is carried out by both the frame difference algorithm and intersection method subsequently the most common and accurate segmented objects are retrieved from both the segmented results whereas the static foreground are segmented using the intersection of consecutive frames. To segment the static and dynamic objects in the environment of abrupt and gradual changes, the object detection is a crucial process. The proposed segmentation technique uses fuzzy c means algorithm for detect the objects in every frame. The frame difference algorithm provides the only the difference between the current frame and the key frame while the frame intersection method provides the difference between consecutive frames. The motion analysis and segmentation of dynamic objects is performed by intersection process of track frames.

V RESULTS AND DISCUSSION

By playing with a range of video sequences, our proposed video segmentation method has been validated. In Matlab, the proposed framework has been implemented (Matlab7.10). The output of the proposed method is presented below

Sample Frames	
Extracted Object Using FCM	
Segmented Object Using FCM	

VI CONCLUSION

Some methodology can be developed to evaluate the segmentation techniques on the statistical basis, so that quantifiable results can be obtained. In this paper, a Fuzzy C-Means clustering technique was implemented for video segmentation. FCM algorithm select frames with high membership degree as a key frame. FCM segmentation algorithm considerably improves accuracy with low error rate when compared with that of other segmentation techniques.

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