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Research Article

Fuzzy Clustering Algorithms in Combination with Other Segmentation Methods for Videos

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Abstract: Segmentation has crucial applications in computer vision, pattern recognition, and the processing of digital information. Video segmentation is a problem that crops up in lots of different contexts, such VOD, DVR, e-learning, GIS, and other similar systems. Pixels are roughly separated using a membership grading system that relies on a way of expanding the basic area. Motion capture and clustering of video segmentation is a major hurdle to overcome when obtaining and storing video data. Fuzzy c-means clustering is used here to divide up a movie into its constituent parts. Fuzzy theory provides a framework for describing scene changes based on fuzzy judgements. Because the data space is partitioned appropriately by the membership functions. The suggested method achieves a high degree of accuracy at a low rate of error.

Index Terms - Video segmentation, clustering and Fuzzy C Means

Introduction

When compared to other media like text, graphics, photos, music, and video, video presents the greatest challenge due to the volume of data it generates and the amount of space it needs to be stored. The introduction of cheap storage devices, improved encoding methods, and high-speed networks has hastened the spread of digital video [1]. One of the primary areas of video study [2] is improving the quality and efficiency of accessing video databases. In order to make visual data more easily interpretable and manipulable, video segmentation is a vital step towards organised video representation [3]. Whenever the camera moves, the sound cuts in and out, or an item undergoes a special effect, the content of the video stream instantly changes. As the initial stage in content-based video analysis [4], temporal video segmentation involves chopping up the incoming video into smaller, sequential clips with similar content. The purpose is to cut the movie into shots, where each shot has a similar series of frames. After shots are identified, major frames are retrieved from each shot for indexing purposes [5]. In order to determine the optimal amount of shots and choose the most important frames from each shot, video segmentation algorithms must reliably recognise shot changes. Shot transitions may be either sudden or slow. Short changes in shot composition caused by edits are usually obvious. Subtle alterations to a photo via chroma, spatial, or mixed edits might be hard to see [6]. Clustering is described as the process of categorising related items into distinct groups, or more specifically, the process of dividing a data collection into smaller subsets (clusters) that are united by a common characteristic, such as geographic closeness. It is possible to categorise the wide variety of clustering schemes available, from the hard clustering scheme to the soft (fuzzy) clustering scheme, and everything in between.

Clustering methods are often used for the purpose of organising and classifying data according to a set of predetermined criteria. Fuzzy C-Means clustering is the most notable clustering method. Introduction These days, social media is an integral part of everyone's daily routine. It promotes innovative education and economic practises by linking individuals worldwide over the internet. In the present day, more and more video is being sent on social media platforms like big, facebook, whatsapp, and twitter. Video segmentation is a cutting-edge innovation with real-world use cases right now. It can be used in a wide range of fields, from sports to news to the military to traffic management to video surveillance to healthcare to the military to multimedia to the smart grid to the navy. Facebook is currently developing a VR video. The method of video segmentation is crucial to the study of moving images. Segmentation is difficult because of problems including occlusion, clutter, low

contrast edges, object overlap, and so on. The development of image segmentation is often impeded by such issues. The object identification, occlusion boundary estimation, and stereo system applications of segmentation methods are all possible. Researchers have recently added the Fuzzy C-means (FCM) method to enhance video segmentation efficiency.[1] Each data point in a fuzzy clustering model has many clusters. Clustering is a method for organising large amounts of data into smaller, more manageable groups called "clusters" or "homogeneous classes," with the goal of making the items within each cluster or class as similar to one another as feasible and those within other clusters or classes as unlike as possible. Distance, connectedness, and intensity are some of the similarity criteria used to classify objects into clusters. The data and the task at hand need distinct similarity metrics.

VIDEO SEGMENTATION

Video segmentation is a popular feature in many currently available apps. A segmentation methodology might be used for purposes such as object detection, occlusion border estimate in-motion, or stereo analysis. In order to increase the effectiveness of video segmentation, scientists have lately used the Fuzzy C-means (FCM) method.

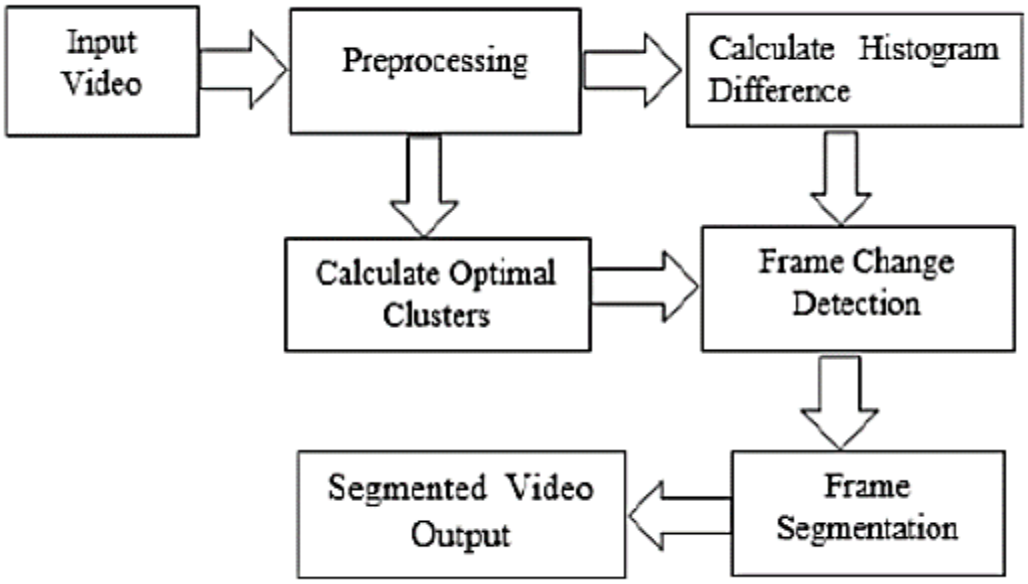

Figure 1: Block diagram of video segmentation.

To begin, the input video has been preprocessed. After that, the frames may be converted into full colour photographs. We compute the variance in the histogram and estimate the optimal clusters for each frame. whether the optimum clusters of two successive frames are different, then segmentation is performed on both frames without first determining whether there is a difference in the histograms of the two sets of images. If the histogram difference is below a certain threshold, the frame is ignored.

Overview of Fuzzy C- means Algorithm

One data point may be shared by two or more groups in Fuzzy C-means (FCM), a technique of clustering. For various degree estimation situations, Fuzzy C Means (FCM) is a popular fuzzy clustering approach. It offers a solution to the problem of how to divide up the points in given multidimensional space into a fixed number of clusters. Since the entries of the membership matrix U in FCM range in value from 0 to 1, a single data point might potentially belong to many classes.

Comparative Study on Video Segmentation using Fuzzy C-means Algorithm

Chi-chun lo et al. (2001) have presented HBFCM, a three-stage clustering technique consisting of feature extraction, clustering, and key-frame selection. First, colour histogram differences are used to extract characteristics. In the second step, characteristics are clustered using the fuzzy c-means FCM to identify instances of shot change (SC), suspected shoot change (SSC), and no shot change (NSC). Finally, frames that indicate a cut are extracted from the SC and SSC and utilised to divide the original movie into individual shots. At last, the best stills from each take are chosen.

K.Mahesh et al. (2012) In this work, we discuss the fuzzy C- means method for object extraction that has been developed. In order to properly segment both static and moving objects, the suggested technique combines the use of a frame difference algorithm with the background removal method and successive frame differences. The effectiveness of the suggested method is examined via the calculation of statistical measures and the kappa coefficient, and it is tested on a number of different video sequences.

Lakshmi S et al. (2013) This work introduces a unique approach to background removal using Fuzzy C-Means Clustering, which examines just a subset of pixels in each picture. Using an edge detector, we can then use the Region of Interest (ROI) approach to zero in on certain parts of the picture or frame. Once the region is identified, just that part of the picture will be segmented rather than the complete thing. By subtracting the current frame from the preceding one, the author uses the Fuzzy cmeans clustering method to partition the item and determine its foreground/background status..

V.Kalist et al. (2015) In this study, the satellite pictures are converted from RGB to HSL space before segmentation. HSL colour system is more perceptually accurate to how colours appear to the human eye than RGB. Comparing satellite picture segmentation in the RGB and HSL colour spaces, the experimental result demonstrates the efficacy of the suggested method.

Ebrahim Asadi et al. (2015)The author suggested an innovative approach for a new keyframe extraction system based on fuzzy c-means clustering to generate static video summaries. As a keyframe, we choose the frame with the highest membership grade across all clusters. Users' summaries are utilised for assessment, and a straightforward approach is applied to determine the number of clusters**..**

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 .

For better segmentation results, comparable pictures are put together in this approach. After a shot has been segmented, the items in the key frame are used to locate the track frames for each shot. This method of selecting track frames expedites the segmentation calculation time. In video segmentation, one of the most important challenges is the extraction of discrete objects from the frame. Object extraction from videos is prioritised in the proposed segmentation method. Both the frame difference approach and the intersection method are used to complete the motion segmentation procedure. The segmented results are then compared to find the most frequently occurring and accurately segmented items, while the static foreground is segmented by using the

intersection of successive frames. Object detection is a vital procedure for distinguishing between stationary and moving targets in a setting characterised by both sudden and slow shifts. Objects in each frame are detected using the fuzzy c means algorithm in the suggested segmentation method. While the frame intersection technique offers the difference between successive frames, the frame difference approach simply provides the difference between the current and key frames. Track frame intersection is used for motion analysis and object segmentation.

K-Means

When it comes to explaining the classic clustering issue, K-means is one of the simplest unsupervised learning techniques available. The technique follows a basic and clear approach to characterising a data set by splitting it into a predetermined number of clusters (k in this case). The idea is to first define k groups and then characterise their respective centres. These centres of gravity should be strategically placed, since their effects vary depending on their location. Therefore, it is preferable to place them as far apart from each other as possible. The next step is to find the centroid nearest to each guide that points towards a certain informative index. When there is no waiting point, the first stage is complete and the early group age is over. As a result of our earlier work, we now need to recalculate k new centroids to serve as the burial sites for the packs that are maturing. After obtaining these k-new centroid values, we will need to re-couple the centres of similar learning lists to the closest new centroid. The arc is complete. From this sphere, we can deduce that the k-centers shift their location as desired up to the point when further adjustments may be made. At the end of the day, centroids have stopped shifting.

Cluster Analysis

Analysis by Clustering Clustering is a method of recognising and categorising objects in accordance with predetermined criteria. This method of categorization uses similarities between objects as its basis rather than any preconceived notions about their respective categories. As a result, there is a high degree of homogeneity across samples within classes and substantial heterogeneity amongst samples from different classes. There are many different types of clustering algorithms now in use, but they may be broadly categorised into five classes: partition-based, hierarchical, grid-based, density-based, and model-based. Figure 2 depicts the precise grouping.

Equalisation of the Histogram Based on Limited Contrast This suggested approach, called Fuzzy c-Means (CLAHEFCM), provides a colour segmentation procedure for pictures with poor contrast or uneven illumination. The approach given in this research initially employs contrast constrained adaptive histogram equalisation to improve the image's contrast. After the picture has been enhanced using this procedure, the colour space is partitioned into a predetermined number of clusters. Before the clustering process can begin, the picture must be transformed from RGB to LAB colour space. In this case, the Fuzzy c means technique is used to do the clustering. Segmentation occurs in the picture by grouping together sections of the same colour. When segmenting a picture, it's important to think about which cluster a particular pixel is most likely to be a part of. Good segmentation results have been seen when applying the approach to a variety of test photos in various colours. (ii) Masked Fuzzy C-Means (MSFCM) A predetermined number of clusters are used by the proposed approach to partition the colour space. Before the clustering process can begin, the picture must be transformed from RGB to LAB colour space. In this paper, we present a robust segmentation method that builds on previous work by extending the conventional fuzzy cmeans (FCM) clustering approach. A noise-free segmentation result has been achieved by considering the spatial information of each pixel in a picture. Segmentation occurs in the picture by grouping together sections of the same colour. When segmenting a picture, it's important to think about which cluster a particular pixel is most likely to be a part of. The approach has been tested on a number of colour benchmark photos, and the results have been compared to those of FCM and FCM-based algorithms to demonstrate its superiority. It has been found that the suggested approach is a simple and effective way to segment noisy pictures.

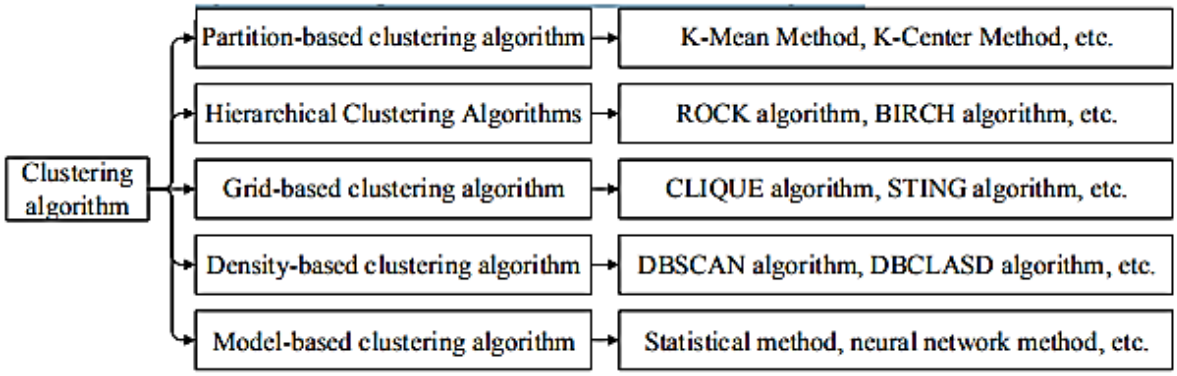

Figure 2: The specific classification of cluster analysis

Experimental Results

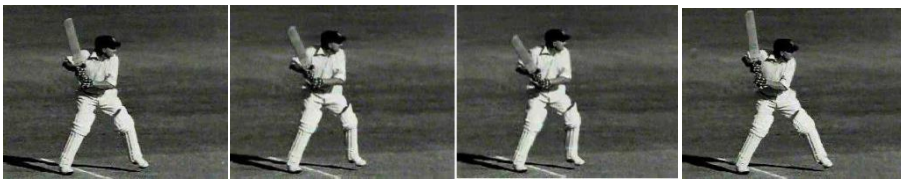

Figure 3.Sample Frames

Figure 4.Extracted Frames

Figure 5.Selected Dynamic Object using Frame Difference Method

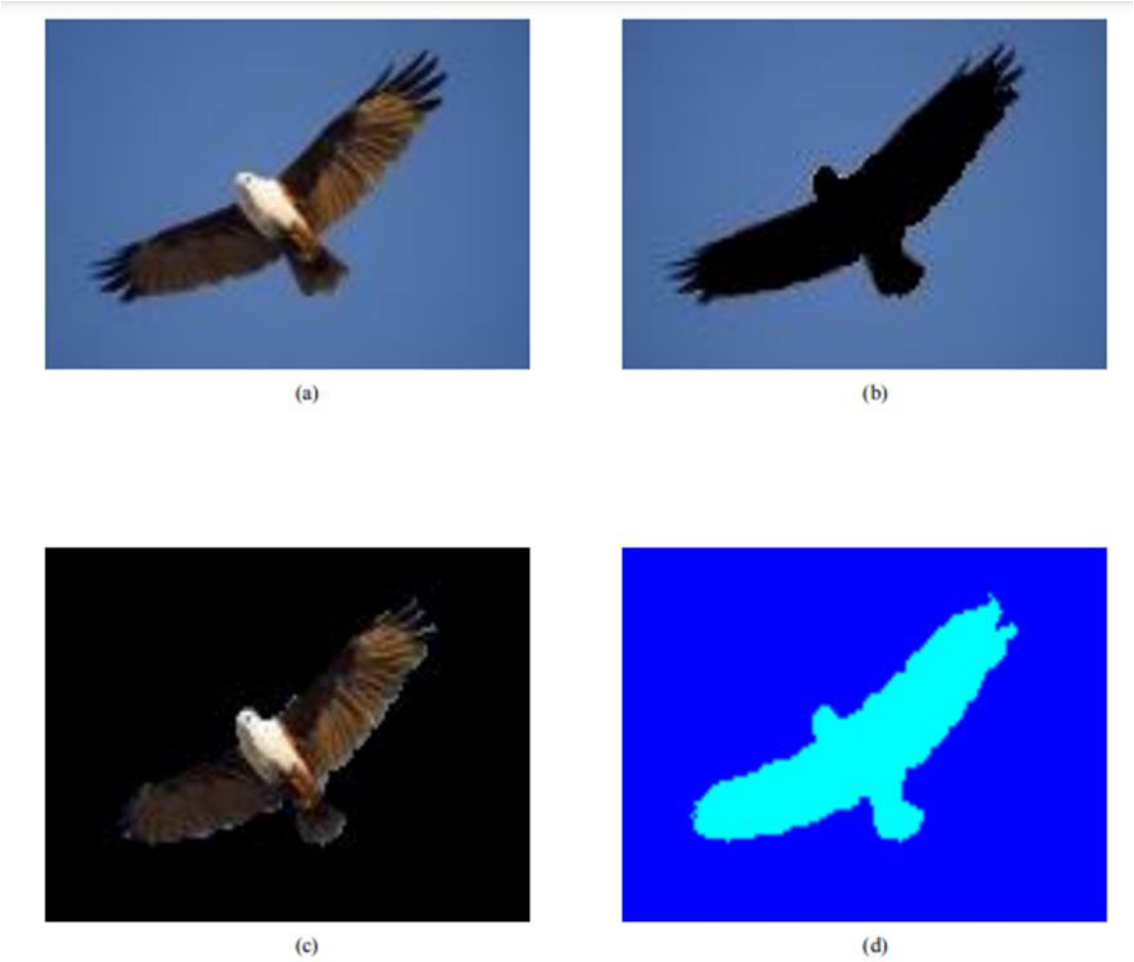

Figure 6. (a) Original image. (b)-(c) The two clusters for c=2 (d) Segmented image

Conclusion

The qualities of Videos may be well described by use of fuzzy theory. As a result, several different segmentation algorithms have been proposed and studied using the fuzzy theory. Particularly popular in the area of picture segmentation is the fuzzy C-means (FCM) clustering approach, which is based on fuzzy clustering.

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