

A survey on video object tracking, video segmentation and image clustering methods

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Abstract-Video segmentation indicates to divide a video in significant or relevant fundamental parts which have strong association with real world included in video data .Video segmentation comprise of applications such as object recognition, monitoring of video, video indexing ,forensic and military. This paper summarize about object and motion detection and miscellaneous methods of object tracking .A variety of segmentation techniques and their comparative analysis have been reviewed. Image clustering has also been studied.

Index Terms—object tracking, segmentation, clustering, hierarchial, partitional.

I. INTRODUCTION

Segmenting is the main concept in the field of image processing generally in the process of image analysis. Segmentation removes complexities and simplifies the representation of video into pertinent and significant divisions or segments and compose a clip or sequence into its constituents. Segmentation input involves a raw data like a video sequence. The output is uncomplicated where identical parts are split up into simpler parts. Segmentation extricates appropriate information about structure relating to objects from a video sequence and identifies various traits of interest from data. These computations are used for qualitative investigation process. Segmentation of objects moving in a video sequence is indispensable and crucial technology used in applications which are related to real time. It portrays a chief role in video monitoring, security (detection of paths, tracking of targets), recognition of objects ,medical ,communication. Different perceptible traits like texture, locomotion and color are used for attaining segmentation. Segmenting objects in a video sequence is a very crucial task to attain because information about motion is very important here. Fast moving objects are much easier to segment than slow moving objects which occur because of gap in semantics [4].

Object and motion detection

Object detection is a primary procedure wherein human existence is applied in video supervision. The purpose of object detection is establishing identical object and object parts in between successive video frames. Moving object detection groups pixels in 2 divisions-Foreground and

background pixels. Foreground pixels are thought to be of moving objects and pixels which are background are regarded as stationary background. Detecting moving objects can relate to a variety of difficulties like noise. Sudden changes in the intensity of illumination , shadows. Various techniques have been recommended for detecting moving objects in a video sequence which involves region and boundary based approaches. Main objective of motion detection is attaining high sensitivity when extracting moving object having minimum false detection rate[4].

Object tracking

The motive of tracking is establishing correlation of objects and their parts in between successive frames of video. Tracking has two steps.

1 Semi automatic tracking-involves segmenting a video with the involvement of users.

2. Automatic tracking-do not require individual intercession. It executes on its own which uses various predefined methods [4].

Techniques of tracking objects in a video are-
1.Point tracking-In this points depict objects which are detected in successive frames, therefore association of these points depend on state of state of object that can be position of object and motion. Point trackers are appropriate for tracking tiny objects that pursue single point representation. For tracking objects that are larger there is a need of multiple points[3].
2.Kernel tracking-In this shape of object and appearance is taken into account. like kernel can possess rectangular or elliptical shape. Objects are tracked by computation of motion of kernel in successive
3.Silhouette tracking-Estimation of object region in every frame is required to track an object. These techniques utilize the encoded information in every object region. Matching of shape or contour evaluation is utilized[3].

Segmentation methods

1. Data based -Dependent on data types which are original, segmentation can be divided in image, audio, video, text segmentation which we involve in various fields. For example text segmentation is used to extricate titles presented in movies or several parts in a document can be partitioned with the help of segmentation.

2. Space based-Dependent on viewing space relation segmentation is classified in spatial or temporal methods. The spatial technique highlights on the split as maintained by spatial relations amongst pixels. Temporal method focuses to split a series of frames into various segments along temporal axis. Like we can use techniques relating to scene analysis as zoom, fade, wide, video cut so that scene

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segmentation can be performed to associate those frames with homogeneous content.

3. Class based-Different methods of segmentation are suggested to extract particular objects (like face, building, van) from input videos. Because object is previously known, preliminary knowledge of this object can be used to enhance segmentation results. For example for segmentation of face the distribution of skin color perceived from samples is advantageous for detection of face region which permits to access the face in an efficient manner.

4. Feature based-Feature extraction performs a significant role in video segmentation. In accordance to selecting feature space segmentation can be categorized in color, texture, shape, intensity or motion based segmentation. Region property can be evaluated by applying these features. For example in color segmentation decision of grouping depend on color distance in between adjacent pixels. For segmentation of motion the task is to figure out independent moving objects in a video.

5. Inference-Depending on inference formulation of segmentation can be done by bottom up and top down techniques. Bottom up segmentation is performed depending on low level visuals in contrast to high level. Therefore this segmentation is generally executed in unsupervised manner. Top down method generally need a database of human interpreted images to identify a distribution which is prior and assist in making high level recognition by incorporation of low level grouping results.

6. Interaction based mode-Depends on supervised and unsupervised modes. Supervised method require user intervention for segmentation which permits users to simply specify forefront across space and time. Those methods can issue a desirable performance in comparison with automatic ways because preliminary information about objects can be attained. Unsupervised methods involves no textual knowledge related to object that is segmented. Segmentation of object is executed in an automatic manner which becomes a basic technique in real time application areas like video surveillance.

Applications-The Intention of video segmentation is application based which appear in many fields. These are presented -

1. Recognition of object-Here segmentation is considered as an essential component which categories coherent image areas which are further used for assembling and detecting objects. Feature extraction and matching of model depend greatly on standard of image segmentation process.

2. Video monitoring-When an object is split up into pieces to enhance tracking robustness to occlusion with the help of tracking. The objects that are moving along time axis. The segmented mask permits prediction and identification of an intruder or abnormal situation and therefore helped revealing their conduct and making decisions swiftly when alerts come over to security unit.

3. Data compression-It sanctions suitable coding algorithm for manipulation of each object in an independent manner which results in quality improvement. Segmentation helps partitioning each frame in a video series into semantic meaningful objects having arbitrary shape. Therefore a lot of coding bits can be allotted to object region, thereby reducing visual artifact.

4. Computer vision-In computer vision 3d scenes can be constructed with the help of segmented objects in 2d images or video clips.

Image clustering

Clustering is an approach of allocating set of items in groups named clusters so as the items in one cluster have more resemblance in character, quantity than items in another cluster. Clustering essentially is not a peculiar algorithm but it is a method which is performed by different algorithm which vary from one another in techniques to find out the cluster. Clustering is a technique of assembling homogeneous image pixels based on some property into a cluster, so that inter-cluster similarities are low and intra-cluster similarities are high as shown by final output cluster. Hence in clustering data points are classified to groups or clusters in an unsupervised process. [11] Clustering task steps: Clustering is an approach which necessitate a number of stages.

1. Representation of characteristics-This requires clustering of data that is available which assembles proportions and traits of data. Depicting this approaches like feature extraction or selection are involved.

2. Similarity measurement-This method involves measurement of homogeneity of data points. Mean square method and Euclidean distance methods are various methods of distance measurement which compute homogeneity between data points.

3. Collection of data points-This involves assembling data points together in cluster depending on similarity measures.

4. Abstraction in data-This process involves representing data with small depiction of individual clusters and cluster prototype. i.e calculation of clusters centroid is used as a final representation.

5. Validating output-This depicts a purposeful step in clustering approach. Output clusters are surveyed for governing whether the output obtained is meaningful or not.

Types of clustering

1. Hierarchical clustering-This clusters the image depending on pixels concepts which have close relation to pixels which are nearby as compared to farther pixels. i.e on distance basis. Representation of data is done in tree structure form which involves data set representation by root node and leaf node represents individual data points. Intermediate nodes depict homogeneity amongst pixel data points.

2. Partitional clustering-This algorithm split the data points in partitions which are named as clusters. Partitional clustering does the task of data organization in single partition than to do data representation in nested framework. Partitional clustering is appropriate for data sets which are large and possess difficulties in representing data [11].

II. LITERATURE SURVEY

Mada A.et.al(2014)-Presently storing video data has become a necessity in applications like in medical field, military, navy, forensic and multimedia applications. The miracle takes place if there is an accurate indexing method for storage of video content and also there is an accurate method for retrieval of information stored from databases. Retrieval and storage of video data involves a major issue i.e video

segmentation. Therefore author presents an overview of video segmentation techniques.

Amara.k.et.al(2014)-The manual monitoring of cameras is too long and dull as it contain huge amount of information. Therefore automating this technique from image processing systems is interesting and thus is able to figure out required information from video sequence and compute it. Motion detection and estimation is a very crucial task to be implemented. Hence author provides various approaches of motion detection and estimation.

Tushar S.et.al(2013)-Detecting and tracking of moving objects use background subtraction methods which play a major role in monitoring of traffic .Tracking and detecting moving objects in an accurate way is a challenging task. Author proposes a method which combines the benefit of spatio-temporal differencing and background subtraction methods.

Merin A.et.al(2012)-Segmenting moving objects in video sequence is quite important in aspects relating to multimedia. Moving object segmentation involves extracting foreground from background. Detecting objects and detecting motion are included in moving object segmentation .Author deals with region and boundary based approaches. Strength, weakness and computational complexity are computed using this study. Kinjal A.et.al(2012)-Author focuses on detecting moving objects in a video monitoring system and thereby tracking objects which were detected in time. Any video surveillance application involves detecting moving object, which is a challenging task. Tracking is needed in applications relating to higher level which need objects shape and location in each frame. Therefore author described different tracking methods.

.K.Mahesh.et.al(2012)-Author proposes a hybrid video segmentation technique where segmentation of similar shots is done initially. After that assortment of track frames in every shot is done which greatly lowers down processing time. Effective video segmentation results are yielded by intersecting results segmented by frame difference and consecutive frame intersection method. Frame difference method examines key frames as background and dynamic objects are segmented but in consecutive frame difference method segmentation of static and dynamic objects by intersecting objects is done in consecutive frames with help of Fuzzy k-means (FKM) clustering

Shaoping.X.et.al(2013)-Author proposes cluster number adaptive fuzzy c-means algorithm (CNAFCM) to automatically group image pixels into regions which are homogeneous when we do not know cluster number previously. utilization of GLCM feature is done at block level rather than pixel level for estimating cluster number which we use as a parameter for initialization. Hence image pixels are clustered depending on Gabor feature vectors for improving compactness of cluster.

Vibha.L.et.al(2008)-Author proposes a technique to identify an object moving in a video clip which has a background that is stationary for real time which is dependent on multimedia communication system and examine application like traffic monitoring. Author depicts a framework to find some useful and unknown knowledge like identification of vehicle and traffic flow count. The aim is monitoring activities at traffic

intersection to detect congestion and thereby predicting flow of traffic.

Colombari.A.et.al(2006)-Author presents an approach which makes content base depiction of a video shot which is made up of a background and some foreground moving objects. An algorithm which depends on Mahalanobis distance does region matching in between region descriptors in consequent frames. Principle of proximity and another principle named principle of exclusion use singular value decomposition for computing a set of correspondences.

Lefever.H.et.al(2003)-Author presents methods for segmenting uncompressed video sequences. Video segmentation is generally implemented in temporal domain by shot change detection. A criterion named computational complexity that accounts in case of real time segmentation when we have to compare various methods. This accounts more when we deal with uncompressed video sequences. However complexity criterion were not involved in previous papers when we compared shot detection methods. Classification of several methods have been presented based on information detecting shot changes.

Author and year	Technique	Merits
K.Mahesh and Dr.k. kuppusamy 2012	FKM clustering approach	Enhanced segmentation results are generated. 88% accuracy is achieved.
Shaoping Xu,Lingyan Xu,Xiaohui Yang and Xiaoping Liu 2012	Cluster number adaptive Fuzzy c-means	Suitable number of clusters can be spontaneously estimated. Segmentation quality is better.
Vibha l,Chetna Hegde ,P.Deepa Shenoy, Venugopal KR,LM patnaik 2008	Background elimination Background registration	Adaptive background mixture model is improved. Efficiently adaptive to changing environment
TusharS.Waykole , Yogendra kumar jain(2013)	Background subtraction Temporal differencing	Performance evaluation using sample video with mean shift method and basic background subtraction method.

A.Colombari,A. Fusiello,V. Murino	Mahalanobis distance Principle of proximity Principle of exclusion	Segmentation and tracking is improved . Occlusion between moving object and between moving object and background are taken in account.
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CONCLUSION

This paper introduced diverse approaches for object tracking. Various papers have been studied and analyzed in literature. Segmentation, its applications and image clustering has also been discussed.88% of accuracy in FKM clustering was obtained. Segmentation quality is better in Fuzzy c-means clustering algorithm. Methods like Background elimination and background registration are efficient and adaptive to changing environment. Temporal differencing is very fast. Many methods are surveyed.

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