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# A NEW APPROACH FOR VIDEO OBJECT MINING: ISSUES AND CHALLENGES

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## ABSTRACT

In these days, due to the increasing rate of video data over the World Wide Web, it is becoming very essential to extract useful information from visual data. The video data consists of various objects as its important visual information. Also video data contains huge amount of direct as well as indirect/hidden information about objects. The users can access direct information from video by viewing it. To access hidden information from the video, mining techniques such as classifications, clustering, regression, outlier detection and association rules etc, can be applied to discover knowledge from the video data, however, there is no ideal framework to mine video objects effectively. In this paper we reviewed some existing video object mining techniques and proposed a new approach for effective and efficient video object mining framework to extract useful knowledge from videos. An attempt is also made to mention about some research challenges in video object mining.

**KEYWORDS**: Video Object Mining Framework, Video Object Detection, Video Object Classification, Video Object Clustering

## INTRODUCTION

Video data is becoming more popular in our daily life due to the significant progress of digital capturing devices, such as digital cameras and smart phones. Through the advanced digital capturing devices, our rich life can be taped truly. Recently, people are used to share their life videos with others by online video sharing systems like YouTube, social websites like Face Book, and Yahoo Screen, and thereby the online users can obtain the interested videos all over the place. As a result, the video data generated by digital capturing devices or Internet sharing systems is growing rapidly. To process/manipulate the huge amount of video data effectively and efficiently, video object mining has attracted the researchers' attention now a days. With the popularity of social media, the volume of web videos is growing exponentially. The statistical report of the YouTube official website says that, more than 1 billion unique users visit YouTube each month, Over 6 billion hours of video are watched each month on YouTube, 100 hours of video are uploaded to YouTube every minute. Facing the rapid growth of volumes of web videos, sometimes it becomes extremely difficult for users to find the right information [5]. Another problem with huge volumes of web videos is- search results are often mixed with diverse and noisy sets of video thumbnails. In addition, the dramatic growth of social media has made the effective browsing, searching and mining of objects in web videos to discover knowledge is a challenging task.

## REVIEW ON VIDEO MINING AND RELATED WORK

Video mining is the process of extracting useful knowledge from videos. Video can be represented in the form of shots and frames with timeline. The video consist of moving objects and static objects as well. The process of extracting knowledge from video objects is known as Video Object Mining. Many works are implemented to extract knowledge from the video. This section represents reviews of existing video mining techniques

### A) Video Frames Retrieval and Indexing

Lakshmi Rupa G, Gitanjali J [13], proposed an algorithm for retrieving and indexing video streams. To retrieve and index the video streams, the authors created digital library of video frames for each frame in the shot, by separating the stream shots and then indexing the shots frames based on the wavelet coefficients. The authors proposed indexing of the video streams frames, which is a part of digital

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library creation process and wavelet coefficients for each frame is also calculated. Using this technique it is possible to retrieve any shot from the digital library effectively and efficiently. This digital library is helpful to retrieve any frame of the shot automatically in the indexed stream. This is scalable to any number of video streams, any number of shots, for creating the shot indexing and wavelet coefficient calculations [13]. The proposed algorithm for video digital library helps in indexing and retrieval based on wavelet transform. This also helps to save a feature representing each stream frames which helps in archiving and retrieving process on stream shots.

***B)* Object detection in Videos**

To detect objects in videos the authors, Josef Sivic and Andrew Zisserman [6], elaborated their work on the possibilities of retrieving objects or scenes in a movie with the speed, ease, and accuracy with which Google retrieves web pages containing particular words, by specifying the query as an image of the scene or object. In this approach, each frame of the video is represented by a set of viewpoint invariant region descriptors. These descriptors enable recognition to proceed successfully despite changes in illumination, partial occlusion and viewpoint. Vector quantizing these region descriptors provides a visual analogy of a word, which term a visual word. Efficient retrieval is then achieved by employing methods from statistical text retrieval, including inverted file systems, and text and document frequency weightings. The final ranking also depends on the spatial layout of the regions. Object retrieval results are reported on the full length video. Josef Sivic and Andrew Zisserman discussed three research directions for the presented video retrieval approach and review some recent work addressing them such as, building visual vocabularies for very large-scale retrieval; retrieval of 3-D objects and more thorough verification and ranking using the spatial structure of objects.

***C)* Event Detection and Summarization**

The authors, P. Thirumurugan and S. Hasan Hussain [5], proposed an advanced framework that utilizes both the distance-based and rule-based data mining techniques for domain independent video event detection to address the rare event detection issue. In this approach, the proposed framework is fully automatic without the need of any domain knowledge, which is achieved by data pre-processing including increasing the percentage of positive instances and reducing the feature dimension, and a decision tree classifier for event detection. The experimental results in goal event detection from multiple broadcast video data show the viability and effectiveness of the proposed framework for general event detection.

***D)* Video Object Extraction**

The author, Jonathan Weber [3], proposed method for applications to video summarization and object retrieval over two different types of datasets. The task of manually generating ground-truth for large videos is tedious. Hence, in this approach, due to space constraints, the results of object retrieval with respect to the ground truth over a relatively smaller duration dataset and also provides video summarization results over a smaller subset of this dataset.

Daniel Getica Perez, Ming-Tin-Sun [15] developed a novel algorithm for semantic video object (SVO) extraction, based on a new multivalued morphological spatial segmentation which integrates edge information and color, and object tracking using backward region classification. The proposed spatial segmentation incorporates a new marker extraction method based on intensity edge information which improves the definition of the real borders of the scene objects, and a new distance criterion based on edge and color information to guide the proposed watershed algorithm. Experimental results on several MPEG-4 test video sequences shows that, the proposed algorithm improves the precision of the extracted SVO boundaries compared to the traditional watershed algorithm, and also which is capable of tracking multiple semantic video objects in static and moving camera scenarios [15].

**E) Classification and Summarization Techniques**

Object detection and classification in video is an important and challenging task in the video object mining. The authors, R Raj Bharath G and Divya [14], proposed an algorithm for moving object detection, classification and evaluate its parameter by alternating the algorithm in a different way. In proposed algorithm, threshold, image subtraction, and foreground detection algorithms are used for object detection and patterns are used for classification purpose. Then frame by frame the objects are tracked and parameters like velocity speed and object counts are calculated. Finally the proposed method proved that, object in both dynamic and static texture scenes over long time period is analyzed and parameter of moving objects are evaluated. The proposed technique has application in boarder protection and monitoring and sports training. In video classification technique, decision boundaries are generated to discriminate between different

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patterns belonging to different classes. Another method for classification of different kinds of videos, that uses the output of a concise video summarization technique that forms a list of key frames, was presented by the authors, Lu, Drew, & Au, in 2001.

**F) Clustering Video Objects**

A novel objects mining system for videos proposed by the authors Arasanathan Anjulan and Nishan Canagarajah [1]. The proposed idea is, segment the video into shots and to extract stable tracks from them. To combine stable tracks into meaningful object clusters, a grouping technique is introduced. These clusters are used in mining similar kind of objects. Using this idea, the authors Arasanathan Anjulan and Nishan Canagarajah mined more instances of similar objects in different video shots. Also they proposed an algorithm to obtaining object clusters from tracks in a shot.

JungHwan Oh, JeongKyu Lee and Sae Hwang [2], discussed video classification, video clustering and pattern findings. Video clustering has some differences with conventional clustering algorithms. As we know, due to the unstructured nature of video data, preprocessing of video data by using image processing or computer vision techniques is required to get structured format features. Another difference in video clustering is that the time factor should be considered while the video data is processed [2].

**G) Video Object Mining System**

The authors R. Shah, R. and Iyer and S. Chaudhuri [4], introduced a new catalog to describe Video Mining System (VMS) and use it to review the current object-related Video Mining System showing its relevance to efficiently compare different VMS. The authors also asserted that objects should play an even more central role and justify their proposal by presenting the benefits which may be offered by such video object mining systems. In this VMS framework, the authors discussed the impact of choosing objects as elements on the other characteristics defined in our taxonomy. The proposed framework describes importance of the video object segmentation step and a way of introducing semantics into Video Object Mining System (VOMS). The VOMS offers new scenario relevance in video mining with higher quality can be achieved using real/semantic objects present in the videos. However, it is observed that, the existing Video Object Mining System doesn't suitable for all types of videos including web videos and offline videos. Hence, an effective and efficient Video Object Mining Framework which is suitable for all types of videos is presented in section 3.

## PROPOSED VIDEO OBJECT MINING FRAMEWORK

In this section we propose a new framework for video object mining. The proposed framework has the following components and the schematic representation of the proposed model is shown in the Figure 1.

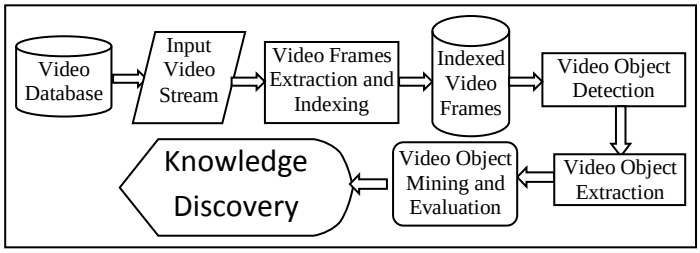


***Figure 1:*** *Proposed Video Object Mining Framework*

**A) Input Video Streams**

Initially, the video database contains large number of video data which are to be mined to discover the knowledge. The video database may contain both web videos which are downloaded from the web as well as offline videos such as video products from digital camera. The video streams are extracted from the video database to retrieve video frames and indexing purpose.

**B) Video Frames Extraction and Indexing**

Video frames extraction can be implement using traditional methods or directly it is possible to extract through many open source tools such as XVideoConverter. The XVideoConverter is an open source tool which can be used for conversion of videos from one format to another and also can be used to extract video frames or video images form video data to specific database. After extracting video frames, store them in a database with suitable indexing scheme.

**C) Video Object Detection**

Object detection is the process of finding instances of real-world objects such as faces, vehicles, and buildings in videos. Object detection algorithms typically use extracted features and learning algorithms to recognize instances of an object category. It is commonly used in applications such as image retrieval, surveillance, security and automated vehicle parking systems.

The existing techniques to detect objects uses a variety of models, including- frequent pattern mining

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algorithm, face recognition algorithms [16], video segmentation algorithms [17], feature-based object detection, Viola-Jones object detection, SVM classification with histograms of oriented gradients (HOG) features [18], image segmentation and blob analysis, gradient-based, derivative-based, and template matching approaches. Also we are currently working to detect objects through metadata analysis of video frames.

**D) Video Object Extraction**

The next task is to extract objects of user interest through object extraction algorithm and store in a object repository database. The object repository database contains objects of similar type which are inputs for the proposed Video Object Mining Framework. Some of the existing algorithms for Video Object Extraction are- techniques for automatic extraction of moving objects using multiple features and multiple frames [19], an unsupervised multi-resolution object extraction algorithm using video-cube [20], object extraction and tracking using genetic algorithms [21], video object extraction based on a comparative study of efficient edge detection techniques [22], semantic video object (SVO) extraction technique based on a new multivalued morphological spatial segmentation [23].

**E) Video Object Mining and Evaluation**

Using data mining techniques such as classification, clustering, association rules and filtering, objects can be mined and results are evaluated through various data mining models and techniques. Some of existing algorithms and techniques for video object mining are- real-time object classification algorithm in video surveillance systems [25], multiclass object classification for real-time video surveillance systems [24], intelligent video object classification scheme using offline feature extraction [26], video object classification using image segmentation algorithm [27], multiple feature clustering algorithm for automatic video object segmentation [28], algorithm for robust video object segmentation based on K-Means background clustering and watershed in conditioned surveillance systems [29], multifeature object trajectory clustering algorithm for video analysis [30], video object segmentation algorithm by clustering region trajectories [31], a model-based conceptual clustering of moving objects in video surveillance [32], automatic video object segmentation using volume growing and hierarchical Clustering algorithm [33]. Also there are many data mining open source tools such as WEKA, RAPID MINER, ORANGE etc are available. Using appropriate and suitable algorithms and available data mining tools, objects of user interest can be mined. Also it has been observed that, there are some research challenges exist to discover knowledge from video database. The section 4 represents some research challenges in video object mining.

## RESEARCH CHALLENGES IN VIDEO OBJECT MINING

The following are the list of challenges in Video Object Mining.

**A) Mining video objects directly from web**

The popularity of World Wide Web (WWW) has made it a fruitful ground for dissipating digital video information. Due to the properties of huge, diverse and dynamic and unstructured nature of web data, web data research has encountered a lot of challenges for mining video data directly from the web.

**B) Object detection in videos through metadata analysis of video frames**

One of the most complex research challenges is to detect objects in videos by analyzing the metadata of video frames. In this process the detailed analysis of metadata is essential. Some metadata extraction tools can be used to extract metadata from video images/frames.

**C) Classifying video objects using the clustered features**

Another major research issue in video object mining is to incorporate the complex video like disaster videos for object detection and classification present in the scene for more sophisticated vision based applications like fire accident, earthquake disaster etc [14].

**D) Semantic gap between low level and high level video concepts**

One of the important research aspects in video object mining is the problem with semantic gap between low level and high level video concepts. The semantic gap characterizes the difference between two descriptions of an object by different linguistic representations, for instance languages or symbols. Semantics of an object depends on the context it is regarded within. For practical application this means any formal representation of real world tasks requires the translation of the contextual expert knowledge of an application (high-level) into the elementary and reproducible operations of a computing machine

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(low-level). Also the research gap has the following issues in video object mining.

- Obtain clusters of similar video objects from a video repository and guiding video mining by user feedback.
- Mining 3-D moving objects in videos.
- Classification of video objects using graph representations.
- Clustering of video objects using similarity based graph matching.
- Classification and extraction of video objects based on object motion analysis.
- Clustering and evaluation of video objects based on object motion analysis.

To find outlier objects from a video based on outlier detection techniques

## CONCLUSION AND FUTURE WORK

In this paper we have reviewed the existing techniques of video object mining system and proposed a new simple video object mining framework. The proposed simple video object mining system consists of various modules and techniques to discover knowledge from video database. Also we described various challenges of video object mining system. The future work includes, finding efficient solutions for the existing research challenges of video object mining system.

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