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Multi-Keyframe Abstraction from Video Using Fuzzy Classifiers

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Abstract: Data mining is an influential technology to help companies to extract hidden and significant predictive information from massive collection of data. In data mining, Video mining is the process of mining useful information that helps a business analyst to take a business decision. Correlation map is process of abstraction from video by using correlation between multi-keyframe of video and it is useful to find out multi-keyframe from overlapping view of videos. Correlation between frames is sorted and then keyframe important is calculated. Database is created for variations in key-components. Fuzzy classifier is used to classify all keyframes because it focuses on all objects and uncertainty data. It is also useful for classification based on properties of object. Keyframe abstraction technique is very useful to find out keyframes from video and classifies all keyframes. This keyframe provide a summary of video that require less time and less space. In organizations and vendor business, It is very needful for browsability of video with minimum time. It provides a summarization of multiple video events into multiple keyframe.

Keywords: Keyframe, Video shot, Fuzzy classifier, Entropy of image, image classification, Video summarization

I. INTRODUCTION

Data mining is a process of extracting knowledge and detecting the interesting patterns from a massive set of data. There are various types of data mining like as web mining, audio mining, video mining, distributed data mining, text mining, etc. These are the techniques for mining various types of data.

Today is a world of audio and video. A video data mining is very useful for mining video database. It is the process of taking a video database and find useful information from it. This information is used for various applications. Application of video data mining is that it requires a less space than conventional storage system, it requires a less time for video summarization and it gives useful event information from videos.

Multimedia contains large amount of data. Video data contains several kinds of data such as text, audio and video. The video content may be classified into three categories,

1. Low-level feature information that includes features such as color, texture, shape and so on,
2. Syntactic information that describes the contents of video, including salient objects, their spatial-temporal position and spatial temporal relations between them, and
3. Semantic information, which describes what, is happening in the video along with what is perceived by the users [1].

Data mining research has drawn on a number of other fields such as inductive learning, machine learning and statistics etc.

Machine learning – is the computerization of a learning process and knowledge is based on observations of environmental statistics and transitions. Machine learning examines earlier examples and their outcomes and learns how to reproduce these make generalizations about new uses.

Inductive learning – Induction means inference of information from data and Inductive learning is a model building process where the database is analysed to find patterns. Main strategies are supervised learning and unsupervised learning.

Statistics: It used to detect unusual patterns and explain patterns using statistical models such as linear models.

1. Video structure mining: Video structure mining is the process of identification of object in video and it is related to semantically content of video.
2. Video clustering and classification: Video clustering and classification is the process of cluster and classify various types of video and improve the browsability of video.
3. Video association mining: Video association mining is the process of association between video or video keyframe.

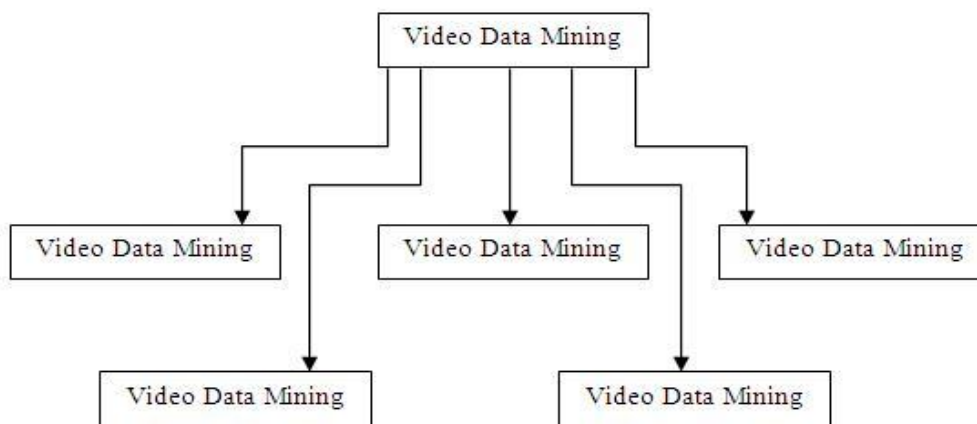


Fig 1 various approaches for video data mining

4. Video motion mining: Video motion mining is the process of mining various motions from video and identify useful event from it.
5. Video pattern mining: Video pattern mining is the process of detecting a pattern from video and this pattern is useful from finding same pattern in other video such as same event in one conference event.

Video is an example of multimedia data as it contains several kinds of data such as text, image, meta-data, visual and audio and it is widely used in many major potential applications like security and surveillance, entertainment, medicine, education programs and sports [3]. With the development of the digital video processing technology, video surveillance has been playing an important role for security and management and it is necessary and important to allow the computer to automatically extract the parts of interest from videos [6]. Video abstraction techniques as an important way to organize video datasets into more condensed forms or extract compact semantically meaningful information for video browsing, retrieval, event detection and genre classification have gained lots of attentions [2].

Video is a nothing but a sequence of frame. Multimedia Data Mining can be defined as the process of finding interesting patterns from media data such as audio, video, image and text that are not ordinarily accessible by basic queries and associated results [4]. Image is mined from various sequence of image based on features like as color, shape, intensity, histogram, contrast, texture, regularity, moment invariants, directionality etc. Video abstraction techniques as an important way to organize video datasets into more condensed forms or extract compact semantically meaningful information for video browsing, retrieval, event detection and genre classification have gained lots of attentions [2].

In key-frame extraction and object-based video segmentation, keyframe are extracted from short video and also find out object in video sequences. It is combination of keyframe abstraction and object detection [9]. Fuzzy c-mean [10] and genetic algorithm [11] is used to classifying text and image segmentation method. Event in video is detected by knowledge-based video

indexing and content management framework for domain specific videos based upon association rule [12]. Soccer Video are mined by decision tree using fuzzy event mining approach [13] and also by using machine learning [14]. Video is summarized by matching low-level user browsing preferences [15].

II. RELATED WORK

Multimodal temporal panorama (MTP) approach is used to accurately extracting and reconstructing moving vehicles in real-time using a remote multimodal (audio/video) monitoring system [17] and object is classified in various categories [18]. Object such as person is detected by automatic training image acquisition and effective feature selection [19] and boundary between video is detected by motion activity descriptor [20].

Fuzzy c-mean [10] and genetic algorithm [11] is used to classifying text and image segmentation method. Event in video is detected by knowledge-based video indexing and content management framework for domain specific videos based upon association rule [12]. Video is summarized by matching low-level user browsing preferences [15]. It is useful for visualizing social data [21] and fraud in data is detected by off-line and semi-online mode [22].

III. CLASSIFICATION OF DATA MINING SYSTEM

There are various classification techniques in data mining. A few of data mining techniques are list below.

- 1) Nearest Neighbor
- 2) Rule Based Classifiers
- 3) Artificial Neural Network
- 4) Rough Sets
- 5) Support vector machines
- 6) Fuzzy Logic
- 7) Genetic algorithms
- 8) Bayesian Networks
- 9) Decision Tree

These are technique are classify all the data into various number of classes. It is same as grouping of data in same class. For example of one class of boys and one class of girls are into different class.

IV. CORRELATION AMONG FRAME

Correlation gives a relationship between frames of video. By using correlation map, we can identify similar frame from rest video. After generating correlation map, we apply a support vector machine is a technique which is based to machine learning and it is used to classify frames of video but this technique is very slower to classify image. So we can't get some good precious based on our query. We require another technique to improve precious to find out maximum number of keyframe from videos. A correlation of keyframe is computed by using correlation map. All the features of keyframe are considered as extraction parameter and noise is removed from all keyframe.

A correlation map to naturally model the correlations with various attributes among multi-keyframe, keyframe importance and weighted correlations are then computed to construct the map and weighted correlations, unlike the unweighted ones, not only model probabilistic relationship among keyframe but also address the temporal and visual similarity [2].

Use of multimedia is increasing in real world, but it contains vast number of video and requires more storage space. Storage of data is easy task but storage of video is challenging task. Various techniques are use to browse a video but they are slower

and not effective to extract a skim or keyframe from video. Correlation map is used for finding a correlation in keyframe of video and apply support vector machine, but it is not effective to classify video. Fuzzy classifier is a technique to classify all the keyframe into various classes.

V. FUZZY CLASSIFIER AND SUPPORT VECTOR MACHINE(SVM)

The objective of video data mining is to discover and describe interesting patterns from the huge amount of video data as it is one of the core problem areas of the data-mining research community. The main intention of it is to create an efficient method to find multi keyframe from video by using fuzzy classifier. Fuzzy rule based classifier [16] is used to classify all the frame of video into relevant classes. Fuzzy rule based classifier is explained in [16]. From this classifier, it provides a better and faster correlation map of videos. Mainly number of event, precious is important in this method. Support vector machine require a lot of data and use for discontinuous data.

Essential keyframe are further generated for abstraction using rough set, and the event-centered correlation maps are presented to serially assemble multi-keyframe along time line, to facilitate easy browsing of video datasets [2].

A support vector machine is a technique which is based to machine learning and it is used to classify frames of video but this technique is very slower to classify image. It requires a summary of video into various classes.

VI. IMPLEMENTATION METHODOLOGY

We implement addition of Fuzzy C-Classifiers for creating better and faster correlation maps. SVM (Support Vector Machine) Technique is used for Machine Learning, but this technique for classification can be slower, and using Fuzzy C-Classifier, a dual layered correlation map can be created, where-in a basic correlation can be laid down by Fuzzy Classifier and then a C-Means Clustering technique can be used for faster and relevant key-frame abstraction.

This system is identifying keyframes from video. It takes all frames of video and classify into various number of classes. Classification a technique is a rule based techniques to classify frames.

We use a color an entropy parameter to create classes. Final result will generate set of keyframe that provide a summary of video.

Main Steps in algorithm:

1. Abstracting random frames from a video.
2. Processing of the frame based upon color histogram, motion detection, and profiling and segmentation methods like motion activity descriptor was applied for different video sequence to detect breaks in videos, and shot boundary detection.
3. Dynamic and essential keyframes sorting
4. Keyframe importance computation
5. Creating database for the variations in key-components. For example roads, parks, ocean view etc.
6. Adding Fuzzy C-Classifier Techniques to the keyframes.
7. Result comparison

VII. EXPERIMENTAL RESULTS

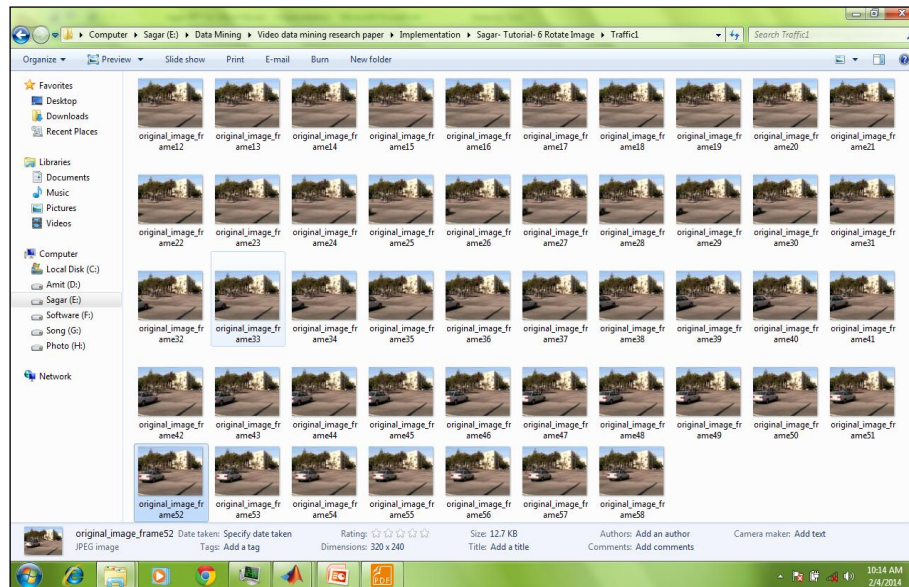
Dataset Format

We take a video of any format and generate a database that contains information about video frames. A frame contains information like as frame number, red value, blue value, green value, mean of RGB (Red, Green and Blue) entropy, class

number and etc. In this technique, I have taken a one rhinos.avi matlab video of 7 second and take 100 frames of video and generate a summary of video in a form of keyframe. It results 5 keyframe from video of 7 second and final video is created from this 5 keyframe. This final video and keyframes gives a summary of whole video.

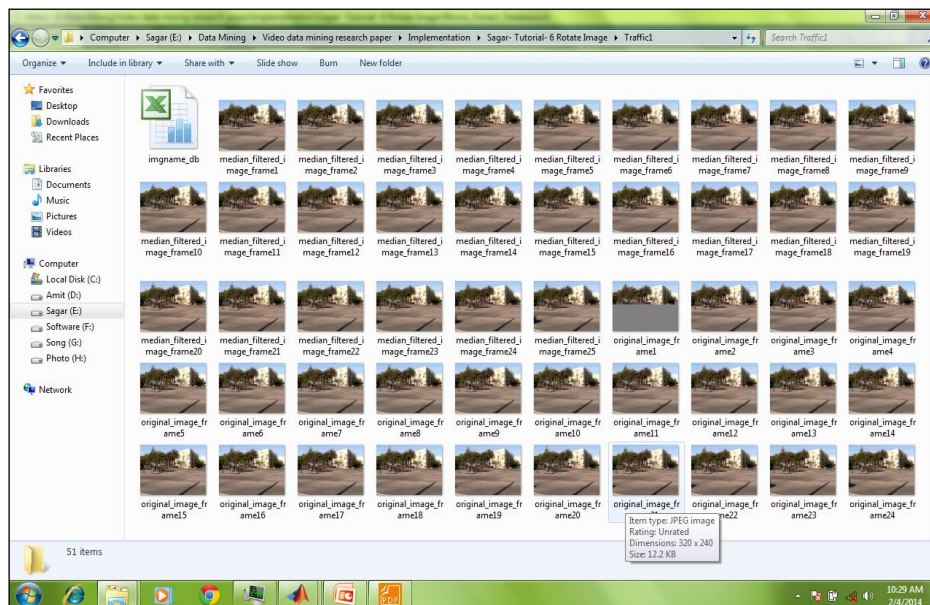
a) Abstract all the frames from video

Calculate the features of video such as height, video, format, no. of frames, frame's height and width.



b) Pre-processing of video

- Take a matrix of images and check orientation by using FLIPUD(Flip up/down) direction
- Median Filtering for Noise Removal
- MEDFILT2 (2D) performs median filtering of the matrix using the default 3-by-3 neighborhood for each R,G & B.



c) Image Colour Component Analysis

- 1) Find a mean value of Red
- 2) Find a mean value of Green

3) Find a mean value of Blue

MEAN() is a row vector containing the mean value of each column. Furthermore mean used for taking mean of row vector equal to one mean of colour per image.

This final mean gives a majority of colour in a frame. This procedure is also repeated for red, green and blue colour. Entropy of frame is also calculated.

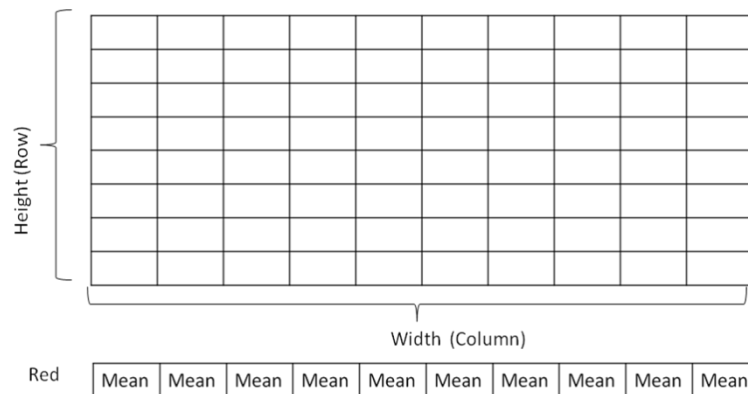


Figure-4 Frame Importance Calculation

d) Fuzzy Rules

Image is made by 3 color which are red, green and blue. So We create a 3 type of fuzzy rules that based on color of frames. We also consider of entropy of each frames of video.

Create a fuzzy rule:-

- A. If color dominance is Red then put in fuzzy set 'R'
- B. Else If color dominance is Green then put in fuzzy set 'G'
- C. Else color dominance is Blue then put in fuzzy set 'B'

Based on fuzzy rule, Create a database for R,G,B set and store color dominance for each frame of video. This dominance gives a major color of frames in video.

e) Keyframes of video & Final video

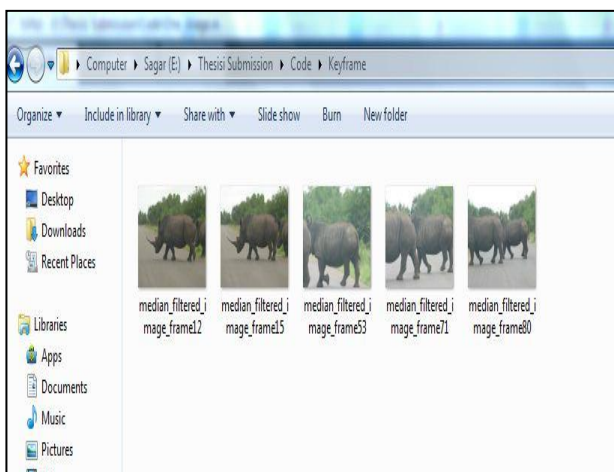


Fig. 5 Keyframes of video

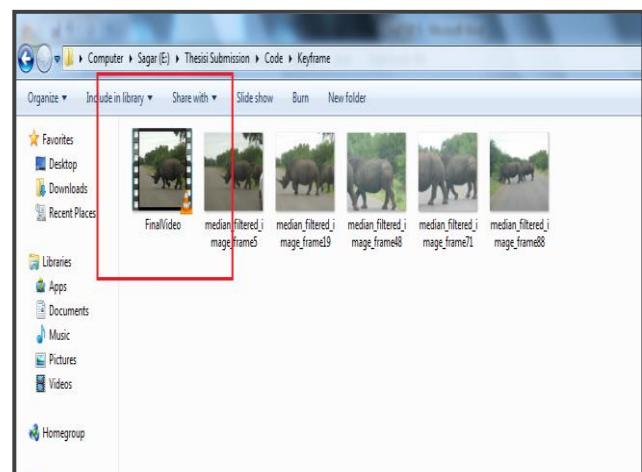


Figure-6 Generation of final video

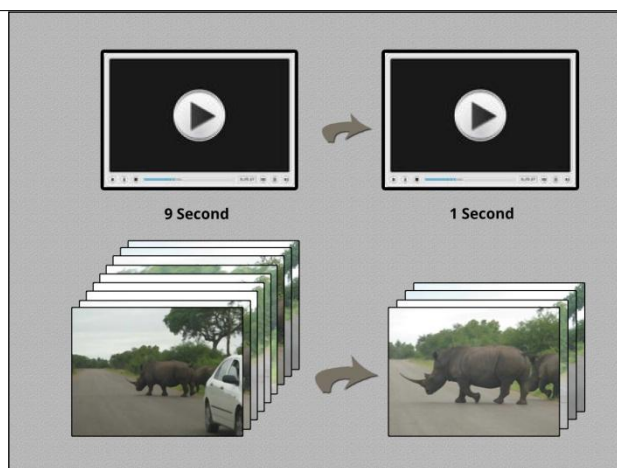


Fig. 7 Summary of video

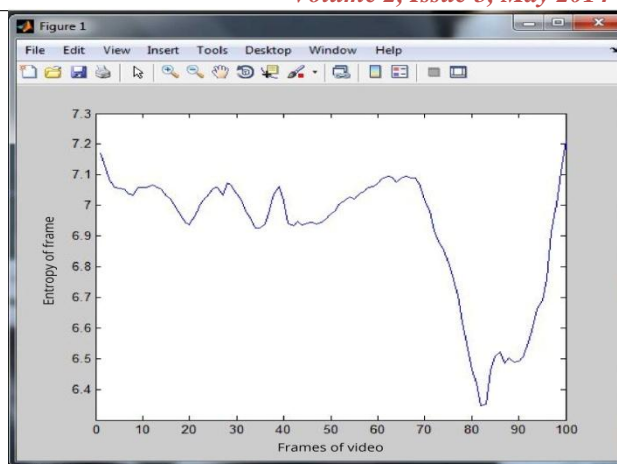


Fig. 8 Entropy v/s frame graph

TABLE I
THE PERFORMANCE COMPARISON WITH PREVIOUS METHODS

Algorithm	Machine Learning [2]	Fuzzy classifier
Method	Support Vector Machine	Rule based classifier
Learning	Supervised Learning	Unsupervised Learning
No. of Classes	2	10
Precious	100%	100%
Required Training Data	Yes	No
Support Vector	2	5
Video Generation	No	Yes
Entropy Calculation	No	Yes

VIII. CONCLUSION

Keyframe abstraction is useful for summarization of video. Fuzzy classifier is very effective technique to classify all the keyframes of video into various classes and it is better than support vector machine to classify keyframes. All classes give a summary of video in a form of keyframe. These keyframe gives summary of video that require less time and space. We will generate a short video from each class that are generated from video and compare to support vector machine. We will also get a keyframe from each class of video.

IX. FUTURE ENHANCEMENTS

This technique is implemented in one video. It is possible to classify multiple video and combine all frames them. After combining, they are separated into various classes and generate a one video. So that only one video provides a summary of big video or multiple video.

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