A Survey on Multimedia Mining

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Abstract— Over the past few decades, data quarrying or mining has been an effective approach for extracting concealed knowledge from huge collections of regulated digital data stored in databases. Multimedia data mining refers to the analysis of large amounts of multimedia information in order to find patterns or statistical relationships. Rapid changes in information technology have drastically changed the functions and activities of multimedia. It includes audio, video, speech, text, web, image and combinations of several types are becoming increasingly available and are almost unstructured or semi structured data by nature, which makes it difficult for human beings to extract the information without powerful tools.. This paper sight sees survey of the current state of multimedia data mining and knowledge discovery, data mining efforts aimed at multimedia data, current approaches and well known techniques for mining multimedia data.

Keywords— Data Mining, Multimedia Data Mining, Data Warehouse, Architectures, Applications, Models.

I. INTRODUCTION

Multimedia data mining is used for extracting interesting information for multimedia data sets, such as audio, video, images, graphics, speech, text and combination of several types of data set which are all converted from different formats into digital media . Multimedia mining is a subfield of data mining which is used to find interesting information of implicit knowledge from multimedia databases. Multimedia data are classified into five types; they are

(i) text data,

(ii) Image data

(iii) audio data

(iv) video data and

(v) electronic and digital ink .

Text data can be used in web browsers, messages like MMS and SMS.

Image data can be used in art work and pictures with text still images taken by a digital camera.

Audio data contains sound, MP3 songs, speech and music. *Video data* include time aligned sequence of frames, MPEG videos from desktops, cell phones, video cameras.

Electronic and digital ink its sequence of time aligned 2D or 3D coordinates of stylus, a light pen, data glove sensors,

graphical, similar devices are stored in a multimedia database and use to develop a multimedia system.

Since 1960s the research in the field of multimedia has initiated for combining different multimedia data into one application when text and images were combined in a document. During the research and development process of video synchronization of audio and animation was completed using a timeline to specify when they should be played. The difficulties of multimedia data capture, storage, transmission and presentation have been explored in the middle of 1990s where the multimedia standards MPEG-4, X3D, MPEG-7 and MX have continued to grow. These are reformed and clearly handled sound, images, videos, and 3-D (three-dimension) objects that combined by events, synchronization, scripting languages which describe the content of any multimedia object . For multimedia distribution and database applications different algorithms are required. Such a database can be queried, for example, with the SQL multimedia and application packages known as SQL/MM. Multimedia database system includes a multimedia database management system (MMDBMS) which handles and provides foundation for storing, manipulating and retrieving multimedia data from multimedia database . Multimedia data consists of structured data and unstructured data such as audio, video, graphs, images and text media.

II. DEFINITION OF MULTIMEDIA MINING

Multimedia mining is a subfield of data mining which is used to find interesting information of implicit knowledge from multimedia databases. Mining of multimedia data requires two or more data types such as text and video or text video and audio. Mining in multimedia is referred to automatic annotation or annotation.

Multimedia Data refers to data such as text, numeric, images, video, audio, graphical, temporal, relational and categorical data. Multimedia data mining refers to pattern discovery, rule extraction and knowledge acquisition from multimedia database .

Definition1. — Multimedia data mining is the discovery and study, by automatic or semi-automatic means, of large quantities of data in order to discover important patterns and rules.

Definition2. —Multimedia data mining is a subfield of data mining that deals with an extraction of implicit

knowledge, multimedia data connection or previous patterns not explicitly stored in multimedia database.
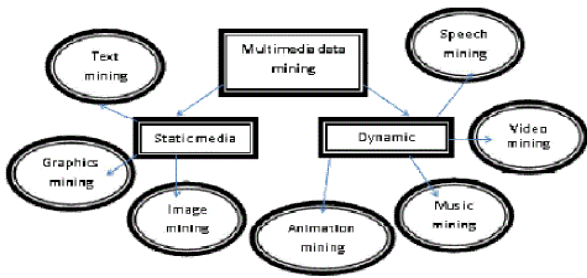

Fig.1 illustrates multimedia data mining, in particular, various aspects of multimedia data mining.

III. CATEGORIES

Multimedia data are classified into five types; they are (i) text data, (ii) Image data (iii) audio data (iv) video data and

1. Text Mining:

Text Mining also referred as text data mining and it is used to find meaningful information from the unstructured texts that are from various sources. Text is the foremost general medium for the proper exchange of information. Text Mining is to evaluate huge amount of usual language text and it detects exact patterns to find useful information.

2. Image Mining:

Image mining systems that can be automatically extracted from image data are increasingly in demand. The fundamental challenge in the image mining is to determine how the low level, pixel demonstration contained in a raw image or image sequence can be processed to identify high level spatial objects and correlation. Image mining is the concept used to detect patterns and extract data from images stored in the large data bases.

3. Audio Mining:

Audio mining plays an important role in multimedia applications, is a technique by which the content of an audio signal can be automatically searched, analyzed and rotten with wavelet transformation. Band energy, frequency centroid, zero crossing rate, pitch period and band-width are often used features for audio processing. It is generally used in the field of automatic speech recognition, where the analysis efforts to find any speech within the audio.

4. Video Mining:

Video contains a number of kinds of multimedia data for example text, image, metadata, visual and audio. It is regularly used in many major potential applications like security and surveillance, entertainment, medicine, culture programs and sports. The Aim of video data mining is to

discover and describe patterns from the large amount of video data as it is one of the core problem areas of data-mining research community. Compared to the mining of the additional types of data, video data mining is still in its immaturity.
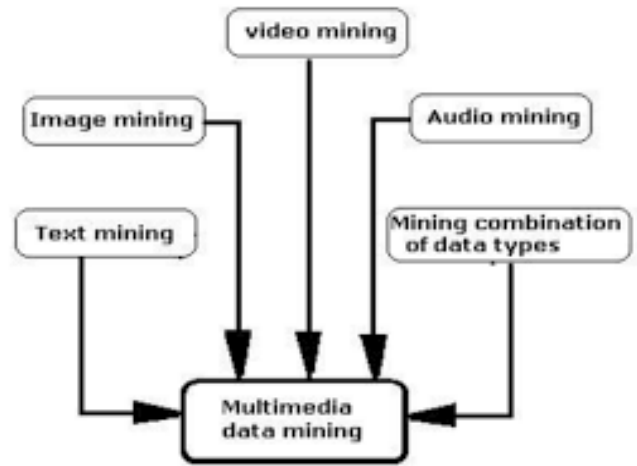

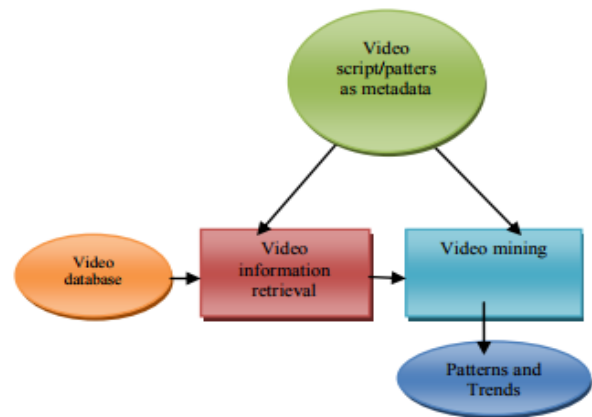
Fig.2 Categories of multimedia mining

Fig.3 Video Mining

IV. DATA MINING AND DATA WAREHOUSING

A. Data Mining:

Data Mining is defined as the procedure of extracting information from huge sets of data. In other words, we can say that data mining is mining knowledge from data. The information or knowledge extracted so can be used for any of the following applications −

- Market Analysis
- Fraud Detection
- Customer Retention
- Production Control
- Science Exploration

Extraction of information is not the only process we need to perform; data mining also involves other processes such as Data Cleaning, Data Integration, Data Transformation,

Data Mining, Pattern Evaluation and Data Presentation. Once all these processes are over, we would be able to use this information in many applications such as Fraud Detection, Market Analysis, Production Control, Science Exploration, etc.
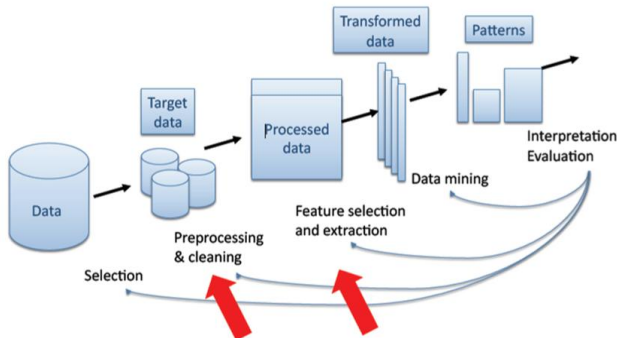

Fig.4 Data Mining

B. Data Warehouse:

A Data Warehouse consists of data from **multiple heterogeneous data sources** and is used for analytical reporting and decision making. Data Warehouse is a central place where data is stored from different data sources and applications.

The term Data Warehouse was first invented by Bill Inmom in 1990. A Data Warehouse is always kept separate from an Operational Database.

A Data Warehouse is used for reporting and analyzing of information and stores both historical and current data. The data in DW system is used for Analytical reporting, which is later used by Business Analysts, Sales Managers or Knowledge workers for decision-making.
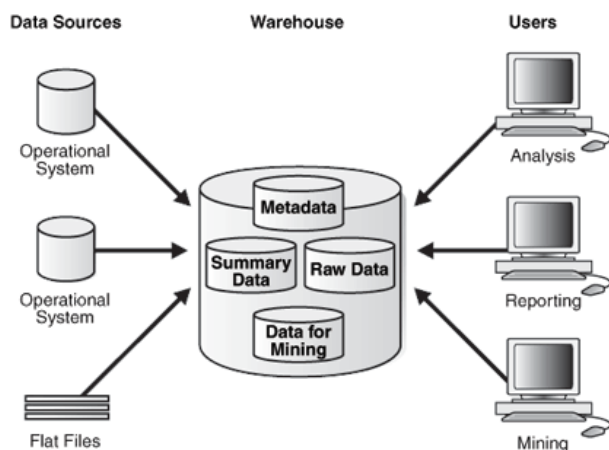

Fig.5 DataWarehouse

V.   ARCHITECHTURE

Various architectures are being examined to design and develop a multimedia data mining system. The first architecture includes the following. Extract data or

metadata from the unstructured database. Store the extracted data in structured database and apply data mining tools on the structured database.
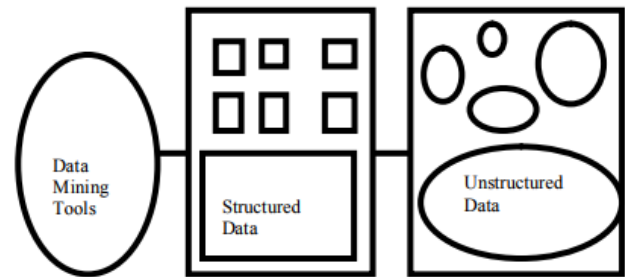

Fig.6 Converting unstructured data to

structured data for Mining.

Figure.7 present architecture of applying multimedia mining in different multimedia types. Data collection is the starting point of a learning system, as the quality of raw data determines the overall achievable performance. Then, the goal of data pre-processing is to discover important features from raw data. Data pre-processing includes data cleaning, normalization, transformation, feature selection, etc. Learning can be straightforward, if informative features can be identified at pre-processing stage. Detailed procedure depends highly on the nature of raw data and problem's domain. In some cases, prior knowledge can be extremely valuable.
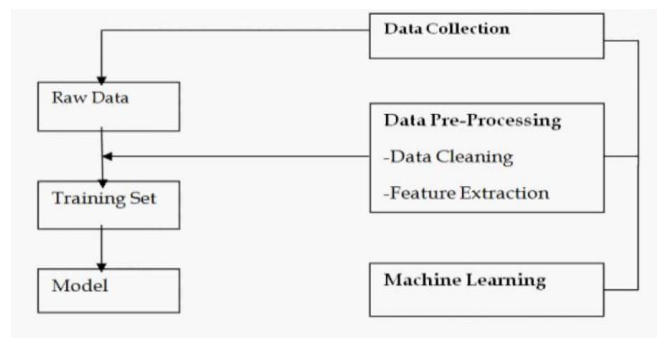

Fig.7 Architecture of multimedia mining

Multimedia mining architecture is given in Figure. The architecture has several components. Important components are:

(1) Input

(2) Multimedia Content

(3) Spatiotemporal Segmentation

(4) Feature Extraction

(5) Finding the similar Patterns and

(6) Evaluation of Results

1. Input stage comprises which multimedia database is used for finding the patterns and to perform data mining process.

2. Multimedia Content is the data selection stage which requires the user to select the databases, subset of fields or data to be used for data mining.

3. Spatio-temporal segmentation is nothing but moving objects in image sequences in the videos and it is useful for object segmentation.

4. Feature extraction is the pre-processing step that involves integrating data from various sources and making choices regarding characterizing or coding certain data fields to serve when inputs to the pattern finding stage.

5. Finding the similar pattern stage is the heart of the whole data mining process. The hidden patterns and trends in the data are basically uncovered in this stage. Some approaches of finding similar pattern stage contain association, classification, clustering, regression, time-series analysis and visualization.

6. Evaluation of Results is a data mining process used to evaluate the results and this is important to determine whether prior stage must be revisited or not. This stage consists of reporting and makes use of the extracted knowledge to produce new actions or products and services or marketing strategies.
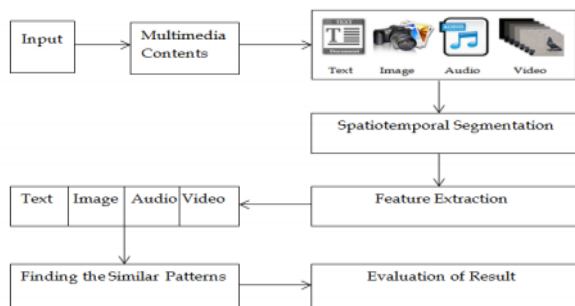

Fig.8 Multimedia Mining Architecture

VI. TASKS

Multimedia Data Cube:

- Model for multidimensional analysis of multimedia data;

- it is difficult to implement a data cube efficiently given the huge number of dimension.

- We may like to model color, course, texture, keywords, and so on. Many of the various dimensions in multimedia data cubes are of single, valued.

- e.g. one image may be matching to a set of keywords.

Feature extraction:

- Multimedia features are extracted from media sequences or collections converting them into numerical or representational form.

- Good features shall be able to capture the perceptual saliency, distinguish contents mantic, as well as being computationally and represent atonally economical.

Data Pre-processing:

- collecting data from similar sources and making choices about representing or coding certain data field is the task of this stage.

- It serves as input to the sample detection stage.

- Because certain fields may contain data at levels of details which are not considered suitable for the sample discovery stage representation other choices are needed.

Discovering Patterns:

- The sample discovery stage is the heart of the entire data mining process.

- Several approaches of the pattern discovery stage includes association, classification, clustering, regression, time-series study and visualization.

Interpretations:

- To evaluate the feature of discovery and its value to determine whether previous stage should be revisited or not this stage of data mining process is used.

Reporting and using discovered knowledge:

- This Last stage is reporting and putting to use the discovered knowledge to generate actions or products and services or marketing strategies as the case may be.

VII. MODELS OF MULTIMEDIA MINING

Commonly four different multimedia mining models have been used.

- Classification,

- Association Rule,

- Clustering and

- Statistical Modeling.

Classification :

- Classification produces a function that maps a data item into one of several predefined classes, by inputting a training data set and building a model of the class attribute based on the rest of the attributes.

- Decision tree classification has an intuitive nature that matches the user's conceptual model without

loss of accuracy. An example of this work is Hidden Markov Model used for classifying the multimedia data.

Association rule :

- An association rule is an expression of A->B, where A is a set of items, and B is a single item.

- Association rule methods are an initial data exploration approach that is often applied to extremely large data set.

- A recent work in this area is due to Lei Wang et. al. , who introduced a clustering method based on unsupervised neural nets and self-organizing maps.

Clustering:

- Cluster analysis divides the data objects into multiple groups or clusters.

- Cluster analysis combines all objects based on their groups.

- Clustering algorithms can be divided into several methods they are hierarchical methods, density-based methods, grid-based methods, and modelbased methods, k-means algorithm and graph based model.

- In multimedia mining, clustering technique can be applied to group similar images, objects, sounds, videos and texts.

Statistical Modeling:

- Statistical mining models are used to regulate the statistical validity of test parameters and have been used to test hypothesis, undertake correlation studies and transform and make data for further analysis.

- This is used to establish links between words and partitioned image regions to form a simple co-occurrence model.

VIII. APPLICATIONS

- Digital Library

- Traffic Video Sequences

- For Automated event analysis of suspicious movements

- Medical Analysis

- Customer Perception

- Media Making and Broadcasting

- Customer Insight

- Surveillance system

A. In Digital Libraries:

The retrieval collection storage and preservation of digital data is performed in the digital library. To fulfil this purpose, there is a need to convert different formats of information such as text, images, video, audio, etc. While conversion of the multimedia files into the libraries data mining techniques are popular.

B. For Traffic Video Sequences:

To discover important but previously unknown knowledge the analysis and mining of traffic video sequences such as vehicle identification, traffic flow, queue temporal relations of the vehicle at intersection, provides an economic approach for daily traffic monitoring operations.

C. For Automated event analysis of suspicious movements: Surveillance system to monitor movements of employees, visitors and machines are used in many government organizations, multi-nationals companies, shopping malls, banks. Which has an ultimate objective to detect suspicious person based on their movements to maintain security and avoid any casualty?

D. In medical analysis:

Multimedia mining is primarily used in the *me*dical field and particularly for analyzing medical images. Various data mining techniques are used for image classification. For example, Automatic 3D delineation of highly aggressive brain tumors, Automatic localization and identification of vertebrae in 3D CT scans, MRI Scans, ECG and X-Ray. Application of Data Mining techniques for Medical Image Classification is used.

E. Customer Perception:

It contains details about customers opinions, products or services, customers complaints, customers preferences, and the level of customer's satisfaction of products or services which are collected together. Many companies have call centers that receives telephone calls from the customers. The audio data serves as topic detection, resource assignment

and evaluation of quality of services.

F. Media Production and Broadcasting:

Proliferation of radio stations and TV channels makes broadcasting companies to search for more efficient approaches for creating programs and monitoring their content.

G. Customer Insight:

It includes collecting and summarizing information about customer's opinions, products or services, customers' complains, customer's preferences, and the level of customer's satisfaction of products or services. Many companies have help desks or call centres that accept

telephone calls from the customers. The audio data serve as an input for data mining to pursue the following goals: Topic detection Resource assignment Evaluation of quality of service.

H. Surveillance:

Surveillance consists of collecting, analyzing, and summarizing audio, video, or audiovisual information about a particular area, such as battlefields, forests, agricultural areas, highways, parking lots, buildings, workshops, malls, retail stores, offices, homes, etc. Which is associated with intelligence, security, and law enforcement and the major uses of this technology are military, police, and private companies that provide security services.

There are several goals of surveillance data mining:

1. Objector event detection/recognition

2. Summarization

3. Monitoring

IX.   CONCLUSION

This proposes a survey of multimedia data mining. The key idea is to provide review of MULTIMEDIA DATAMINING, which is an active and growing area of research. First described the motivation for multimedia-data mining with applications and then discussed different approaches for mining multimedia mining. This also describes well known techniques for multimedia mining.

X.   FUTURE SCOPE

This review provides analysis of MULTIMEDIA DATA MINING, methods for MULTIMEDIA DATAMINING and compares the result of them. In future we explore the effect of Multimedia techniques on multimedia database to mine the multimedia components and improve the multimedia database environment. Researchers in multimedia information systems, in the search of techniques for improving the indexing and retrieval of multimedia information, are looking for new methods for discovering indexing information.

REFERENCES

[1] Mylavarapu Kalyan Ram, M.Venkateswara Rao," An Overview on Multimedia Data Mining and Its Relevance Today" International Journal of Computer Science Trends and Technology (IJCST) – VOL 5, Issue 3, May – June 2017.

[2] Ankita R. Makode, Arvind S. Kapse, "Knowledge Discovery using Various Multimedia Data Mining Technique", International Journal on Recent and Innovation Trends in Computing and Communication[IJRITCC] VOL.3, Issue 3, March 2015.

[3] S. VijayaRani, A. Sakila, "Multimedia Mining Research – An Overview ", International Journal of Computer Grapics & Animation[IJCGA] VOL.5, No. 1, January 2015.

[4] Manjunath R, S. Balaji , "Review and Analysis of Multimedia Data Mining Tasks and Models ", International Journal of Innovative Research in Computer and Communication Engineering (An ISO 3297: 2007 Certified Organization) VOL.2, PP-124-130, Special Issue 2, May 2014.

[5] Manjunath T. N, Ravindra S Hegadi, Ravikumar G K (November 2010) "A Survey on Multimedia Data Mining and its Relavance Today", International Journal of Computer Science and Network Security [IJCSNS], VOL. 10 No. 11, PP-165-170.