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PART - III

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Multimedia Data Mining

Ms. Krutika H. Churi

Dept. of I.T, Sonopant Dandekar Arts, V. S. Apte Commerce & M. H. Mehta Science College, Tal & Dist-Palghar, Maharashtra

Abstract

Data mining has become more popular for extracting knowledge from multimedia data sets such as audio, video, speech, text, web, image and a combination of several types of these data sets. These are increasingly available and are semi-structured data or unstructured data. This poses a great challenge to manually extract the hidden, useful knowledge embedded within the multimedia collections without the use of new techniques and powerful tools. This challenge drives the need to develop data mining tools and techniques which can be used for the above mentioned types of data sets. This paper presents a review and analysis on the state-of-the-art in the field of multimedia data mining and knowledge discovery, advanced technologies, and data mining approaches that are useful for decision making applications and researchers.

Keywords: Introduction, Applications of Data Mining, Multimedia Data mining, KDD Process.

Introduction

Data mining is the process of discovering patterns in large data sets. It is an interdisciplinary subfield of Computer Science. Data Mining is the Computational Process of discovering Pattern in Large Data Sets involving Method at the intersection of artificial intelligence, machine learning statistics and Database Systems. The Overall goal of the Data Mining process is to extract information from a data set and transform it into an understandable structure for further use.

Applications of Data Mining :

1. Data Mining Applications in Sales/Marketing

Data mining enables businesses to understand the hidden patterns inside historical purchasing transaction data. Data mining is used for Market Basket Analysis to provide information on what product combinations were purchased together when they were bought and in what sequence. This information helps businesses promote their most profitable products and maximize the profit. In addition, it encourages customers to purchase related products that they may have been missed or overlooked.

2. Data Mining Applications in Health Care and Insurance

Data mining is applied in insurance industry lately but brought tremendous competitive advantages to the companies who have implemented it successfully. The data mining applications in insurance industry are listed below:

Data mining is applied in claims analysis such as identifying which medical procedures are claimed together.

Data mining enables to forecasts which customers will potentially purchase new policies. Data mining allows insurance companies to detect risky customers' behaviour patterns. Data mining helps detect fraudulent behavior.

3. Data Mining Applications in Education

There is a new emerging field, called Educational Data Mining, concerns with developing methods that discover knowledge from data originating from educational Environments. The goals of EDM are identified as predicting students' future learning behaviour, studying the effects of educational support, and advancing scientific knowledge about learning. Data mining can be used by an institution to take accurate decisions and also to predict the results of the student. With the results the institution can focus on what to teach and how to teach. Learning pattern of the students can be captured and used to develop techniques to teach them.

4. Data Mining Applications in Manufacturing Engineering

Knowledge is the best asset a manufacturing enterprise would possess. Data mining tools can be very useful to discover patterns in complex manufacturing process. Data mining can be used in system-level designing to extract the relationships between product

architecture, product portfolio, and customer needs data. It can also be used to predict product development span time, cost, and dependencies among other tasks.

Multimedia Data Mining

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 four types; they are (i) text data, (ii) Image data (iii) audio data (iv) video data.

Categories Of Multimedia Data Mining

The multimedia data mining is classified into two broad categories as static media and dynamic media. Static media contains text (digital library, creating SMS and MMS) and images (photos and medical images). Dynamic media contains Audio (music and MP3 sounds) and Video (movies). Multimedia mining refers to analysis of large amount of multimedia information in order to extract patterns based on their statistical relationships. Figure 1 shows the categories of multimedia data mining.

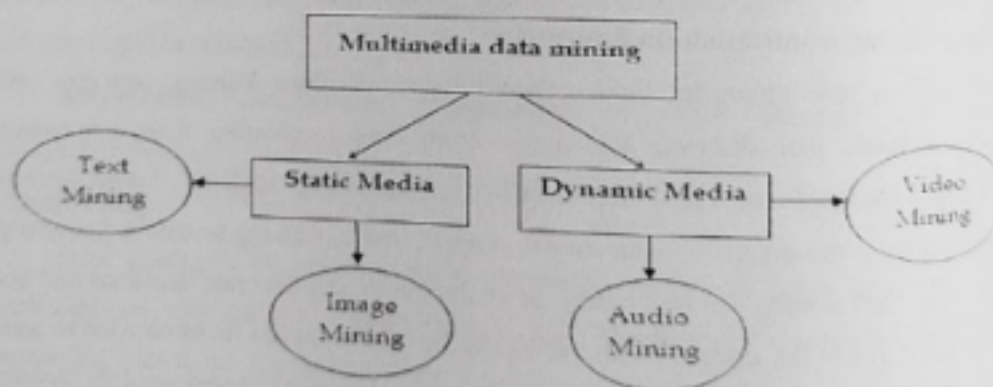


Figure 1. Categories of Multimedia Data Mining

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.

Image mining

Image mining systems can discover meaningful information or image patterns from a huge collection of images. Image mining determines how low level pixel representation consists of a raw image or image sequence can be handled to recognize high-level spatial objects and relationship . It includes digital image processing, image understanding, database, AI and so on.

Video Mining

Video mining is unsubstantiated to find the interesting patterns from large amount of video data; multimedia data is video data such as text, image, and metadata, visual and audio. The processing are indexing, automatic segmentation, content-based retrieval, classification and detecting triggers. It is commonly used in various applications like security and surveillance, entertainment, medicine, sports and education programs.

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.

Overview of the KDD Process

The term *Knowledge Discovery in Databases*, or KDD for short, refers to the broad process of finding knowledge in data, and emphasizes the "high-level" application of particular data mining methods. It is of interest to researchers in machine learning, pattern recognition, databases, statistics, artificial intelligence, knowledge acquisition for expert systems, and data visualization. The unifying goal of the KDD process is to extract knowledge from data in the context of large databases. It does this by using data mining methods (algorithms) to extract (identify) what is deemed knowledge, according to the specifications of measures and thresholds, using a database along with any required preprocessing, subsampling, and transformations of that database.

The overall process of finding and interpreting patterns from data involves the repeated application of the following steps:

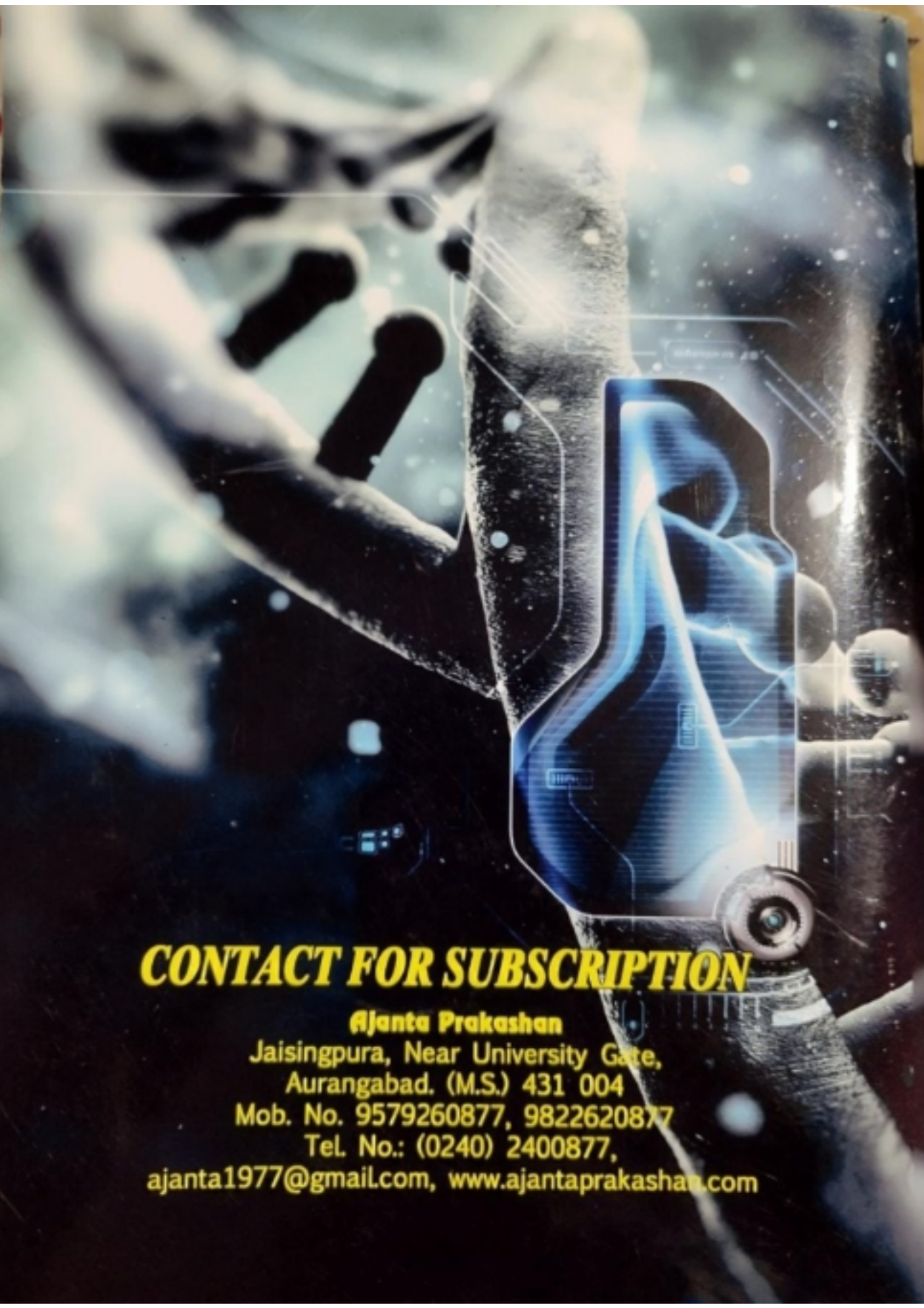
1. Developing an understanding of
 - o the application domain
 - o the relevant prior knowledge
 - o the goals of the end-user
2. Creating a target data set: selecting a data set, or focusing on a subset of variables, or data samples, on which discovery is to be performed.
3. Data cleaning and preprocessing.
 - o Removal of noise or outliers.
 - o Collecting necessary information to model or account for noise.
 - o Strategies for handling missing data fields.
 - o Accounting for time sequence information and known changes.
4. Data reduction and projection.
 - o Finding useful features to represent the data depending on the goal of the task.
 - o Using dimensionality reduction or transformation methods to reduce the effective number of variables under consideration or to find invariant representations for the data.
5. Choosing the data mining task.
 - o Deciding whether the goal of the KDD process is classification, regression, clustering, etc.
6. Choosing the data mining algorithm(s).
 - o Selecting method(s) to be used for searching for patterns in the data.
 - o Deciding which models and parameters may be appropriate.
 - o Matching a particular data mining method with the overall criteria of the KDD process.
7. Data mining.
 - o Searching for patterns of interest in a particular representational form or a set of such representations as classification rules or trees, regression, clustering and so forth.
8. Interpreting mined patterns.
9. Consolidating discovered knowledge.

Conclusion:

History shows that we have witnessed revolutionary changes in research. Data mining is helpful in data cleaning, data pre-processing and integration of databases. The researchers can find any similar data from the database that might bring any change in the research. Identification of any co-occurring sequences and the correlation between any activities can be known. Data visualisation and visual data mining provide us with a clear view of the data. Multimedia mining is one of the important and challenging research domains in the field of computer science. The key idea is to provide review of MDM, which is an active and growing area of research. We first described the motivation for multimedia-data mining with applications and then discussed different approaches for mining multimedia mining. This paper also describes well known techniques for multimedia mining.

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CONTACT FOR SUBSCRIPTION

Ajanta Prakashan

Jaisingpura, Near University Gate,
Aurangabad. (M.S.) 431 004

Mob. No. 9579260877, 9822620877

Tel. No.: (0240) 2400877,

ajanta1977@gmail.com, www.ajantaprakashan.com