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A STUDY ON APPLICATION OF DATA AND WEB MINING TECHNIQUES TO ENRICH USER EXPERIENCE IN LIBRARIES AND ONLINE BOOK STORES

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ABSTRACT

Data mining is a new developing research discipline and it is also a subdivision of Business Intelligence. It has attracted a great deal of attention in the Information Technology and in the society as a whole in recent years, due to the availability of a wide range of huge amount of heterogeneous data. To mine this available huge data to make it usable and presentable, and giving right solution to a particular problem with it is a big real challenge. Library and information services in schools, colleges, universities, corporations and communities obtain information about their users, circulation history, resources in the collection, and search patterns. Now-a-days many libraries have taken advantage of these data as a way to improve reader service, managing budgets, and influence strategic decision-making about uses of MIS in their organizations. The Library Management System Software has the ability to display the details of the books available in various departments, the transactions of books and about the book holders. It enables online reservation of books. It also enables a fully automated library service, which makes the library processes easier and systematic. This paper presents an overview of the data mining, web mining concepts and their application in the library data sources and Library Management Systems. The paper also tries to identify the suitable applications of data mining techniques in the library.

KEYWORDS

Data Mining , Web Mining , Library Management System

INTRODUCTION

Library management software is the software which is used to do library housekeeping activities and other work like accessioning, cataloguing, indexing etc. Library management System provides a simple Graphical User Interface for the Library Staff to manage the functions of the library effectively. Usually when a book is returned or issued, it is noted down in register after which data entry is done to update the status of the books in moderate scale. This process takes some time and proper updating cannot be guaranteed. Such anomalies in the updating process can cause loss of books. So a more user friendly interface which could update the database instantly has a great demand in libraries. Its main objective is to provide all the functions of the library along with support of barcode reader. The contemporary system stores the database information on a local computer, which can't be updated and accessed on a remote computer or a computer in the library network.

Many library systems are operated manually by a group of people. In such situations many people are involved in the process of managing the library. The library works are shared among the workers in such a way that different workers will engage in doing different works like keeping records regarding the books and students (borrowers), check the books manually, keep records on issued books etc. All these things have to be carried out manually and if the library is large then content handling becomes a big problem. On the other hand keeping large amount of maintenance workers may not be a cost efficient proposition for the libraries. Manual record keeping is also not a reliable method as people tend to forget things. On the borrower's point of view, in manual system borrower can't find a book exactly at once as they are not ordered well. Sometimes user might be searching for a book that is not available in the library. In such situations people get annoyed or depressed. Therefore there should be a reliable way to manage the library system.

Most LMS performs a prescribed set of functions including the material acquisitions, ordering, receiving, invoicing, and cataloguing classifying and indexing materials, lending materials to patrons and receiving them back, assigning serials for tracking magazines and newspaper holdings etc. Each patron and item has a unique ID in the database that allows the ILS to track its activity. However there are lots of other issues related with library management which is not addressed with the present LMS packages such as Digital preservation and licensing of copyrighted material. This paper deals with how we are overcoming these issues with the help of new information technology applications.

BUSINESS INTELLIGENCE

Business intelligence mainly refers to computer-based techniques used in identifying, extracting and analyzing business data, such as sales revenue by products and/or departments, or by associated costs and incomes. These technologies provide historical, current and predictive views of business operations. Common functions of business intelligence technologies are reporting, online analytical processing, analytics, data, process mining, complex event processing, business performance management, benchmarking, text mining and predictive analytics. Data mining as a concept of business intelligence has the power to harness the hidden knowledge present in the huge data which is collected at point of sales. Generally Data dictionary is data about data also called Meta data, here this data gives valuable information, required to understand the customers buying patterns, key performance indicators which helps retailers in making decision such as catalog design, cross-marketing and customer shopping behavior analysis.

DATA MINING

Data mining refers to extracting or mining knowledge from large amounts of data. The term is actually a misnomer. Remember that the mining of gold from rocks or sand is referred to as gold mining rather than rock or sand mining. This, data mining should have been more appropriately named knowledge mining from data, which is unfortunately somewhat long. Knowledge mining a shorter term may not reflect the emphasis on mining from large amounts of data. Nevertheless, mining is a vivid term characterizing the process that finds a small set of precious nuggets from a great deal of raw material. Thus, such a misnomer that carries both data and mining became a popular choice. Many other terms carry a similar or slightly different meaning of data mining, such as knowledge mining from data, knowledge extraction, data pattern analysis, data archaeology, and data dredging many people treat data mining as a synonym for another popularly used term, knowledge discovery from data, or KDD. Alternatively, others view data mining as simply an essential step in the process of knowledge discovery.

The following figure presents the structure of the data mining process in a library context.

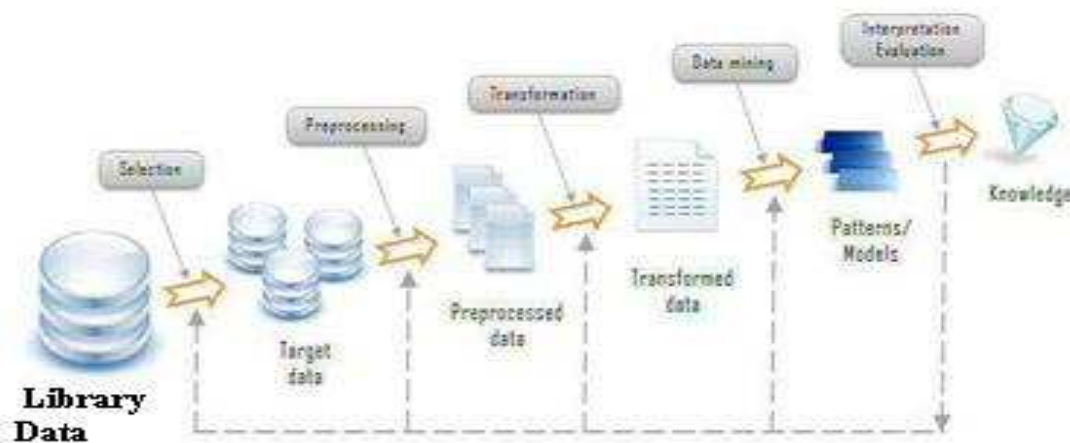


Fig. 1.0

Steps 1 to 4 are different forms of data preprocessing, where the data are prepared for mining. The data mining step may interact with the user or a knowledge base. The interesting patterns are presented to the user and may be stored as new knowledge in the knowledge base. Note that according to this view, data mining is only one step in the entire process, albeit an essential one because it uncovers hidden patterns for evaluation.

Data mining is process of discovering interesting knowledge form large amounts of data stored in databases, data warehouses, or other information repositories.

KNOWLEDGE DISCOVERY PROCESS IN LIBRARY MANAGEMENT SYSTEM

The following steps are involved in the knowledge discovery process in a library data mining application.

1. Data Cleaning

This is the first step in the mining process. The data available should be cleaned to remove the inconsistencies and redundancies using appropriate tools.

2. Data Integration

In this stage, data available in the multi library environment is combined using the data integration tools.

3. Data Selection

In this stage the huge volume of integrated data is screened with preset conditions to select the appropriate data that would be useful for meaningful analysis

4. Data Transformation

It is at this stage that the selected data is transformed or consolidated according to the user preferences into forms appropriate for mining by performing summary or aggregation operations.

5. Data Mining

This is an essential process where intelligent analytical methods are applied in order to extract data patterns from huge volume of Library data.

6. Pattern Evaluation

The objective of this step is to identify the truly interesting patterns representing knowledge based on some interesting measures.

7. Knowledge Presentation

This is the last stage is the mining process where visualization and knowledge representation techniques are used to present the mined knowledge to the user or librarian with help of different reports like Online Member Details Report.

OTHER TECHNIQUES IN DATA MINING WHICH ALSO APPLY IN LIBRARY MANAGEMENT SYSTEM

ASSOCIATION

Identification of frequent patterns is one of the basic requirements of any data mining system. As the name suggests, they are the patterns that occur frequently in the organized data. There are many kinds of frequent patterns, including item sets, subsequences, and sub structures.

A frequent item set typically refers to a set of items that frequently appear together in a transactional data set. In library context this may be the books or articles that are jointly taken for use by different users. A frequently occurring subsequence that can be observed in the library context may be a pattern that users tend to borrow first a book on a particular discipline followed by a book of some other discipline.

A substructure can refer to different structural forms, such as graphs, trees or lattices, which may be combined with item sets or subsequence. If a substructure occurs frequently, it is called a frequent structured pattern.

Mining frequent patterns leads to the discovery of interesting associations and correlations within data. This is what is called in business intelligence as the market basket analysis. This technique can be profitably applied to library on line book selling and purchasing. The association techniques in data mining can be used to identify and track the books by author, publishing date and the relationship among the various attributes. Using the Apriori algorithm in the association rule can effectively tap valuable information lying latent in the voluminous data, and provide efficient decision support for the library services and help libraries to carry out personalized information services and book lending services.

CLASSIFICATION

Classification is a classic data mining technique based on machine learning. Basically classification is used to classify each item in a set of data into one of predefined set of classes or groups. Classification method makes use of mathematical techniques such as decision trees, linear programming, neural network

and statistics. In classification, we make the software that can learn how to classify the data items into groups. For example, user can apply classification in application that gives the past records of all employees who left the institute or library, and predict which current employees are probably to leave in the future. In this case, we divide the employee records into two groups namely left and staying. And then user can use the data mining software to classify the employees into each group. One application of the classification techniques in libraries is Book Cataloging

CLUSTERING

Clustering is a data mining technique that makes meaningful or useful cluster of objects that have similar characteristics using automated techniques. Clustering is different from classification. In Clustering the classes are defined automatically by the data mining application and the objects are assigned to the respective classes whereas in classification objects are assigned into predefined (user defined) classes. To make the concept clearer, sorting of books in a library can be taken as example. In a library, books in a wide range of topics are available. The challenge is how to keep those books arranged in such a way that readers can take several books in a specific topic without hassle. By using clustering technique, user can keep books that have some kind of similarities in one cluster or one shelf and label it with a meaningful name. If readers want to grab books in a topic, he or she would only go to that shelf instead of looking the whole in the whole library. Clustering is the one of the best techniques in data mining to group information of members in the Library.

PREDICTION

The prediction as the name implied is one of a data mining techniques that discovers relationship between independent variables and dependent variables. For instance, prediction analysis technique can be used in sales to predict profit for the future. If sales are an independent variable, profit could be a dependent variable. Then based on the historical sale and profit data, user can draw a fitted regression curve that is used for profit prediction. Prediction analysis in data mining can be used to analyze the readers' usage rate, analysis of their status.

SEQUENTIAL PATTERNS

Sequential patterns analysis is one of data mining technique that seeks to discover similar patterns in data transactions over a business period. The uncovered patterns are used for further business analysis to recognize relationships among data. Sequential patterns analysis can be used in libraries to find an e book and reviews by past readers or to view a current list of the top-rated titles based on the user history if they follow any specific pattern to select the book for reading. How they review of a e-book and share their opinions with other readers here also find the any pattern or relation is appeared in the reviewer.

PATH ANALYSIS

Path analysis is tool in the internet website analytics. It is the process of determining the sequence of pages visited in a visitor session prior to some desired event, such as the lending a book to visitor or the visitor requesting a newsletter. The precise order of pages visited may or may not be important and may or may not be specified. In practice, this analysis is done in aggregate, ranking the paths (sequences of pages) visited prior to the desired event, by descending frequency of visits. The path analysis is very helpful in exploring the library data about user URL information concerning access to electronic sources. It allows the user to identify the distribution of patrons who log in to the library website and from where they login. Also, Path Analysis provides us with a count of the number of times each link has occurred in the dataset and a list of association rules.

OPERATIONS ANALYSIS (how related to library)

By frequently identifying purchased combinations of products, book sellers can help improve their store layout and assortment planning. Basket analysis can drive promotional campaigns and help to measure the effectiveness of marketing initiatives. In addition, better analysis of in-store operations can improve staff planning to maximize efficiency and cut staffing costs.

CUSTOMER MANAGEMENT ANALYSIS

Business intelligence can help **book sellers** or retailers improve customer targeting, revenue management, customer knowledge management, and multichannel integration. By analyzing transactional data during the day, book sellers or retailers can identify differences in customer profiles, while real-time tools help stores adapt prices to match demand patterns and improve profitability. Critically, by understanding how personal priorities affect shopping habits, book sellers or retailers can also anticipate customer or reader needs to provide more appropriate services and products.

EVENT ANALYSIS

In a library any occurrence of theft or internal frauds need to be identified as quickly as possible. Data mining analytics can help control such occurrence by pinpointing exceptional events quickly and help librarian sort any problems out rapidly.

TREND ANALYSIS

With accurate analysis of stock-outs, libraries can make use of the demand forecasting techniques to improve their books availability and manage their stock levels. At the same time, by assessing the impact on readers demand patterns of removing slow-accessing book form the rack, librarian can gain insights to optimize readers' satisfaction and stock turn.

SUPPLY CHAIN ANALYSIS

Real time traceability is essential for book sellers who want to respond quickly to changing demand. Business intelligence can help book sellers attain a clearer view of their supply chain and even re-route global consignments to accelerate deliveries as necessary.

CATEGORY AND EVENT ANALYSIS

Using business intelligence tools in event monitoring, category management, and new book introductions is vital. Book Sellers or Librarian need to be able to share information between the point of sale and publishers so that forecasts can be shared and performance accurately mapped to maximize sales opportunities. In addition, new book releasing and the impact of promotions need to be quickly analyzed so that book shops can maintain a competitive edge.

SUPPLIER RELATIONSHIP ANALYSIS

Successful replenishment often depends on the efficiency of the book publishers, whole sellers and third-party logistics providers. Sharing accurate performance data with suppliers or book sellers can help avert queries over service level agreements and provide a common basis for mutual improvement.

COLLABORATIVE ANALYSIS

Real-time analysis of user demand improves order management and can help streamline production and cut lead times. With the seamless exchange of information between the store and the supplier, everyone in the supply chain has access to the same product data, at the same time, to reduce errors and duplicated effort. A common frame-work for discussion can be established. To keep pace with their competitors, and retailers, book sellers must ensure that their technology infrastructure can support initiatives to understand readers preferences and consequently increase sales.

WEB MINING IN LIBRARY

Web mining is one of the major and important sub divisions of data mining. Some of the tools which are popular in usage for online libraries include web usage analyzers, site maintainers, and pre fetched systems. Most of the data mining techniques are applied on contents, structures and log files of web sites. Web usage analyzers are mainly used to improve the performance of the web pages, personalization of the web pages etc., Web log analysis mainly focuses on the web log files and their structures. It is one the key areas of web log mining system. It is used to record users' browsing information on web servers. When a user visits a webpage for the first time his/her profile information can be stored into separate web log file and a new log record is generated every time the user access the libraries webpage. Each log record will contain users' behavior, user name, access time, information searched are stored in separate log. Using data preprocessing techniques the above log files can be analyzed to identify patterns of user behaviour and user perception over internet library system.

CONCLUSION

This paper introduces the theoretical basics of data mining and web mining. With the information overload, Web log mining is a new and promising research avenue which could help users in gaining valuable insights into overwhelming information available on the Web. Data mining is a relatively new research area, which has a broad development and application. Data mining is an evolving area where many problems are yet to be solved through in-depth research studies. The Librarians should know the latest trends and technology to improve the efficacy of the libraries. At the same time libraries must also continue to protect their users and employees from misuse of personally identifiable data records. In the current setup libraries have to compete against online booksellers,

downloadable audio books, and the vast supply of “free” information of varying quality from the Internet. librarians must begin to take the initiative in using their systems and data for competitive advantage and to justify continued support and funding of libraries. The various data mining tools were explored in the above paper which could be used to mine the potential information from the library data with the objective of boosting the readers’ interest, confidence and satisfaction.

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