1. Mining Object and Multimedia
2. Web-mining
3. Time-series data mining

1. Mining Object and Multimedia

- Multimedia data mining is a popular research domain which helps to extract interesting knowledge from multimedia data sets such as *audio, video, images, graphics, speech, text and combination of several types of data sets.*
- Normally, multimedia data are categorized into unstructured and semi-structured data.
- These data are stored in multimedia databases and multimedia mining is used to find useful information from large multimedia database system by using various multimedia techniques and powerful tools.
- Multimedia database system stores and manages a large collection of multimedia data e.g. audio, video, images, graphics, speech, text
- Image/multimedia mining deals with extraction of implicit/ unknown knowledge, data relationship or other patterns not explicitly stored in images/multimedia
- The fundamental challenges in images mining is to determine the low-level pixel representation contained in an image or image sequence and can be effectively and efficiently processed to identify high level spatial objects and relationships.
- Typical image/multimedia processing involves preprocessing, transformations and feature extraction mining, evaluation and interpretation of the knowledge.
- Different data mining techniques can be used such as association rules, clustering.

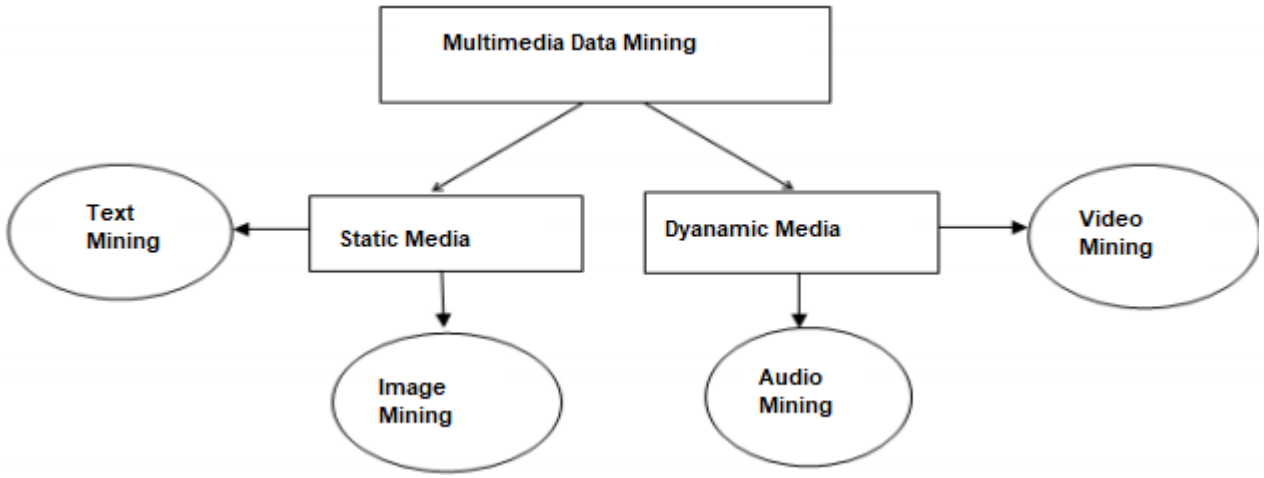


Fig: Categories of Multimedia Data Mining

- **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** 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** 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 is 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** 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*

Multimedia Data Mining Process

- **Data Collection**: is the initial stage of the learning system;
- **Pre-processing**: is to extract significant features from raw data, it includes *data cleaning, transformation, normalization, feature extraction*, etc.
- **Machine Learning:** Learning can be direct, if informative types can be recognized at pre-processing stage.
- **Training Set:** Complete process depends extremely on the nature of raw data and difficulty's field. The product of pre-processing is the training set.
- **Model**: Specified training set, a learning model has to be selected to learn from it and make multimedia model is more constant

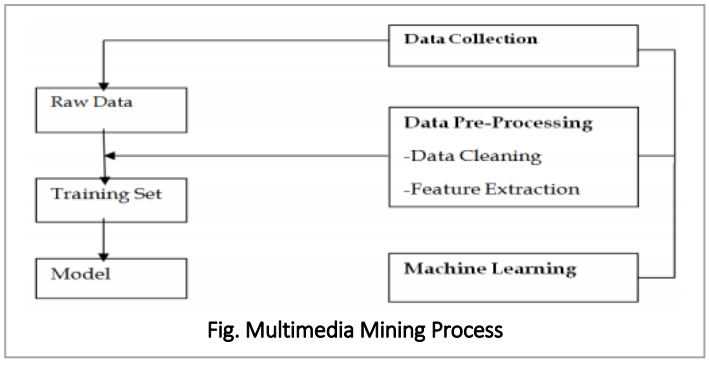


Fig. Multimedia Mining Process

ARCHITECTURES FOR MULTIMEDIA DATA MINING

1. **Input** stage includes 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. Such representation of choices is required because certain fields could include data at various levels and not considered for finding the similar pattern 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

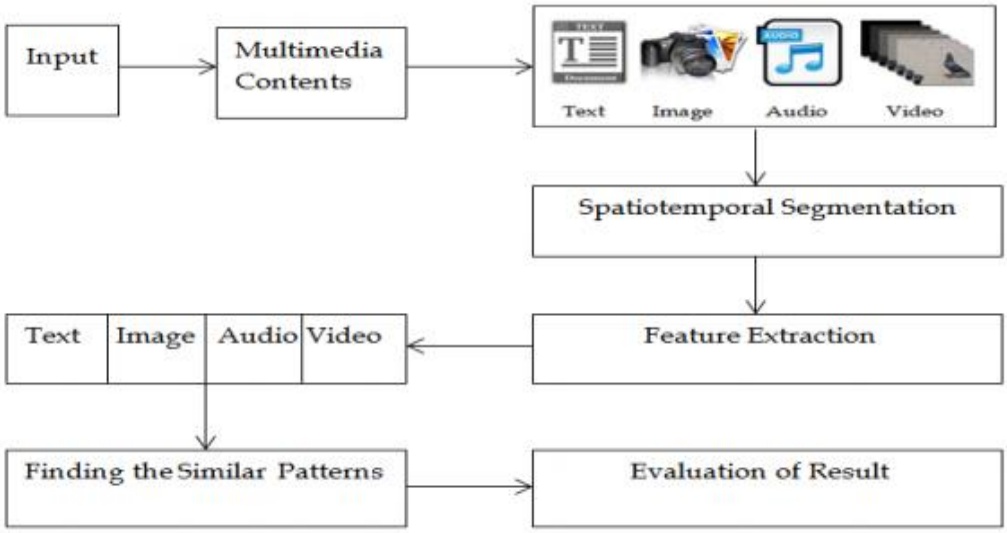


Fig: Multimedia Data Mining Architecture

MODELS FOR MULTIMEDIA MINING

- **Classification**: can learn from every property of a specified set of multimedia
- **Association Rule**: is used to display the multiple reports for the same image
- **Clustering**: 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

Applications of Multimedia Mining

- **Digital Library**: The collection of digital data are stored and maintained in digital library, which is essential to convert different formats of digital data into text, images, video, audio, etc.
- **Traffic Video Sequences**: In order to determine important but previously unidentified knowledge from the traffic video sequences, the detailed analysis and mining to be performed based on vehicle identification, traffic flow, and queue temporal relations of the vehicle at intersection.
- **Medical Analysis**: Multimedia mining is primarily used in the medical 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.
- **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.
- **Media Making and Broadcasting**: Radio stations and TV channels creates broadcasting companies and multimedia mining can be applied to monitor their content to search for more efficient approaches and improve their quality.
- **Surveillance system**: It consists of collecting, analyzing, summarizing audio, video or audio visual information about specific areas like government organizations, multi-national companies, shopping malls, banks, forest, agricultural areas and highways etc. The main use of this technology in the field of security hence it can be utilized by military, police and private companies since they provide security services.

2. Web-mining

Web mining is an important tool to gather knowledge of the behaviour of Websites' visitors and thereby to allow for appropriate adjustments and decisions with respect to Websites' actual users and traffic patterns. Web mining consists of three major parts: collecting the data, preprocessing the data and extracting and analyzing patterns in the data.

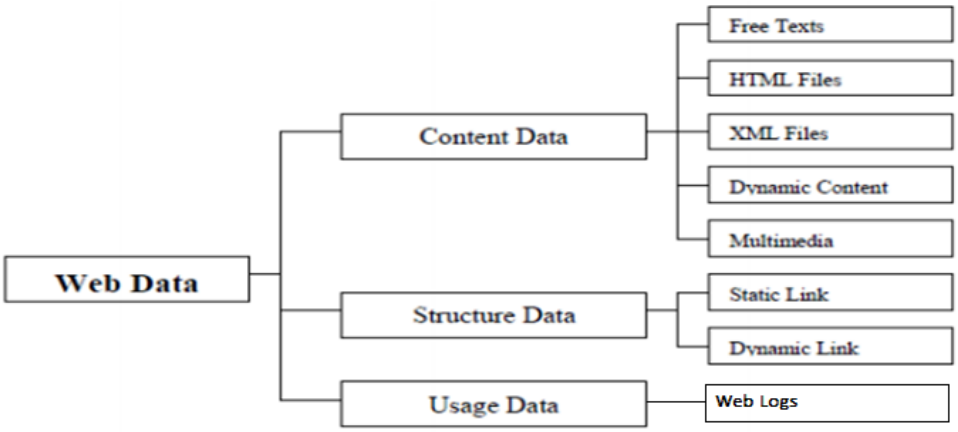


Fig. Types of Web Data

Along with a description of the processes involved in Web mining [Srivastava, 1999] states that "Website Modification, System Improvement, Web Personalization and Business Intelligence are four major application areas for Web mining." These are briefly described in the following sections.

a. **Website Modification** The content and structure of the Website is important to the user experience/impression of the site and the site's usability. The problem is that different types of users have different preferences, background, knowledge etc. making it difficult (if not impossible) to find a design that is optimal for all users. ***Web usage mining*** can then be used to detect which types of users are accessing the website, and their behaviour, knowledge which can then be used to manually design/re-design the website, or to automatically change the structure and content based on the profile of the user visiting it.
b. **System Improvement** The performance and service of Websites can be improved using knowledge of the Web traffic in order to predict the navigation path of the current user. This may be used e.g. for cashing, load balancing or data distribution to improve the performance. The path prediction can also be used to detect fraud, break-ins, intrusion etc.
c. **Web Personalization** Web Personalization is an attractive application area for Web based companies, allowing for recommendations, marketing campaigns etc. to be specifically customized for different categories of users, and more importantly to do this in real-time, automatically, as the user accesses the Website. For example, web mining uses association rules and clustering for grouping users and discover the type of user currently accessing the Website (based of the user's path through the Website), in real-time, to dynamically adapt hyperlinks and content of the Website.
d. **Business Intelligence:** Web mining is a powerful tool to collect business intelligence to get competitive advantages. Patterns of the customers' activities on the Website can be used as important knowledge in the decision-making process, *e.g. predicting customers' future behaviour, recruiting new customers and developing new products* are beneficial choices.

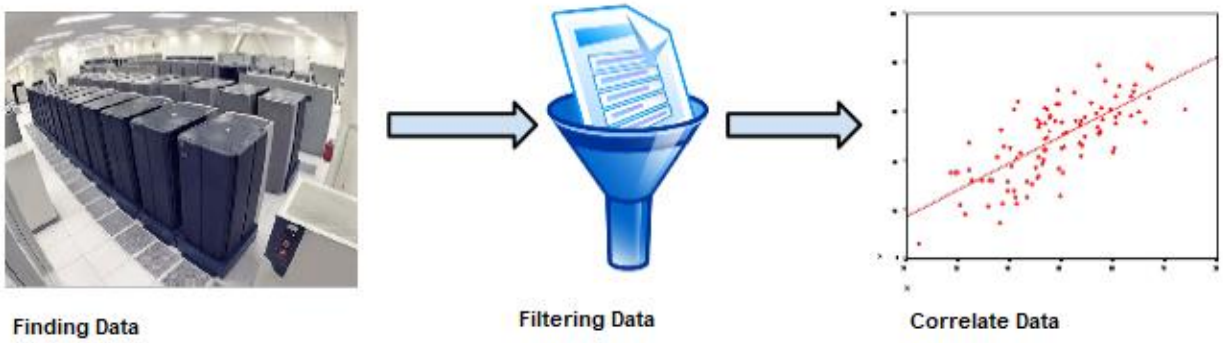


Figure 1. The pipeline of web mining

With the rapid and explosive growth of information available over the Internet, World Wide Web has become a powerful platform to store, disseminate and retrieve information as well as mine useful knowledge. Due to the properties of the huge, diverse, dynamic and unstructured nature of Web data, Web data research has encountered a lot of challenges, such as scalability, multimedia and temporal issues etc. As a result, Web users are always drowning in an "ocean" of information and facing the problem of information overload when interacting with the web. Typically, the following are the problems mentioned in Web related research and applications.

- **Finding relevant information**: To find specific information on the web, users often either browse Web documents directly or use a search engine as a search assistant.

- **Finding needed information**: Most search engines perform in a query-triggered way that is mainly on a basis of one keyword or several keywords entered.
- **Learning useful knowledge**: With traditional Web search service, query results relevant to query input are returned to Web users in a ranked list of pages.
- **Recommendation/personalization of information**: While a user interacts with the web, there is a wide diversity of user's navigational preference, which results in needing different contents and presentations of information.

Challenges:

i. Too huge for effective data warehousing and data mining.
ii. Too complex and heterogeneous.
iii. Growing and changing rapidly
iv. Broad diversity of user communities.
v. Only small portion of the information on the web is truly relevant or useful

Web Mining Categories

Web Mining can be broadly divided into three categories according to the kinds of data to be mined :

- Web Content Mining
- Web Structure Mining
- Web Usage Mining

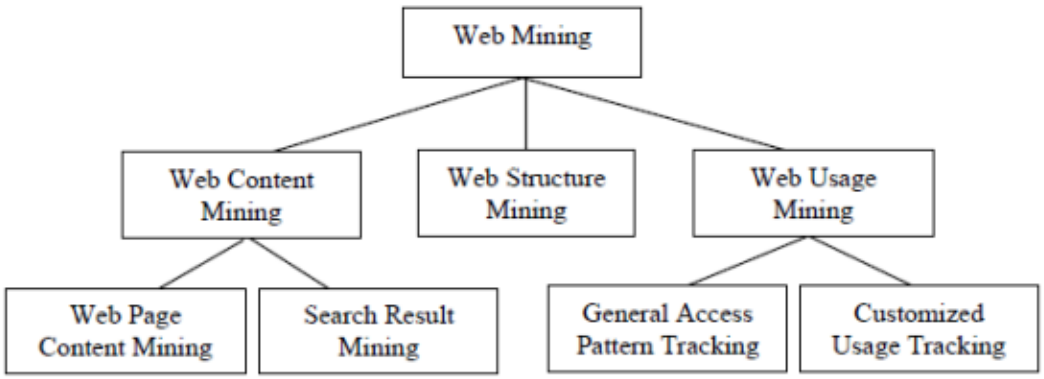
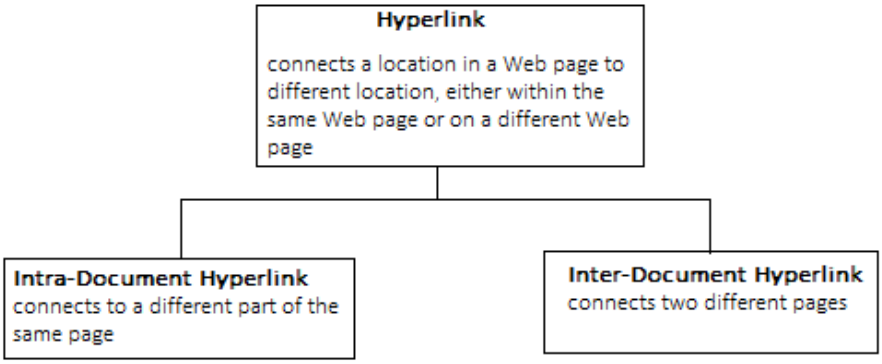


Figure 3.4 Taxonomy of Web Mining

- **Web content mining**: is the task of extracting knowledge from the content of documents on World Wide Web like mining the content of html files. Web document text mining, resource discovery based on concepts indexing or agent-based technology fall in this category.
  - Web Content Mining is the process of extracting useful information from the contents of Web pages and Web documents which are mostly text, images and audio/ video files.
  - Content data corresponds to the collection of facts a Web page was designed to convey to the users.
  - May consist of text, images, audio, video, or structured records such as lists and tables.
  - Web content has been the most widely researched. Issues addressed in text mining are: topic discovery, extracting association patterns, clustering of web documents and classification of Web Pages
- **Web structure mining**: is the process of extracting knowledge from the link structure of the World Wide Web. Web structure mining can be defined as a task of discovering structure information from the web. The aim of web structure mining is to produce structural information about the web site and its web pages. Web Structure Mining can be classified into two categories based on the type of structure data used.
  i. **Web structure or Link Information:** how it is connected to other sites
  Given a collection of web pages and topology, interesting facts related to page connectivity can be discovered. There has been a detailed study about inter-page relations and hyperlink analysis, which provides an up-to-date survey.



ii. **Document structure:** website itself, as to how each page is connected.

Web document contents can also be represented in a tree-structured format, based on the different HTML and XML tags within the page. Mining have focused on automatically extracting document object model (DOM) structures out of documents.

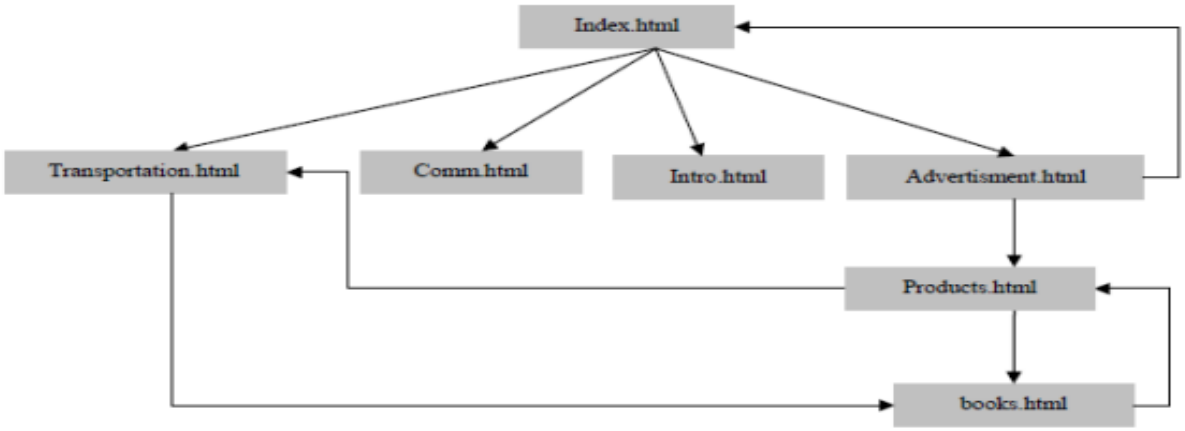


Figure 3.3 An Example Web Graph for a Particular Web Domain

Interesting facts describing the connectivity in the Web subset can be discovered based on the given collection of connected web documents. The structure information obtained from the Web structure mining has the followings:

- The information about measuring the frequency of the local links in the web tuples in a web table
- The information about measuring the frequency of web tuples in a web table containing links within the same document
- The information measuring the frequency of web tuples in a web table that contains links that are global and the links that point towards different web sites
- The information measuring the frequency of identical web tuples that appear in the web tables.

- **Web usage mining**:
  - Also known as Web Log Mining, is the process of discovering interesting patterns from web access logs on servers.
  - This is the process of extracting patterns and information from server logs to gain insight on user activity including where the users are from, how many clicked what items on the site and the types of activities being done on the site.
  - Web Usage Mining is the application of data mining techniques to discover interesting usage patterns from Web data, in order to understand and better serve the needs of Web based applications.
  - Usage data captures the identity or origin of Web users along with their browsing behavior at a Web site.
  - Web usage mining itself can be classified further depending on the kind of usage data considered:

    ♣ **Web Server Data**: This is the most commonly used data type in web usage mining applications. It is the data obtained from user logs that are kept by a web server. The basic information source in most of the web usage mining applications is the access log files at server side. When any user agent (e.g., IE, Mozilla, Netscape, etc.) hits an URL in a domain, the information related to that operation is recorded in an access log file.

    Access log file on the server side contains log information of user that opened a session. These logs include the list of items that a user agent has accessed. The log format of the file is Common Log Format [CLF], which includes special record formats. These records have seven common fields, which are:

    i. User's IP address
    ii. Access date and time
    iii. Request method (GET or POST),
    iv. URL of the page accessed,
    v. Transfer protocol (HTTP 1.0, HTTP 1.1),
    vi. Success of return code.
    vii. Number of bytes transmitted.

    ♣ **Application Server Data**: Application server software like Web logic, Broad Vision, Story Server used for e-commerce applications, have important properties in their structure. These properties will allow many e-commerce applications to be built on top of them. One of the most important properties of application servers is their ability to keep track of several types of business transactions and record them in application server logs. For example: when a customer visits an e-commerce site that displays real-time availability and pricing information for the products, the application servers looks up the availability and price for each product and delivers this information in real time.

    ♣ **Application Level Data**: At the application server, the number of event types are increased while moving to upper layers. Application level data can be logged in order to generate histories of specially defined events. This type of data is classified in three categories based on the source of information.

    i. **Server-side** data gives information about the behaviors of all users, whereas the
    ii. **Client-side** data gives information about a user using that particular client.
    iii. **Proxy side** data is somewhere in between the client and server-side data.

ROLE OF WEB MINING IN E-COMMERCE

- **Financial Analyses**: It includes reviewing of costs and revenues, calculation and comparative analysis of corporate income statements, analysis of corporate balance sheet and profitability, cash flow statement, analysis of financial markets and sophisticated controlling. Web mining can be an effective tool.
- **Marketing Analyses**: It includes analysis of sales receipts, sales profitability, profit margins, meeting sales targets, time of orders, actions undertaken by competitors, stock exchange quotations, and market identification and segmentation. Web mining can be used here as a key tool that helps in building effective marketing strategy.
- **Customer Analysis**: It mainly concern time maintaining contacts with customers, customer profitability, modelling customers' behavior and reactions, customer satisfaction, mix analysis etc. web mining tells us what strategy should be used to get number of customers with quality.
- **Production Management Analysis** where work is mainly to identify production 'bottlenecks' and delayed orders and enabling organizations to examine production dynamics and to compare production results obtained by departments or plants, etc.
- **Logistic Analysis** where can be effective to identify partners of supply chain quickly, reverse logistics analysis and handling.
- **Wage analysis** where analysis of wage related data including wage component reports made with reference to the type required, reports made from the perspective of a given enterprise, wage report distinguishing employment types, payroll surcharges, personal contribution reports, analyze of average wages, etc.
- **Personal data analyses** that includes examination of employment turnover, employment types, presentation of information on individual employee's personal data, etc.

WEB MINING TOOLS IN E-COMMERCE

Different data mining tools are used depending on different mining goals; there are major three categories that are statistical analysis, knowledge discovery, and prediction models.

1) Statistic analysis. This method is basically used to check the math rules in data and utilize statistic modes and math models to interpret these rules. There are some commonly used methods: linear and nonlinear analysis, continuous regression analysis and logistic regression analysis, univariate and multivariate analysis, and time series analysis. This method help to find the identification of time series data patterns and anomalies in the data to help select the appropriate statistical model and generate the appropriate charts, completed by the appropriate statistical tools regression analysis, and multivariate analysis.

2) Knowledge discovery Knowledge discovery is obtained from artificial intelligence and machine learning, which uses a data search process, to extract information from the data, as well as the relationship between data elements and models from which to discover business rules and business facts. In Knowledge discovery we can use data visualization tools and navigation tools to help developers analyze the data before mining, to further enhance data mining capabilities, visualization systems can be presented with a graphical analysis of multivariate data to help business analysts, knowledge discovery.

3) Prediction model Prediction model is based on consumer behavior has a certain repetitive and regularity of such a hypothesis, which allows businesses to collect stored in the database and analyzing the transaction information to predict consumer behavior. According to specific consumption behavior to classify, businesses will be able to implement targeted marketing strategies.

3. Time-series data mining

- A time series is a collection of observations made sequentially in time.
- Consists of sequences of values or events obtained over repeated measurement of time at equal time interval in most of the time.
- Generates hidden patterns that are characteristic and predictive time series characteristic and predictive time series events

Application of Time-series data mining

- Stock Prediction

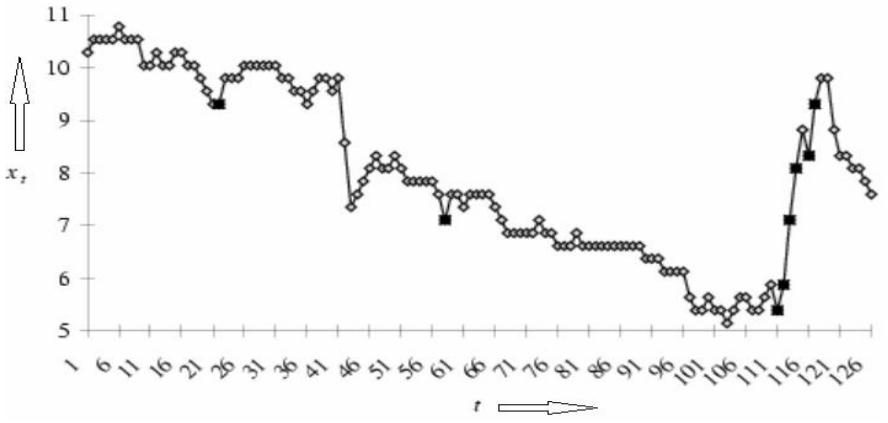
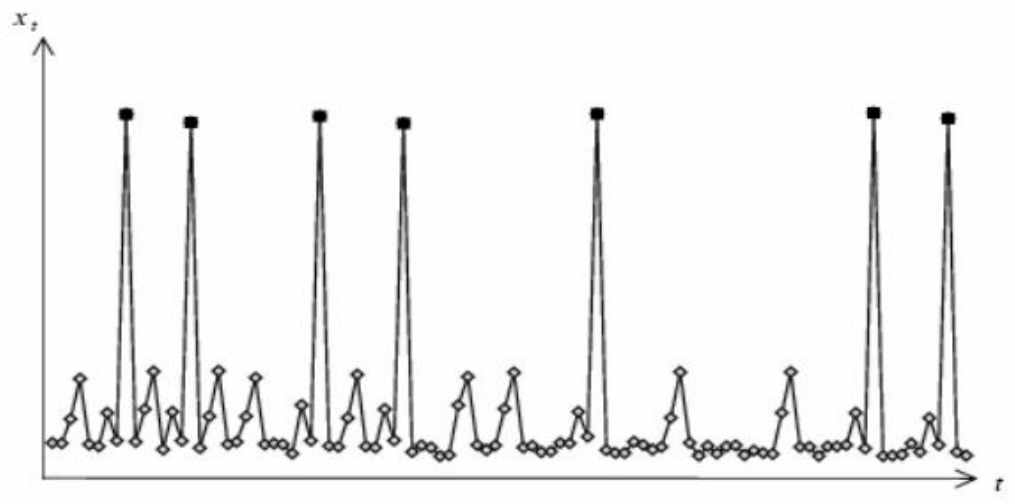


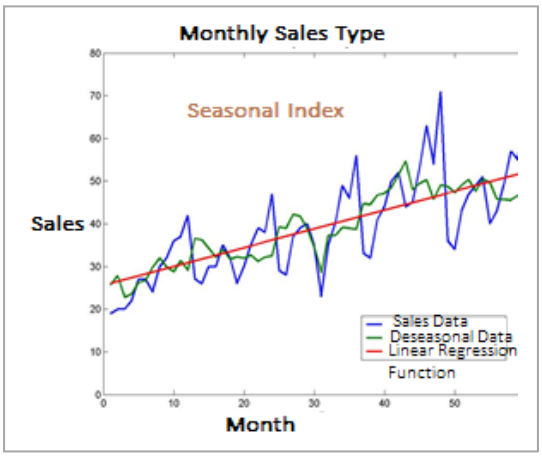
Fig. 3: stock prices Example 3: stock prices

(**Diamonds**: daily open Diamonds: daily open price; **Squares**: days when price increases more price increases more than 5%, **Goal**: to find hidden patterns that provide patterns that provide the desired trading edge)

- Seismic Analysis



Diamonds = observations – E.g. Seismic activity; **Squares** = important observations = events – – E.g. Earthquakes; **Goal**: to characterize, when characterize, when peeks occur



Goals in time series analysis.

i. **Modeling Time Series**: Generating the time series with underlying mechanism.

ii. **Forecasting Time Series**: Predict the future values of the time series variables.

Approaches for time series data analysis:

- **Regression Analysis** is commonly used for find trend in time series data.
- **Seasonal Index** is used for analysis to adjust the relative values of a variable during the time series (months of the year). Eg. Sudden rise in sales of sweets in Tihar.
- **Autocorrelation analysis** is applied between i^{th} element of the series and the $(i\text{-}k)^{th}$ element to detect seasonal patterns. Where K is referred to as the log.
- **Calculating the moving average** of order n is the common method for determining trend. Smoothes the data. Eliminates cyclic, seasonal and irregular movements. Sensitive to outliers (can be reduced by weighted moving average)

$$\frac{y_1 + y_2 + \cdots + y_n}{n}; \frac{y_2 + y_3 + \cdots + y_{n+1}}{n}; \frac{y_3 + y_4 + \cdots + y_{n+2}}{n}; \cdots$$

Eg: Original Data: 3 7 2 0 4 5 9 7 2

Moving average of order 3: (3 + 7 + 2)/3 = **4**, (7+2+0)/3=**3,** => 4, 3, 2, 3, 6, 7, 6,

Weighted (1, 4, 1) average: ((1*3 +4*7 +1*2)/(1+4 +1))= 5.5, 2.5 1 3.5 5.5 8 6.5

- **Free hand method** is used to draw approximate curve or line to fit a set of data based on user's judgment.
- **Least square** method is used to fit best curve. Find the curve minimizing the sum of the squares of the deviation of points on the curve from the corresponding data points

Major task considered by the time series data mining community.

- **Indexing (Query by Content):** Given a query time series Q, and some similarity/dissimilarity measure D(Q, C), find the most similar time series in database DB.
- **Clustering**: Find natural groupings of the time series in database DB under some similarity/dissimilarity measure D(Q, C)
- **Classification**: Given an unlabeled time series Q, assign it to one of two or more predefined classes.
- **Prediction (Forecasting)**: Given a time series Q containing n data points, predict the value at time n + 1.
- **Summarization**: Given a time series Q containing n data points where n is an extremely large number, create a (possibly graphic) approximation of Q which retains its essential features but fits on a single page, computer screen, etc.
- **Anomaly Detection (Interestingness Detection)**: Given a time series Q, assumed to be normal, and an unannotated time series R, find all sections of R which contain anomalies or "surprising/interesting/unexpected" occurrences
- **Segmentation**: (a) Given a time series Q containing n data points, construct a model Q^-, from K piecewise segments (K << n), such that Q^- closely approximates Q; (b) Given a time series Q, partition it into K internally homogenous sections (also known as change detection)

Page rank algorithm

PageRank is a family of algorithms for assigning numerical weightings to hyperlinked documents (or web pages) indexed by a search engine. Its properties are much discussed by search engine optimization (SEO) experts. The PageRank system is used by the popular search engine Google to help determine a page's relevance or importance. It was developed by Google's founders Larry Page and Sergey Brin while at Stanford University in 1998

PageRank relies on the uniquely democratic nature of the web by using its vast link structure as an indicator of an individual page's value. Google interprets a link from page A to page B as a vote, by page A, for page B. But, Google looks at more than the sheer volume of votes, or links a page receives; it also analyzes the page that casts the vote. Votes cast by pages that are themselves "important" weigh more heavily and help to make other pages "important."

The algorithm uses individual web page information to determine the ranking of each page, with each link to a particular page working to increase the popularity of that individual page. This is determined using:

- The PageRank of web page A: PR(A)
- The Inbound Link, Ti pages that link to page A: PR(Ti)
- The Outbound Link number on page Ti: C(Ti)
- The Damping Factor, usually described as between 0 and 1: d

- This information results in the PageRank Algorithm **PR(A) = (1-d) + d x {PR(T1)/C(T1) + … + PR(Tn)/C(Tn)}**
- PageRank for a given page **= Initial PageRank + (total ranking power / number of outbound links) +…**
- Second version of the algorithm, the Page Rank of page A is given as **PR(A) = (1-d) / N + d {PR(T1)/C(T1) + … + PR(Tn)/C(Tn)};** Where N is the total number of all pages on the web.

- Page Rank does not rank web sites as a whole, but is determined for each page individually. Further, the Page Rank of page A is recursively defined by the Page Ranks of those pages which link to page A.
- The Page Rank of pages Ti which link to page A does not influence the PageRank of page A uniformly. Within the Page Rank algorithm, the Page Rank of a page T is always weighted by the number of outbound links C(T) on page T. This means that the more outbound links a page T has, the less will page A benefit from a link to it on page T.
- The weighted Page Rank of pages Ti is then added up. The outcome of this is that an additional inbound link for page A will always increase page A's Page Rank.
- Finally, the sum of the weighted Page Ranks of all pages Ti is multiplied with a damping factor d which can be set between 0 and 1. Thereby, the extend of PageRank benefit for a page by another page linking to it is reduced.

The Characteristics of Page Rank

The characteristics of Page Rank shall be illustrated by a small example. We regard a small web consisting of three pages A, B and C, whereby page A links to the pages B and C, page B links to page C and page C links to page A. According to Page and Brin, the damping factor d is usually set to 0.85, but to keep the calculation simple we set it to 0.5. The exact value of the damping factor d admittedly has effects on Page Rank, but it does not influence the fundamental principles of Page Rank. So, we get the following equations for the Page Rank calculation:

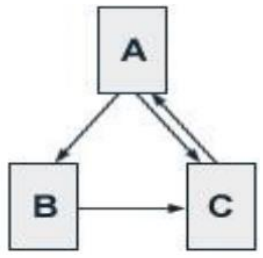
PR(A) = 0.5 + 0.5 x PR(C) / C(C); *there is not incoming pages from B*
PR(B) = 0.5 + 0.5 x PR(A) / C(A); *there is not incoming pages from C*
PR(C) = 0.5 + 0.5 x {PR(A) / C(A) + PR(B) / C(B)} *there are incoming pages from A & B*

Here; ***Outgoing Links i.e.*** *Outbound from A, C(A) = 2; Outbound from B, C(B) = 1; Outbound from C, C(C) = 1;*

These equations can easily be solved. We get the following Page Rank values for the single pages:

For iteration 12: PR(A) = 14/13 = 1.07692308
PR(B) = 10/13 = 0.76923077
PR(C) = 15/13 = 1.15384615

It is obvious that the sum of all pages' Page Ranks is 3 and thus equals the total number of web pages. As shown above this is not a specific result for our simple example. For our simple three-page example it is easy to solve the according equation system to determine Page Rank values. In practice, the web consists of billions of documents and it is not possible to find a solution by inspection.



Consider an imaginary web of 3 web pages. And the inbound and outbound link structure is as shown in the figure.

The Iterative Computation of Page Rank

Because of the size of the actual web, the Google search engine uses an approximate, iterative computation of Page Rank values. Each page is assigned an initial starting value and the Page Ranks of all pages are then calculated in several computation circles based on the equations determined by the Page Rank algorithm. The iterative calculation shall again be illustrated by our three-page example, whereby each page is assigned a starting Page Rank value of 1.

Initially Page Rank(PR) for all the web pages = 1

For Iteration 1

- PR(A) = 0.5 + 0.5 x PR(C)/C(C)
  = 0.5 + (0.5x1/1) = 1
- PR(B) = 0.5 + 0.5 (PR(A) / 2) = 0.5 + 0.5 (1/2) = 0.5 + (0.5 * 0.5)
  = 0.5 + 0.25 = 0.75
- PR(C) = 0.5 + 0.5 ((PR(A) / 2)+ PR (B)/C(B))
  = 0.5 + 0.5 (1/2 + 0.75) = 0.5 + 0.5 (1.25) = 0.5 + 0.625 = 1.125

For Iteration 12

- PR(A) = 0.5 + 0.5 PR(C)
  = 0.5 + (0.5 X 1.15384615)
  = 1.07692308
- PR(B) = 0.5 + 0.5 (PR(A) / 2)
  = 0.5 + 0.5 (1.07692308 / 2)
  = 0.76923077
- PR(C) = 0.5 + 0.5 ((PR(A) / 2)+ PR (B))
  = 0.5 + 0.5 (1.07692308 /2 + 0.76923077)
  = 1.15384615

Iteration	PR(A)	PR(B)	PR(C)
0	1	1	1
1	1	0.75	1.125
2	1.0625	0.765625	1.1484375
3	1.07421875	0.76855469	1.15283203
4	1.07641602	0.76910400	1.15365601
5	1.07682800	0.76920700	1.15381050
6	1.07690525	0.76922631	1.15383947
7	1.07691973	0.76922993	1.15384490
8	1.07692245	0.76923061	1.15384592
9	1.07692296	0.76923074	1.15384611
10	1.07692305	0.76923076	1.15384615
11	1.07692307	0.76923077	1.15384615
12	1.07692308	0.76923077	1.15384615

Inbound Links are links that point to your website coming from other website or resources. Example- See this link https://bizidex.com/en/ADO-Woods ADO Woods Company get a backlink from http://bizidex.com.

Outbound links are links that point to other resource from your website. One person visit your website and then clicks on link that points to other resource not from your website. Example- See this link 5 DIY Best Online Video Creation Tools, In this links Blog author mentions different resources of Video Creation and gives links to each resource. These are examples of Outbound links.

In link building internal linking also play an important role. Giving links to other pages of your website from particular page is considered as internal link.

Example- See this post Beginners Guide For Google Analytics 2016 - Scoolico

At the end of this post author has given a link to another related topic of analytics in also read section so its a god internal linking way.