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## Business Intelligence

Business Intelligence (BI) is a set of tools supporting the transformation of raw data into useful information which can support decision making. Business Intelligence provides reporting functionality, tools for identifying data clusters, support for data mining techniques, business performance management and predictive analysis.

The aim of Business Intelligence is to support decision making. In fact, BI tools are often called Decision Support Systems (DSS) or fact-based support systems as they provide business users with tools to analyze their data and extract information.

Business Intelligence tools often source the data from data warehouses. The reason is straightforward: a data warehouse already has data from various production systems within an enterprise; the data is cleansed, consolidated, conformed and stored in one location. Because of this BI tools are able to concentrate on analyzing the data.

## Techniques Used in BI

### Data Visualization

When data is stored as a set or matrix of numbers, it is precise but difficult to interpret. For example, are sales going up, down or holding steady? When looking at more than one dimension of the data, this becomes even harder. Hence the visualization of data in charts is a convenient way to immediately understand how to interpret the data.

### Data Mining

Data mining is a computer supported method to reveal previously unknown or unnoticed relations among data entities. Data mining techniques are used in a myriad of ways: shopping basket analysis, measurement of products consumers buy together in order to promote other products; in the banking sector, client risk assessment is used to evaluate whether the client is likely to pay back the loan based on historical data; in the insurance sector, fraud detection based on behavioral and historical data; in medicine and health, analysis of complications and/or common diseases may help to reduce the risk of cross infections.

### Reporting

Design, schedule and generation of the performance, sales, reconciliation and savings reports is an area where BI tools help business users. Reports output by BI tools efficiently gather and present information to support the management, planning and decision making process. Once the report is designed it can be automatically send to a predefined distribution list in the required form presenting daily/weekly/monthly statistics.

### Time-series Analysis Including (Predictive Techniques)

Nearly all data warehouses and all enterprise data have a time dimension. For example, product sales, phone calls, patient hospitalizations, etc. It is extremely important to reveal the changes in user behavior in time, relation between products, or changes in sale contracts based on marketing promotion. Based on the historical data, we may also endeavor to predict future trends or outcomes.

### On-line Analytical Processing (OLAP)

OLAP is best known for the OLAP-cubes which provide a visualization of multidimensional data. OLAP cubes display dimensions on the cube edges (e.g. time, product, customer type, customer age etc.). The values in the cube represent the measured facts (e.g. value of contracts, number of sold products etc.). The user can navigate through OLAP cubes using drill-up, -down and -across features. The drill-up functionality enables the user to easily zoom out to more coarse-grained details. Conversely, drill-down displays the information with more details. Finally, drilling-across means that the user can navigate to another OLAP cube to see the relations on another dimension(s). All the functionality is provided in real-time.

### Statistical Analysis

Statistical analysis uses the mathematic foundations to qualify the significance and reliability of the observed relations. The most interesting features are distribution analysis, confidence intervals (for example for changes in user behaviours, etc). Statistical analysis is used for devising and analyzing the results from data mining.



## Popular Business Intelligence Tools

- Oracle Enterprise BI Server
- SAP Business Objects Enterprise
- SAP NetWeaver BI
- SAS Enterprise BI Server
- Microsoft BI platform
- IBM Cognos Series 8
- Board Management Intelligence Toolkit
- BizzScore Suite
- WebFocus
- QlikView
- Microstrategy
- Oracle Hyperion System
- Actuate

This list is not meant to be comprehensive.

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## DATA MINING TECHNIQUES AND APPLICATIONS

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### Abstract

Data mining is a process which finds useful patterns from large amount of data. The paper discusses few of the data mining techniques, algorithms and some of the organizations which have adapted data mining technology to improve their businesses and found excellent results.

Keywords: Data mining Techniques; Data mining algorithms; Data mining applications.

### 1. Overview of Data Mining

The development of Information Technology has generated large amount of databases and huge data in various areas. The research in databases and information technology has given rise to an approach to store and manipulate this precious data for further decision making. Data mining is a process of extraction of useful information and patterns from huge data. It is also called as knowledge discovery process, knowledge mining from data, knowledge extraction or data /pattern analysis.

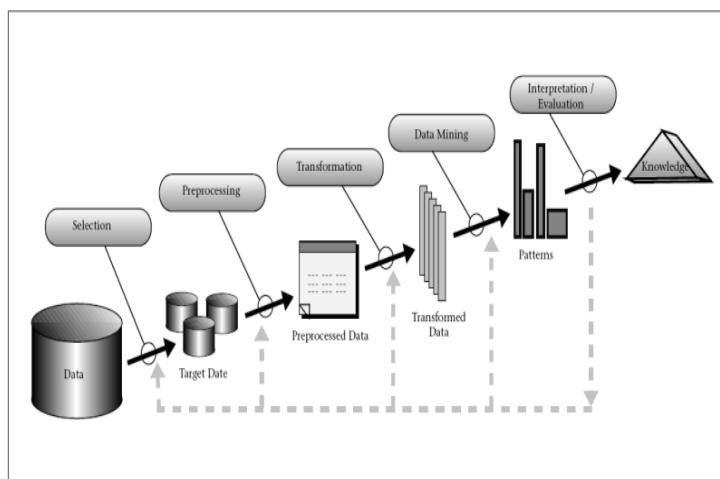


Figure 1. Knowledge discovery Process

Data mining is a logical process that is used to search through large amount of data in order to find useful data. The goal of this technique is to find patterns that were previously unknown. Once these patterns are found they can further be used to make certain decisions for development of their businesses.

Three steps involved are

- Exploration
- Pattern identification
- Deployment

**Exploration:** In the first step of data exploration data is cleaned and transformed into another form, and important variables and then nature of data based on the problem are determined.

Pattern Identification: Once data is explored, refined and defined for the specific variables the second step is to form pattern identification. Identify and choose the patterns which make the best prediction.

Deployment: Patterns are deployed for desired outcome.

## ***2. Data Mining Algorithms and Techniques***

Various algorithms and techniques like Classification, Clustering, Regression, Artificial Intelligence, Neural Networks, Association Rules, Decision Trees, Genetic Algorithm, Nearest Neighbor method etc., are used for knowledge discovery from databases.

### ***2.1. Classification***

Classification is the most commonly applied data mining technique, which employs a set of pre-classified examples to develop a model that can classify the population of records at large. Fraud detection and credit-risk applications are particularly well suited to this type of analysis. This approach frequently employs decision tree or neural network-based classification algorithms. The data classification process involves learning and classification. In Learning the training data are analyzed by classification algorithm. In classification test data are used to estimate the accuracy of the classification rules. If the accuracy is acceptable the rules can be applied to the new data tuples. For a fraud detection application, this would include complete records of both fraudulent and valid activities determined on a record-by-record basis. The classifier-training algorithm uses these pre-classified examples to determine the set of parameters required for proper discrimination. The algorithm then encodes these parameters into a model called a classifier.

*Types of classification models:*

- Classification by decision tree induction
- Bayesian Classification
- Neural Networks
- Support Vector Machines (SVM)
- Classification Based on Associations

### ***2.2. Clustering***

Clustering can be said as identification of similar classes of objects. By using clustering techniques we can further identify dense and sparse regions in object space and can discover overall distribution pattern and correlations among data attributes. Classification approach can also be used for effective means of distinguishing groups or classes of object but it becomes costly so clustering can be used as preprocessing approach for attribute subset selection and classification. For example, to form group of customers based on purchasing patterns, to categories genes with similar functionality.

*Types of clustering methods*

- Partitioning Methods
- Hierarchical Agglomerative (divisive) methods
- Density based methods
- Grid-based methods
- Model-based methods

### **2.3. Predication**

Regression technique can be adapted for predication. Regression analysis can be used to model the relationship between one or more independent variables and dependent variables. In data mining independent variables are attributes already known and response variables are what we want to predict. Unfortunately, many real-world problems are not simply prediction. For instance, sales volumes, stock prices, and product failure rates are all very difficult to predict because they may depend on complex interactions of multiple predictor variables. Therefore, more complex techniques (e.g., logistic regression, decision trees, or neural nets) may be necessary to forecast future values. The same model types can often be used for both regression and classification. For example, the CART (Classification and Regression Trees) decision tree algorithm can be used to build both classification trees (to classify categorical response variables) and regression trees (to forecast continuous response variables). Neural networks too can create both classification and regression models.

#### *Types of regression methods*

- Linear Regression
- Multivariate Linear Regression
- Nonlinear Regression
- Multivariate Nonlinear Regression

### **2.4. Association rule**

Association and correlation is usually to find frequent item set findings among large data sets. This type of finding helps businesses to make certain decisions, such as catalogue design, cross marketing and customer shopping behavior analysis. Association Rule algorithms need to be able to generate rules with confidence values less than one. However the number of possible Association Rules for a given dataset is generally very large and a high proportion of the rules are usually of little (if any) value.

#### *Types of association rule*

- Multilevel association rule
- Multidimensional association rule
- Quantitative association rule

### **2.5. Neural networks**

Neural network is a set of connected input/output units and each connection has a weight present with it. During the learning phase, network learns by adjusting weights so as to be able to predict the correct class labels of the input tuples. Neural networks have the remarkable ability to derive meaning from complicated or imprecise data and can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer techniques. These are well suited for continuous valued inputs and outputs. For example handwritten character reorganization, for training a computer to pronounce English text and many real world business problems and have already been successfully applied in many industries. Neural networks are best at identifying patterns or trends in data and well suited for prediction or forecasting needs.

#### *Types of neural networks*

- Back Propagation

### ***3. Data Mining Applications***

Data mining is a relatively new technology that has not fully matured. Despite this, there are a number of industries that are already using it on a regular basis. Some of these organizations include retail stores, hospitals, banks, and insurance companies. Many of these organizations are combining data mining with such things as statistics, pattern recognition, and other important tools. Data mining can be used to find patterns and connections that would otherwise be difficult to find. This technology is popular with many businesses because it allows them to learn more about their customers and make smart marketing decisions. Here is overview of business problems and solutions found using data mining technology.

#### ***3.1. FBTO Dutch Insurance Company***

Challenges

- To reduce direct mail costs.
- Increase efficiency of marketing campaigns.
- Increase cross-selling to existing customers, using inbound channels such as the company's sell center and the internet a one year test of the solution's effectiveness.

Results

- Provided the marketing team with the ability to predict the effectiveness of its campaigns.
- Increased the efficiency of marketing campaign creation, optimization, and execution.
- Decreased mailing costs by 35 percent.
- Increased conversion rates by 40 percent.

#### ***3.2. ECtel Ltd., Israel***

Challenges

- Fraudulent activity in telecommunication services.

Results

- Significantly reduced telecommunications fraud for more than 150 telecommunication companies worldwide.
- Saved money by enabling real-time fraud detection.

#### ***3.3. Provident Financial's Home credit Division, United Kingdom***

Challenges

- No system to detect and prevent fraud.

Results

- Reduced frequency and magnitude of agent and customer fraud.
- Saved money through early fraud detection.
- Saved investigator's time and increased prosecution rate.

#### ***3.4. Standard Life Mutual Financial Services Companies***

Challenges

- Identify the key attributes of clients attracted to their mortgage offer.
- Cross sell Standard Life Bank products to the clients of other Standard Life companies.
- Develop a remortgage model which could be deployed on the group Web site to examine the profitability of the mortgage business being accepted by Standard Life Bank.

## Results

- Built a propensity model for the Standard Life Bank mortgage offer identifying key customer types that can be applied across the whole group prospect pool.
- Discovered the key drivers for purchasing a remortgage product.
- Achieved, with the model, a nine times greater response than that achieved by the control group.
- Secured £33million (approx. \$47 million) worth of mortgage application revenue.

### ***3.5. Shenandoah Life insurance company United States.***

#### Challenges

- Policy approval process was paper based and cumbersome.
- Routing of these paper copies to various departments, there were delays in approval.

#### Results

- Empowered management with current information on pending policies.
- Reduced the time required to issue certain policies by 20 percent.
- Improved underwriting and employee performance review processes.

### ***3.6. Soft map Company Ltd., Tokyo***

#### Challenges

- Customers had difficulty making hardware and software purchasing decisions, which was hindering online sales.

#### Results

- Page views increased 67 percent per month after the recommendation engine went live.
- Profits tripled in 2001, as sales increased 18 percent versus the same period in the previous year.

## **4. Conclusion**

Data mining has importance regarding finding the patterns, forecasting, discovery of knowledge etc., in different business domains. Data mining techniques and algorithms such as classification, clustering etc., helps in finding the patterns to decide upon the future trends in businesses to grow. Data mining has wide application domain almost in every industry where the data is generated that's why data mining is considered one of the most important frontiers in database and information systems and one of the most promising interdisciplinary developments in Information Technology.

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# Business Intelligence using Data Mining Techniques and Business Analytics

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**Abstract**—The objective of this paper is to present a review literature on what are impacts of Data Mining (DM) in Business Intelligence (BI). The paper highlights various features of DM. It involves three steps: explorations, pattern identification and deployment. BI is the hot topic among all industries aiming for relevance. BI emphasizes on detail integration and or organizing of data. DM and BI work together to process and analyse data to lighten workload for the user and organization and hence in understanding discovered materials. It also explains Business Analytics (BA) as a part of BI which is again dependent on BI. There are various sectors in business to which BA has proved to be a powerful tool to obtain effective results.

**Keywords:** *Business Intelligence, Data Mining, Business Analytics*

## I. INTRODUCTION

The task of studying through and finding out certain patterns in business data is not new. The author of the paper [10] spreads the awareness that the business community of today is suffering information overload and business source analysis shows that:

- 61% of managers believe that information overload at their own workplace.
- 80% believe the situation will get worse.
- Over 50% of managers ignore data in current decision-making process because of the information overload.
- 84% of managers store this information for the future use; it is not used for current analysis.
- 60% believe that the cost of gathering information outweighs its value.

Since a long time it is done with the help of statistical techniques. But now, only to make the task easier improved techniques like “Data Mining” is used. Data mining is the process of “knowledge discovery” in database which can be used in decision making. It is a fast expanding and dynamic field that uses artificial intelligence, machine learning, database systems and statistics to apply the advanced techniques of data analysis [1]. In this [5], the research stated that the process which is designed and used for the purpose of exploring data is called as data mining. This process is very much similar to

the real life process of mining out nuggets of gold from the Earth. More specifically it is like taking out non-trivial nuggets from the huge volumes of available data. This paper gives a view about how data mining assists business intelligence to find out patterns and gain knowledge from existing data.

In the research [2], it was explained that it is because of the intense competition that the companies are compelled to find out innovative ideas in which they can capture and enhance their market shares while reducing their costs too. Implementation of the data analysis techniques can help the companies to find such solutions like finding out some unexpected patterns from the large volumes of the data present in the database or data warehouse. These patterns can provide information which could help in predicting future outcomes [1].

## A. Why do we Need to Manage Data?

- For faster decision making: Almost 77% of the executives complain of not having real time information so that they can take decisions. Data needs to be managed and kept in an organized way so that it would be easy and quick to be referred to when taking the decisions.
- Limited insight due to large volumes of information: About 6 out of 10 respondents agree to the statistics that almost all of the organizations have more volumes of data than they can handle and use effectively. Since the organizations cannot handle so much of data, their working procedures and insight gets restricted and ultimately they function inefficiently.
- New emerging varieties: Emails, audio, video, documents, and images are responsible for generating 80% of the new data. Due to this newly generated data there emerges another problem of the storage. Data should be stored in such a way that they can be identified and segregated at any point of time.

- Overflowing volume: The amount of data is increasing at the speed of 44x. In the next decade it is expected to range from 800K petabytes to 35 zettabytes [3]. This is why it is important to organize the data from the very beginning so that later confusions and efforts can be avoided.
- Among the extremely large volumes present, the data can be divided into four broad classifications which are as follows:
- Attitudinal data: Options, preferences, needs and desires
- Interaction data: Call centre notes, in person dialogues, email/chat transcripts and web click streams.
- Behavioural data: Transaction, usage history, payment history and orders
- Descriptive data: Self-declared info, (geo) demographics, characteristics and attributes. [3]

### B. Techniques of Data Mining

The extraction of hidden patterns of data with the help of different data mining methods can be classified into two types: description methods and prediction methods. The data description methods focus on understanding and interpreting the data with the help of examples and the way in which the underlying data relates to its parts. According to the research [1], the aim of the prediction-oriented models is to construct a behavioural model with new samples which can predict the values which are related to the sample.

The data mining techniques which are used for the analyses of data are as follows:

- Regression
- Association Rule Discovery (Dependency Model)
- Classification [23]
- Clustering [5]
- Anomaly detection
- Summarization [4]

**Regression:** Regression can be simply called as the “predictive power”. Assuming a linear or nonlinear model of dependency, regression analysis can be used by us to predict the value of given (continuous) features based on the other features in the data. The data item is mapped into a real valued prediction variable. Here are some examples: The revenue of new products are predicted depending upon the complementary products. Based on the amount of food and cigarette consumed by a person and his age the prediction of cancer can be done. “Logistic regression” is such a term which appears in almost every aspect of this field and regression techniques are also found to be useful in this science. These techniques are especially used in the case of neural network which can be used to create such complex functions which help in imitating the functionalities of the brain.

#### *Association Rule Discovery (Dependency Model):*

The descriptive method which is used in data mining is Association rule discovery. In this model significant dependencies between variables are defined. Though it is a very simple method to be used but it is capable of providing a lot of insight and information related to the day to day business. This information can be used to generate the required revenue and even improve the efficiency of the business. There are far fledged applications related to this method which can help various industries and business to increase their value. Here are some examples: Up-selling and cross-selling of products, physical organization of items, network analysis, and marketing and management. This method was used for many years in the industry for the market basket analysis but now new recommendations have been made by the engineers, which have overpowered the traditional methods.

**Classification:** Before digging into the hectic modelling phase of the analysis of data the primary step we have to take is classification. This classifies the data item in any one of the predefined classes. Assume you have a set of records which have their own set of attributes and one of the present attribute is our class (as per the letter grades). Our main motive is to find a model for the class that will be able to predict the undiscovered records (from external similar data sources) accurately which will be similar to the known label of the class, provided all values of other attributes. We usually divide the data set into two subsets, to train the model in a particular manner for a specific task: training set and test set. The model will be built with the help of training set and the test set will do the validation. It is the test set which determines the accuracy and performance of the model.

**Clustering:** Clustering is an important technique through which object grouping can be done (like the different groups of customers). The objects belonging to the same cluster are similar but those which are in the different groups are different. In this descriptive task a finite set of clusters are determined which identify or describe the data. The process of clustering can be defined in such a way that if you have a group of data points which have attributes of their own and have some kind of similarity then they should be clustered in such a way that the data points in that cluster are much alike each other. Data points in separate clusters are likely to be dissimilar to one another. To find how close or far one cluster is from the other, we can use the Euclidean distance, which can be applied only if attributes are continuous or other similarity measures that are relevant to the specific problem. A useful application of clustering is marketing segmentation, in which distinct set of customers are made in the market and distinct marketing strategies are applied to each of the subsets. It is possible to do this by analysing the lifestyle related and geographical information of each customer and make their clusters. This will help in finding

out the clustering quality of the customers by observing the difference in the buying patterns of the customers in one cluster to the customers in the other cluster. [5]

*Anomaly detection (change and deviation detection):* This technique helps to determine the most significant data change that has taken place in the database. This is calculated and identified on the previously determined data.

*Summarization:* With the help of this technique, a subset of the data present in the database is evaluated and a consequently a compact description is found.

## II. BUSINESS INTELLIGENCE

As described by the author [7] Business Intelligence (BI) is a concept of applying a set of technologies to convert data into meaningful information. Basically, the term business intelligence has two different meanings when related to intelligence. The first is the human intelligence or the capacity of a common brain applied to business affairs. Business Intelligence has become a novelty, the applications of human intellect and new technologies like artificial intelligence is used for management and decision making in different business related problems. The second is the information which helps raise currency in business. The intelligent knowledge gained by experts and efficient technology in managing organizational and individual business.

### C. Business Intelligence Using Data Mining

Emergence of business intelligence has thrown a light upon the new dimensions of the data collected over a business. In this paper [8] the author said that risk management and enterprise decision-making are inseparable from mining tools. Business Intelligence (BI) can only be acquired by using mining of data in different ways. Use of data warehousing and Information Systems (IS) have made it possible for enterprise datasets to grow rapidly.

With the prescient knowledge the author in paper [9] has said that the demand for more sophisticated and intelligent BI solutions is constantly growing due to the fact that storage capacity grows with twice the speed of processor power. This unbalanced growth relationship will over time make data processing tasks more time consuming when using traditional BI solutions.

There are a variety of advanced data processing techniques that can help BI processes to run efficiently which are offered by DM. The comprehensive process of applying BI for a business problem is referred to as the Knowledge Discovery in Databases (KDD) process and is vital for successful DM implementations with BI in mind.

### D. Business Analytics

Business analytics is a major part of business intelligence. Business analytics is directly aided by data mining and business intelligence. Business intelligence is mainly analysing data and collection of knowledge and applying them to various different methods.

This paper [22] explains that identifying various patterns in a data set exception to the side of the data set i.e. either a small database or large data warehouse is the main purpose of data mining. Searching for a pattern or relationship among different data groups is the main purpose served by DM. It is unlike a normal OLAP query where an identified pattern or relationship is used to process answers from the database. Identifying possible patterns in DM can help organizations at the most. The main purpose of an organization is to provide better products and outstanding services to their customers. If patterns can be identified it will aid in prediction, association and grouping of various events, products, or customers in a more effective manner.

Business analytics is a term used in context with the entire process which involves application of skills, technology and different algorithms of data mining. Business analysis produce valuable information to help managers make better decisions regarding their business and have proper control on their business operations. There are two main faces of business analytics function, the back-end where the main application of data mining takes place and the front-end is a collation of diverse information and executive reporting metrics. If we can effectively execute the business analytics function, it may result in becoming the core competence for an organization containing valuable business intelligence which can support an organization in taking strategic and efficient actions in business.

### E. Use of Data Mining in Business Analytics

The paper [22] says that the main locomotive driving the application of business analytics in businesses is data mining or knowledge discovery in databases. Data mining give us a view of the past and present situations and a understanding of the possible future outcomes which can give effective results, hence, we can say that DM act as a detective. Clusters are made by examining the past and the current customers' behaviour like transaction, sales selections and servicing choices.

Simple extrapolation is used to describe the working of DM. Queries related to data on various data software help us extract useful information. Data mining in organization is mainly used for the growth of business through discovery of useful patterns. In simple words, queries help us retrieve information of which we already have pre-knowledge whereas mining of data help us discover unknown facts that are there in the database. The

latter is termed as knowledge discovery [1], it is a process through which huge databases can be identified of various novel, valid and recognizable patterns which are hidden. The terms knowledge discovery and data mining are sometimes used interchangeably.

### III. CASE STUDY

- Telecomm Services: Fraudulent activities in services and call intrusion.
- Results: Reduced fraud activities in services and save resources time and money.
- Financial Companies: Client attracted to their offers, cross sell standard products to clients.
- Results: Discover key drivers for purchasing re-mortgage producers; get greater response and worth of mortgage application revenue.
- Software sales companies: facing difficulty customer purchasing hardware and software decisions for online sales.
- Results: Recommendation engine went live pages viewed per month more than 67 per cent, profits increased than previous years.]
- Some of these are broadly explained under application of DM in BI.

### IV. APPLICATIONS OF DATA MINING BUSINESS

Data mining is a business process used to study huge volumes of data and derive some useful patterns of information from them. Many companies have improved in their business by using data mining. [1] Those companies which have a strong focus on consumers in fields like Communication, Financial, Marketing Organization, Retail use Data mining to go deep into or “drill down” into their transactional data. This will help them in determining the customer preferences, the pricing and the positioning of the product, the satisfaction of the customers along with the corporate profits. [11] Data mining has been successfully applied in the following areas.

#### A. Marketing or Retail

In the marketing field, the applications of data mining includes market based analysis, product performance analysis, market segmentation analysis and retail sales analysis. [11] The buying behaviour, the support patterns and trends that can be identified using data mining and hence better customer satisfaction and retention could be achieved and goods consumption ratio can be enhanced thereby reducing the cost of business [12]. The techniques of data mining which could be useful in the retail industry are as follows:

- Establish customer shopping behaviour: So the buying patterns of the customers could be

identified and kind of product they are likely to buy next can be found out.

- Customer retention: Adjust the portfolio, pricing and promotions of the products according to the customer shopping patterns.
- Customer segmentation: Associate each customer's to proper group by identifying their groups.
- Analyse sales campaign: We can determine the effectiveness of the sales campaign by studying certain factors such as advertisements used and discounts offered.

#### B. Banking or Finance

How can we use it? Data mining is used in financial sectors such as credit analysis, marketing, predicting payment default, ranking investments, cash managements and forecasting operations and many more. [17] In data mining technique we can use it in the following applications:

- Credit Scoring: Factors like customer payment history can be distinguished which can influence the loan payment.
- Customer Retention: Adjust the portfolio, pricing and promotions of the products according to the customer shopping patterns.
- Customer Segmentation: Include the new customers in the right groups by establishing certain customer groups.
- Predict customer profitability: Factors like the products used by the customers help to identify patterns and predict the profitability of the customers.

Nowadays Rules Visualizer of MineSet [14] and Nicheworks [15] are tools which can be used to identify the frequently purchased products. The performance analysis can be done with the help of an explanation based mining system called as Spotlight [16].

#### C. Insurance

Data Mining is used in many of the business practices such as performing complex classifications and correlations, gathering new customers while relating the existing ones, designing and selection of policies [19]. The data mining techniques will have following applications:

- Fraud detection: The factors which show a high probability of a claim or a fraud taking place and its different patterns can be analysed.
- Risk factor identification: Factors like behaviour pattern or customer claims history may have an influence over the insured level of risk.
- Customer segmentation and retention: Identify such packages and discounts which could

increase the loyalty of the customers and include each new customer to appropriate groups.

Sometimes more than one machine learning techniques are used in data mining applications. Kim and Noh [14] report an integrated system that is combined with NN and CBR to forecast the rate of interest for the treasury bills and corporate bonds. In some field of finance data visualization is used. Knowledge Seeker, GUHA and KEX are used to identify accounts with interesting behaviour patterns [18]. An NN-based approach is used by FALCON to identify the credit card transactions which are suspicious [15].

#### D. Biomedical and DNA Data Analysis

Nowadays data mining is being widely used in areas related to Medical science such as Genetics, DNA, Medicine, Biomedical etc. it is being used in the field of Genetics to learn about the mapping relationships which are related to the DNA sequences of humans and the susceptibility of certain diseases. Data mining serves as an aid in treatment as well as the prevention of diseases and providing proper diagnosis. [20] The data mining techniques will have following applications:

- Data Cleansing and Data Mining: The data of the DNA is found to be highly distributed and heterogeneous as well as uncontrolled in nature. The process of data mining can serve as tool to properly systemize the data and then store it in a data warehouse or a database so that it can be used in research processes.

#### E. Telecommunication Industry

Telecommunication Industry and technology both grow at the same pace. The services of Telecommunication have also grown from the local as well as the long distance voice communication to the advanced methods of pager, fax, e-mails and cellular phones. Now they are integrated with various communication technologies like internet, network and computer. [21] The data mining techniques will have following applications:

- Cluster analysis: Fraudulent activities pose a major threat to the telecommunication industry. The performance of the network is affected by these activities. Clustering can help in detecting these fraudulent patterns and increasing the efficiency of the various communication services.

#### F. CRM

The process of acquiring and relating the customers, increasing their loyalty level and executing the strategies focused on the customers all are included under the Customer Relationship Management. In order to maintain

a proper relationship with the customer it is necessary to collect and analyse information. [6]

#### V. CONCLUSION

This paper discusses the till date effect of data mining technique in business intelligence. Two powerful tools determine the growth in business sector. The primary is data mining which is used to deal with large amount of data to find useful result, whereas the secondary is business intelligence which helps in making business related decisions. The paper shows business analytics with a wide application domain almost in every industry where the data is generated that's why data mining is considered one of the most important outwork in databases and information systems and business intelligence as an interface of the organization.

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# Use Of Data Mining In Business Analytics To Support Business Competitiveness

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## ABSTRACT

*In this paper, the use of data mining and text mining techniques in business analytics and how they support the use of business intelligence in e-businesses are discussed. The distinction between data mining, business analytics and business intelligence is presented. Suggestions on how electronic businesses can leverage on data mining to enhance their competitiveness are discussed.*

**Keywords:** Business Analytics; Data Mining; Business Intelligence; E-Business

## INTRODUCTION

The business world we work and operate in has changed dramatically over the past 20 years. With the computer and the Internet becoming ubiquitous tools in almost all business organizations now, the often-mentioned information age has really come of age. The capacity to collate data and present information efficiently in real time and the ability to make it readily accessible to everyone has been a major catalyst for many organizations to embrace globalization and improve productivity. For many consumers, they have benefited from the changing landscape that has evolved over the years in the business environment, in particular the new business models that have been introduced by many traditional companies as well as new companies. Consumers are now able to buy most products on the Internet. We use the hand-phones to conduct meetings, order tickets, and check stock prices, among a host of other tasks. Computers, information systems and telecommunications have been the vanguard for these new business models. But often, not many of us realize that although computers, information systems and communications are the basic building blocks of the information age, data is actually the primary driver for the information age. Without relevant data, the need for computers and communications would be much reduced.

Companies are requiring more regular in-depth analytical review of the data within their repositories to have a better understanding of their business environment and competitiveness capability. The ability to generate valuable insights based on business data is termed business intelligence. The approaches to generate these insights are commonly the function of business analytics.

Business analytics is the use of analysis techniques and decision rules to provide business users with critical insights of the operational and performance characteristics in every aspects of the business. In this paper, the use of data mining techniques in business analytics and how they support the use of business intelligence in e-businesses are discussed. The distinction between data mining, business analytics and business intelligence is presented. Suggestions on how electronic businesses can leverage on data mining to enhance their competitiveness are discussed.

## CONDUCTING BUSINESS IN THE INFORMATION AGE

The Internet, the increasing sophistication of customer needs, and relentless globalization are forcing businesses to change the way they manage business and customers. When you walk into supermarkets, have you ever wondered why some of them place eggs next to bread? When you receive product brochures from your credit card issuers, have you ever stopped to ponder why they are able to know what you desire? When you apply for car insurance, do you know why your insurance company requires all sorts of personal information about you and your car before deciding on your premium?

In today's global competition, a good organization will make the effort to find out whether its customers are satisfied with its products and services. However, an excellent organization will not only know whether it has satisfied customers, but will also be able to understand why they are satisfied and what will make them stay satisfied in the long term. In this scenario, the former is focusing on symptoms while the latter is going beyond the symptoms and trying to understand the causes. The difference between these two organizations in having a more in-depth understanding of the customer lies in the amount of business intelligence one has over the other.

Furthermore, businesses are relying on the Internet to provide some if not most of their services other than the actual manufacturing of their products. Online companies like Amazon and E-Bay obviously based their business models solely on the Internet. However, traditional companies who are either selling tangible products or intangible services do also feel the need to have a presence on the Internet. The form of presence could vary from informational, to marketing and selling, to after-sales services and customer support.

For all companies, a major portion of their revenues is generated from repeat customers. This is especially true for e-businesses. E-business faces intense competition on the Internet as customers are spoilt for choice and prices when doing online shopping. It is so much easier for a customer to browse and move from one virtual online store to another in a matter of clicks compare to walking and driving from one store front to another. Because of the nature of online shopping, building customer loyalty and understanding and anticipating customer needs become a lot more critical than in traditional brick-and-mortar organizations.

Data generated in online customer transactions, be it sales, queries, feedback, searches, or simply browsing provide the organizations with a potential wealth of information that could help reinforce loyalty for existing customers or create opportunities for new leads. Data generated in internal databases maintained by organizations could also be a source of relevant information to help organizations in improving business operations and enhance capabilities and competencies.

Thus, in the era of the information age, businesses have to view its collected data as a source of competitive advantage. Data mining and text mining are promising techniques to harness the potential value of data found in organizations. The application of data mining and other data analysis tools produces useful information or relational functions that helps managers to make insightful decisions.

## **DISTINCTION BETWEEN DATA MINING, BUSINESS ANALYTICS, BUSINESS INTELLIGENCE**

Some sources use the terms data mining, business analytics and business intelligence in an interchangeable manner. However, in strict theoretical sense, there are distinct differences among the three terms.

Data mining is a collective term used to describe different analysis techniques such as statistics, artificial intelligence and machine learning that are employed to scan huge amounts of data found in the organization's databases or online databases. Its purpose is to identify patterns in the data set. These data sets could come from a single database or could come from integrated data established in a data warehouse. The key here is that one is searching for a pattern or relationship among different data groups. It is unlike a normal OLAP query whereby an identified pattern or relationship is used to process answers from the database. In data mining, by identifying possible patterns, it could then help to predict, associate and group events, products, or customers in a more effective manner so that the organizations could provide better products or services to the customers or improve their operations.

Business analytics is used to describe the entire function of applying skills, technologies, standard practices, and algorithms related to data mining and data collation methods to generate valuable information, usually presented in highly readable format so that managers can make business decisions and to control and manage their business operations. Data mining is usually applied in the back-end of the business analytics function while the front-end of business analytics function consists of executive reporting metrics and collated information.

When the business analytics function is efficiently and effectively executed, it may become a core competence for the organization in the form of valuable business intelligence that will support the strategic actions undertaken by the organization.

## **USE OF DATA MINING AND TEXT MINING IN BUSINESS ANALYTICS**

The main locomotive driving the application of business analytics in businesses is data mining or knowledge discovery in databases. In applying data mining, the business analytics professional act like a data detective, analyzing data to better understand an organization's current and past situation, predict future outcomes and act effectively. Customers' current and past transaction behaviors in sales, servicing and selection choices can also be scrutinized and grouped either in clusters. Event sequencing and product portfolio determination can also be studied using data mining.

Akin to flying an airplane, the use of business analytics is like having a management navigation dashboard to steer the business towards the right path and achieve greater performance.

Data mining uses algorithms to mine huge data sets so as to identify patterns in the data set that may be used to establish valuable information that help organizations to compete more effectively in the market place. By uncovering patterns in the data set, data mining can predict, associate and cluster events, products, or customers in a more effective manner so that the organization could provide better products or services to the customers or improve the efficiency of their operations.

To describe the power of data mining, let's use a simple analogy. In today's world, we have powerful database software that can help us to do a variety of data queries. These data queries allow us to extract information from huge databases. But in order to perform the data queries, we must first know and state the query to be answered before the database software can help us to perform the specific query.

In data mining and text mining, it is the opposite. We do not know what queries we want to ask in advance. We simply use data mining to help us search through the huge databases in the organization and identify patterns in the data sets that might be useful to us. In simple analogy, database query helps us to obtain information that we know existed in the databases while data mining helps us to discover knowledge that we do not know existed in the databases. The latter is termed as knowledge discovery [1], a non-trivial process to identify valid, novel, practical and recognizable patterns in data residing in huge databases. The terms knowledge discovery and data mining are sometimes used interchangeably.

## **THE MECHANICS OF DATA MINING**

The strategy for performing effective data mining generally encompasses four phases. In today's information intensive business environment, the availability of data is not an issue in most organizations. However, the formats in which these data are represented may not all be suitable for data mining purpose. Thus, the first phase of data mining strategy is to prepare the data. Data preparation is a critical activity and is often the most time consuming activity in data mining. It involves converting unsuitable data formats into specific formats that lend themselves readily for data mining. Data preparation may include tasks such as data cleaning (how to deal with missing data), data transformations (converting data values through normalization, mapping, and/or aggregation), and data reduction (combining data that involves large number of variables into a smaller set of variables).

Once data preparation is completed, the second phase involves selecting appropriate data mining and text mining techniques to search for patterns in the data sets. Depending on the objective of the data mining exercise, one would most likely use any one of the primary data mining techniques such as association, clustering and classification or estimation/prediction. Each approach invokes a particular algorithm that will systematically search for specific forms of pattern in the data sets.

In the third phase, the results generated by data mining have to be interpreted and the model it created has to be assessed for accuracy, validity and/or relevance. If the model proved to be accurate, valid and/or relevant, it will then be used as a decision making tool in business applications. If the assessment of the model concluded that it is insignificant, the data mining exercise can be repeated using a bigger sample data set or alternatively using new data attributes.

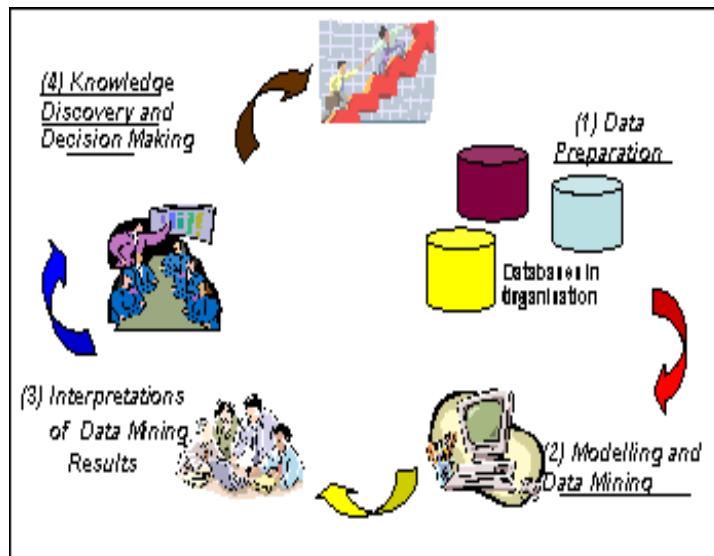


Figure 1: The 4 Phases of Data Mining

In the fourth phase, once the association, clustering or classification model has been assessed and is deemed to be accurate, valid and/or relevant, deployment of business plans guided by the model will follow. For example, if a grocery chain develops an association model that shows there is a high percentage of people who purchase baby diapers on weekends also purchase sports magazines, the chain could deploy a business plan that make sports magazines an obvious display item next to diapers. This is a case of knowledge discovery followed by relevant decision making.

## LEVERAGING ON BUSINESS ANALYTICS AND BUSINESS INTELLIGENCE IN E-BUSINESS

Organizations are beginning to realize that the ability to generate business intelligence provides them with a competitive edge over their competitors. This is especially so for e-businesses. This phenomenon is primarily driven by the abundance of data created by advances in information and communication technologies as well as the increasing use of the Internet to conduct business operations. Various data mining techniques such as association, clustering and classification or estimation/prediction are currently deployed across many industries [2].

The data mining technique related to association is commonly applied in the retail industry. The main application here is to associate a basket of products that are most likely to be purchased by customers. This application is commonly called market basket analysis. Results from market basket analysis help retailers to cross sell products, develop focused promotions and design more effective shelf arrangement of products. A good example is the online book or music retailer whereby the moment you purchase or select a particular item, the online retailer will suggest various other items of similar genre to you. On websites, e-businesses can also place their products that have high association on the same webpage to entice online customers to increase their purchase volume. Association rules are usually derived using apriori algorithm [3] that detects important relationships among cross-tabulation tables.

Clustering, as a data mining technique, is commonly used by businesses to perform customer segmentation. Customer segmentation is usually used to support marketing promotions and target selling. However, it can also be

used to identify customer segments that are good credit risks and those that are bad credit risks, especially in the insurance and banking industries. Such an application of clustering is termed risk management. Clustering can also be applied to detect fraud. Such applications could be found in the credit card industry whereby data mining models are built to detect possible fraudulent credit card transactions. One of the most common techniques used in clustering is the K-Means algorithm [4], using Euclidean distance to identify distinct clusters in data.

For e-businesses, the ability to have real-time identification of customer segments, credit risks, or fraudulent transactions is critical for business competitiveness and to mitigate business risks. Figure 2 provides an illustration of how data mining can be deployed to detect fraudulent credit card transactions in e-businesses. In an online purchase scenario, credit card details will be entered in the website. The information will then be transmitted via Internet to a processing center for verification, authentication and approval. It is at the processing center whereby fraud detection models derived from data mining (clustering) can be applied to evaluate the possibility of fraudulent cards. With a quick assessment by the model, the card payment is either placed in the low probability or high probability categories and automated decision can be initiated as to whether final approval will be given to accept or reject card payment.

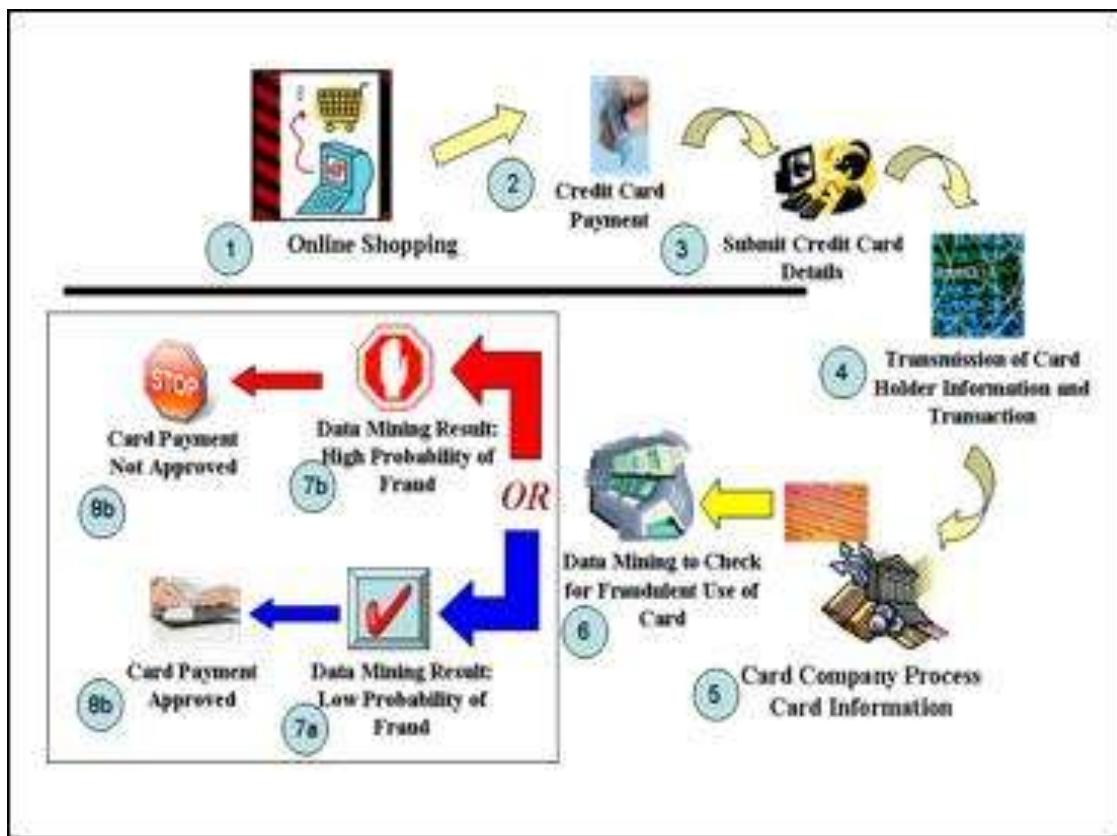


Figure 2: Application of Data Mining to Detection of Fraudulent Credit Card Transactions

Besides clustering and association, the other commonly used data mining approach in business applications is classification, estimation or prediction. Classification, estimation or prediction is based on induction-based supervised learning. In classification, the goal is to place records into defined classes. The dependent variable is normally categorical. In estimation, the goal is similar to classification. However, the dependent variable is normally numerical. Both methods attempt to predict in which defined class should a new instance be placed (an instance is a record in a data set). In prediction, the goal is to determine a future outcome rather than to place new instances in pre-defined classes.

Using credit card as an analogy, to determine if a credit card purchase is fraudulent will be classification, to estimate the probability that a credit card has been stolen is estimation, and to forecast the number of credit cards that are likely to be stolen in the next 6 months is prediction. Although classification, estimation or prediction can be used in many applications, one of the most common applications is to build churn models.

In industry, churn modeling evaluates which customers are likely to leave in the near future. Decision tree [5], statistical regression and neural network are the common techniques employed in this data mining approach. Churn models are important in e-businesses. It allows management to determine the likelihood of an existing online customer from switching to a competitive firm for his/her purchase in the near future. If the likelihood is high in the near future, proactive action could be initiated to prevent customer from switching to competitors. Such proactive actions include offering discounts, lower pricing, and other enticing propositions to the customer.

## **CONCLUSION**

Increasing data resources are expected to drive a growth in business analytics and thus data mining. Businesses are beginning to realize that the application of data mining and text mining provides them with a competitive edge. With data increasing in an exponential manner, the ability to use data mining to sieve through massive amount of data and identify relevant patterns will become a strategic tool in improving key areas of the business such as customers, operations and the supply chain.

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# THE IMPACT OF IMPLEMENTING DATA MINING IN BUSINESS INTELLIGENCE

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## ABSTRACT

*In today's world data became the new gold & extracting these golds created a new opportunity to business, this will allow the business to generate a valuable data which can be used to analyze the customer patterns. This re-search will study the data mining, the research question will be what business intelligence will benefit out of data mining implementation. To answer the research question & reach the result and conclusion in this research, information from different trustworthy books & articles were collected, After the data was collected, we analyze these data, after the analysis it has been found that data mining is very helpful for the businesses, it gives the business a better understanding of the customers, market condition, & many others. In this study, & based on the results, it is highly recommended for the business to use the data mining, for a better knowledge & higher profits.*

**Keywords:** Data Mining, Business Intelligence, Knowledge Discovery of Database

## INTRODUCTION

Data is a major thing in today's world, the success of the businesses today is very much depending on the information the business has, & the data analyzed by the organizations. The businesses today must be updated in order to compete in the market. To stay updated, the businesses needs to have data & analyze the data, to know their customers, their needs, study the competitors .... etc. Traditionally the way of analysis used to be by analyzing a structured data, which is an organized number collected to be analyzed to convert them into a useful information. However, approximately 80% of the data are unstructured data, which were not analyzed in the traditional way (Bavota, 2016). Data mining will allow the analysis of the un-structured data, so this will open a big source of information for the businesses nowadays, to help them compete and survive in the current highly competitive market. The businesses today has to make decisions that are very important to their survival, yet to make these decisions correctly, they must have a data to predict, know the market trend, & know their customers, so to do that they must do business intelligence. Business need to minimize the mistakes in decision making, as such mistakes might be catastrophic (Dam, Le Dinh, & Menvielle, 2019). This paper will study the benefits of implementing data mining and business intelligence in the business sector.

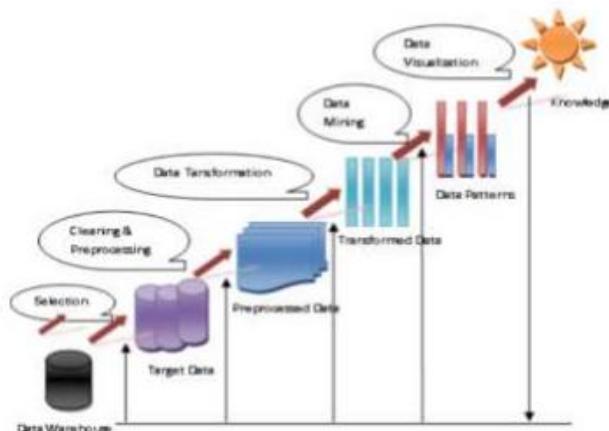
### **Business Intelligence and Data Mining**

Business intelligent is a modern approach to analyze the raw data by transforming them into the information to have a making decision it include different methodology, process & technologies. Business intelligent is important for better decision making, avoiding threat and funding new business insight and opportunities. Business intelligent is important to be used for many organizations working in different industries. Business intelligent can use structured data for analysis however no unstructured data can be used to gather information this can make the decision based on incomplete information which will affect the correctness of the decisions (Llave, 2018). Data mining is analysis method where structured & unstructured data will be an-alyze this method go beyond only analyzing numbers &

reports, using this method we can analyze image, video, text, email, social media and many more, this method can predict outcomes by find the patterns & correlations in database. Data mining is more complete method then business intelligent, data upon gathering are mostly unstructured & difficult to be analyze, Data mining will help to analyze the raw datasets & provide the business intelligence team with the information to make a conclusion (Shmueli, Bruce & Patel, 2016; Kassner, GrKger, Mitschang & WestkUmpfer, 2015)

## Knowledge Discovery

The customers and businesses are having a dramatically different relationship than in the old days. The companies today have to create new strategies, & ways to adopt to the new changes in their relationship with their customers, in order to make profit. The mass production & marketing where the companies used to make a mass production of their products then try to market their products which considering the customers taste and & has to be first in any of the business strategies in order to succeed. Data mining, data warehousing also the customer relationship management techniques can help the companies to act upon the customer's needs and wants as the new market dictates & requires. In the modern market, knowledge is a main key to survive in the business world, so the companies need to do knowledge discovery (Bathinda, 2012). Knowledge discovery: it is to convert the raw data into a useful and meaningful information, it's a key part of business intelligence & data mining. The data is stored in a database, then these data after some steps will be transferred to a meaningful information, these steps are KDD known as knowledge discover in database (Figure 1) (Sindhu & Sangwan, 2017).



**FIGURE 1  
THE STEP OF KNOWLEDGE DISCOVERY IN DATABASES (Sindhu & Sangwan, 2017)**

Data selection- the data warehouse contains a lot of data in it, so we need to select part of the data which match the business problem or what business wants to study. In other words, data selection is not sampling it choosing which point, and pieces of data are important to the issue you are solving. (Sindhu & Sangwan, 2017).

Data cleaning & preprocessing- After we targeted the data the next step would be to substituting missing values, smoothing noisy data, find outliers and fixing inaccurate information in database (Sindhu & Sangwan, 2017).

Data Transformation- The pre-processed data is mapping and convert data from one structure to another structure in order to perform the mining (Sindhu & Sangwan, 2017).

Data mining-in this stage the data mining will generate some patterns us-ing data mining techniques (Sindhu & Sangwan, 2017).

Data visualization -display findings that can be readable and graphically represented like bar chart, in this stage the knowledge is displayed as a chart. The business can make a decision based on the finding (Sindhu & Sangwan, 2017).

## **DATA MINING TECHNIQUE**

### **Classification**

Data attribute transferred into classes which can help to forecast consumer behavior like based on the customer purchase in supermarket we can identify the customer class (Bayer, Aksogan, Celik & Kondilogluc, 2017).

### **Association**

Is used to find the connection between the variables, for example if the customer buys certain item then they are going to buy another X item (Bayer, Aksogan, Celik & Kondilogluc, 2017).

### **Clustering**

The objects that are similar in database can be grouped by used the algorithm, for example it can be used for customer profiling and segment (Bayer, Aksogan, Celik & Kondilogluc, 2017).

### **Regression**

Is one the data mining techniques which is used to identify the connection between two or more variables (Bayer, Aksogan, Celik & Kondilogluc, 2017).

### **Prediction**

similar to classification method but instead of finding the classes we are predicting value for a numerical value by using the past data (Dam, Le Dinh & Menvielle, 2019). Each of the techniques mentioned has advantages and also disadvantage. How useful is the methods depends on some factors like dataset size, pattern type in the data whether the data comply with the assumptions in the methods, noisiness of the data and analysis goal (Shmueli, Bruce & Patel, 2016). The result of the methods and their performance can vary according to the method. In data mining it is regular process to apply multiple methods to see the best method for the goal and accordingly the best method will be chosen. (Shmueli, Bruce & Patel, 2016).

### **Applications Of Data Mining In Business Sector**

Data mining in business Intelligence have increases in popularity over the past decade. The data mining provides more techniques which can be used to extract customer pattern, this can help the business in understanding the customer preference, amount spent, product preference & the customer satisfaction.

### **Retails**

The transaction information which are done by the consumer is stored in data warehouses & never accessed again for cleaning or research purpose in past 20 years but with the help of data mining this data can be useful to predict potential sales and make it easier for business owners to monitor purchases by their customers (Maksood & Achuthan , 2016). Walmart which is one of the biggest retail in USA, failed to in e-commerce and marketing online so it began using digital interfaces to obtain the customers information and link them with their personal accounts, also they will try to find some information about consumer in online, these data were based in a new data mining technique to find consumer behavior. Consumer behavior can predict their next purchase, when they will visit the store, disease prediction, comparison with global consumption strategies & other biological effects. The

digitized world where we log a record into a database every move we take, & the precise manipulation of these records is the reason why Walmart achieves great success (Maksood & Achuthan , 2016). Target is another popular retail in USA, implements data mining to predict pregnancy in their customers based on their previous purchase and when they found she will be pregnant they sent her a promotion for baby stuff (Maksood & Achuthan , 2016).

## **Insurance**

In many business activities, data mining is used, such as carrying out complex classifications & correlations, gathering new clients when referring to current ones, developing & choosing policies. The technique which can be used are: (Mishra, Hazra, Tarannum & Kumar, 2016).

**Detection of fraud:** It is possible to examine the variables that indicate a high possibility of an allegation or a fraud taking place and its numerous trends. (Mishra, Hazra, Tarannum & Kumar, 2016).

**Consumer retention & segmentation:** Identify packages and promotions that could improve customer satisfaction and include each new customer in suitable categories (Mishra, Hazra, Tarannum & Kumar, 2016).

## **Telecommunication**

Telecommunication has now evolved from local & long-distance voice communication to modern pager, fax, email, & mobile phone strategies. They are now incorporated with numerous networking systems such as the Telephone, networks, & computers. The data mining which can be used are: (Mishra, Hazra, Tarannum & Kumar, 2016).

**Cluster analysis:** In the telecommunications sector, fraudulent activities face a significant danger. Network efficiency is influenced by these events. Clustering can help to identify these deceptive trends & increase the efficacy of the different contact services. (Mishra, Hazra, Tarannum & Kumar, 2016).

## **Banking**

The banking system contains a lot of data where data mining can be used to help the bank make a better decision making. In their decision-making, banks who implement data mining strategies tremendously profit & hold an advantage on those that don't. Some of the fields where decision can improve banks are risk management, detection of fraud, marketing, identify money laundering & customer relationship management (Raj, 2015).

## **Marketing**

The bank can analyze the past data, along with the present data to determine the customer behavior of different services and goods in order to achieve more market prospects. The data mining can be used to identify the good and profitable customer (Miyan, 2017).

## **Risk management**

A certain level of risk is involved in each lending decision a bank makes. Defining this risk will simplify the process of risk management & limit the bank's risk of financial loss. Knowing the ability for the customer to repay can significantly improve the decision of credit management. Data mining can help the bank to identify which customer will repay on time and which will delay this can help the bank to take the right decision to prevent any losses. Data mining can analyze old data to predict some future patterns; also can improve credit rating (value which reflect the credit worthiness of a borrower) & forecast probability of default. Behavioral ratings are collected to predict their possible actions in diverse circumstances using probability models of consumer behavior. Data mining may use the

borrower's previous debt reduction habits to extract this rating by evaluating the credit history available (Mi-yan, 2017; Raj, 2015).

## **Fraud Detection**

Banks lose millions of dollars in fraud annually so detecting a fraud in a transaction can help the bank & reduce the possibility of fraud occurring. One of the areas where fraud detection can be used is credit card product where we can apply data mining to analyze the history of the customer transaction & the risk of new behavior can be estimated to determine if it's a fraud. Customer transaction trends can be found, and warnings can be produced if any detectable anomalies are observed. Another area for fraud detection is in financial statement. These statements can contain overstated income, revenue, & income, so this may contribute to money laundering. To identify money laundering in such programs usually consider customer risk evaluation data, transaction risk measurement data, & activity patterns. Based on their similarity contained in these selected characteristics, transactions can be identified if it's a money laundering (Miyan, 2017; Matthew, Yunusa, Gumel & Abdullahi, 2019).

## **Social Media**

Millions of users are nowadays using the social media. For businesses, any post or tweet on a social media platform can be of useful data in order to analyze the customer patterns & also to keep in touch with their customers. The social media especially important for small business as they are lacking some resource compare to the competitors so with the help of data mining they can analyze social media to maximize the efficiency of the business and keep ahead of competition and consumer expectations. By analyzing social media the businesses will know more about their customer's needs ,taste and preference and how to satisfy their customers, so from this knowledge they will be able to target the customer in their advertisement , tailor their product as per the customer preference and satisfy their customers (Balan & Rege, 2017).

## **Other Applications**

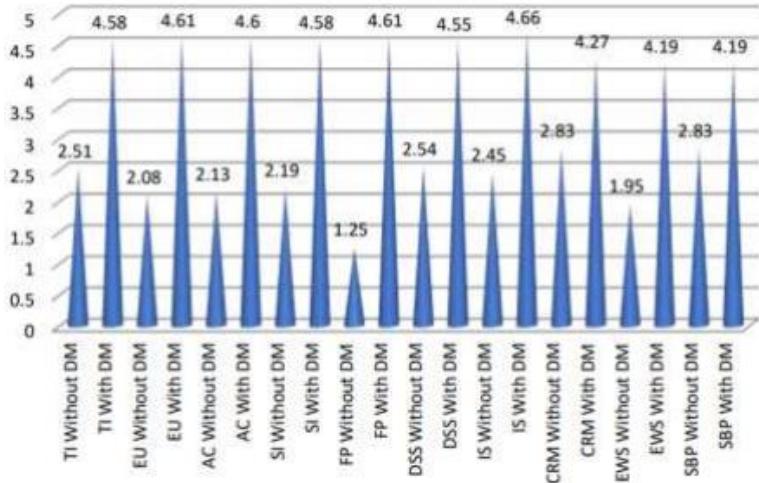
Manufacturing- The manufacturers needs to predict the customer preference in order to customize the product that best meet the customer's taste (Bathinda, 2012). Warranties- The manufacturing need to identify the number of consumers who are willing to claim their warranty and expense of those claims (Bathinda, 2012). Frequent flier incentives- the airline can identify the customer segment who can be offer opportunities to travel more (Bathinda, 2012).

## **Compare Traditional Business Intelligence without Data Mining and Business Intelligence with Data Mining**

A research paper conducted a questionnaire comparing BI with and without data mining using 10 performance metrics (Kumar, 2020)

- Timely Information (TI)
- Ease of Use (EU)
- Data Analysis Capability (AC)
- Strategic Information (SI)
- Future Prediction (FP)
- True Enterprise Wide Decision Support (DSS)
- Improved Sales Measurement (IS)
- Improved CRM (CRM)
- Detecting Early Warning Sign (EWS)
- Streamline Business Process (SBP)

Business intelligent without the data mining -analysis data and present it in such a way that its easier for the person to understand it and make a business decision



**FIGURE 2**  
**COMPARE BUSINESS INTELLIGENCE WITH/WITHOUT DATA MINING**  
**QUESTIONNAIRE RESULT (Kumar, 2020)**

## RESULTS

In this study, we found out that data mining can improve the business intelligence and enhance the profits of the business, such that the data the business can gain more understanding about the customer pattern and based on these patterns the business companies can react so this will boost the business profits and will decrease the risk when making a decision. Furthermore, because data mining can help business to know their customers, and the market trend, it will dramatically improve the marketing, and the way business do marketing. By gathering the data of the customer in the internet along with data available in the warehouse, data mining can be implemented to analyze data to find a much better understanding of the customers, as a result, business can know the customer history and based on that they can predict the customer next purchase, so this will reduce the level of risk. In addition, data mining is not only helpful for the big business, yet it can also help the small business-es, small business can benefit from data mining to analyze the customer preference for their good using the social media platform. In the banking sector, data mining can be used to identify money laundering, reduce fraud transaction, and find customer trends.

## CONCLUSION AND FUTURE WORK

To conclude the business intelligence, need to implement the data mining techniques as it significantly improves the way business deals with data. The data mining techniques allows the business to get a better understand of their data as it allows business to have much more understand about their customer pattern and this can lead to an improvement in marketing .Furthermore the data mining can be used to analyze both structured and unstructured data, also it helps to identify any fraud within the system and also data mining can analyze the social media data. There are a lot of data mining techniques to be implemented in the business field but it's important to choose the right techniques to get the best result out of your data. Since we have seen some benefits in implementing the data mining to the business intelligent. The future work would be what are the risks in implementing data mining, in order to benefit from the data mining and reduce the risks that might happen from implementing the data mining.

## Acknowledgement

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**BUSINESS ANALYTICS**

# Evolution of Business Analytics And Its Future

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## Preface

This article will cover the evolution of Business Analytics throughout the years. We will also discuss how the future looks like in Business Analytics.

## Introduction

Business Analytics has become an integral part of business operations and performance management. Businesses and corporations who wish to gain a competitive edge in the market during modern times must employ the services of skilled business analysts to do so. Without utilizing data effectively and without a dedicated analytics team, companies will not be able to sustain themselves in this world where the competition employs various analytical tools and techniques to facilitate peak performance. It's not just about performance, as business analytics can help companies increase revenue by cutting costs and decreasing waste.

Companies can now judge their markets better, understand how their products perform against substitute products from other companies and analyze how consumers react to their services or products. With the valuable information and insights gained from data sourced or generated, organizations can make better data-driven decisions that can help them become successful. Business analytics is also about sustainability and the efficient use of resources. Without skilled business analysts, companies will not effectively conduct their businesses anymore. From finances and marketing to performance or operations analytics, business analytics is being used everywhere to optimize a company's operational (business) affairs. Business analytics has existed for a long time, even without the advanced tools and techniques we have at our disposal now. For instance, merchants used to rely on handwritten annotations to contemplate their business's annual perfor-



tools advanced business analytics were slowly introduced into our society. Along these came the later generations of business analysts that would change the world forever. The evolution of business analytics was welcomed with open arms by corporations around the world.

## 1. Evolution of Business Analytics

In recent times, business analytics has evolved into a much more advanced set of tools and techniques assisted by automation and big data. Initially, business analytics was limited to a few corporate applications used by only the major MNCs. The first adoption of computing for business was noticed in the use of report-building, presentations and data entry using applications such as Microsoft Excel. Later on, more advanced applications that involved multi-dimensional data processing and data analytics were seen using add-ons such as PowerPivot in Excel. This was still a long way from BI or business intelligence, which the highly accredited firm, Gartner.

Once the concept of BI was introduced into the market, corporations around the globe wanted their hands on it. BI used various digital instruments, technologies, and metrics to evaluate business performance and helped companies get valuable insights. This facilitated more informed decision-making and ensured that all the important organizations during that time adopted software such as Tableau, SAS, or Microsoft Power BI to support their business activities and operations. With BI, concepts such as ‘web questions,’ collaboration, data security, and sourcing data from databases and distributed file systems came into mainstream use as well. By now, business analytics was not just used by large MNCs and conglomerates but also medium-level and much smaller enterprises as well. This introduced the world to an era where analytics helped create research models, design models, and simulators that further helped companies use data to forecast and predict future outcomes more accurately than ever.



## 2. Business Analytics Historical Facts

Analytics and visualizations have been used throughout history without the support of computers and software. This was done by manually plotting graphs using statistical methods and manually recording data. This was quite different from the business analytics that we recognize and know about. The more modern version of business analytics was only used much later in the 20th century to identify trends during the Second World War. This process of identifying trends helped code-breakers use data from encrypted messages such as destination (recipients of the messages), origin, and the time and date of these messages to find out what information these contained. This is a more modern use of analytics to predict information. However, we have also seen business analytics being used a bit earlier in history. Sir Henry Furnese, a well-documented banker, had been extensively using data during the 1860s to stay ahead of his competition.

Here are some more historical facts about business analytics:

- During the early 1900s, Henry Ford, inspired by Frederick Taylor's scientific management system, hired him in order to measure the performance of the assembly line of his famous Ford Model T. This led to a series of events that had transformed



 In 1973, IBM introduced the first hard disk drive that allowed users to store data which can be used for business or corporate purposes.

- During the 1970s, Bill Inmon started discussing the concept of a data warehouse to solve the problem of storing vast amounts of data for business intelligence.
- During the 1980s, the first business data warehouse was developed by IBM researchers Barry Devlin and Paul Murphy.
- In this period between the 1990s and early 2000s, various solutions and software were introduced, such as business intelligence tools by companies like SAP, Microsoft, SAS and IBM alongside relational databases.
- After the early 2000s, common people started using data more proactively for personal purposes. This also led to more corporate use of data through employees extensively using organisational data. More tools were also introduced during this time with which individuals can use business intelligence tools without extensive training. Eventually, Google Analytics was introduced that allowed website owners to analyse statistics about their website, such as trends in website visits.
- After 2010, business intelligence and analytics truly took off, being adopted worldwide by companies and businesses around the world. This also pushed us to an era of cloud computing and extensive use of Artificial Intelligence or automation.

### 3. Recent Evolution in Business Analytics

The recent evolution that business analytics has experienced can be fundamentally traced back to the introduction of automation in analytics and the concept of big data. The advent of big data meant that analytics along with various data sources should become more scalable and more powerful. This helped in introducing more advanced tools and systems that are compatible with large volumes of data. The emergence of cloud technologies also meant that data did not need to be on-site. There was also a huge demand for automating analytical tools by this time due to the massive amount of data that needed to be worked upon. All of this motivated companies to upgrade their existing

fore<sup>ing</sup> abilities that were now more accurate than ever with the help of modern business analytics. This is where businesses truly understood the importance of data analytics in business. All this technology had already existed, but the industry's growing requirement encouraged businesses of all sizes to start incorporating data analytics into daily operations.

There have been four main spheres where business analytics has evolved greatly, these are:

- Artificial Intelligence and Automated Analytics
- Predictive Analytics
- Real-time Analytics
- Big Data

## Recent Evolution In Business Analytics

There Have Been Four Main Spheres Where Business Analytics Has Evolved Greatly.



Artificial Intelligence &  
Automated Analytics



Predictive Analytics



Real-time Analytics



Big Data



Here are some reasons why Business Intelligence and analytics are essential for a successful business:

- Business analytics is very helpful in reducing risk in business operations.
- It increases revenue and helps companies churn out more profit.
- Analytics allow companies to make better and more informed business decisions that are data-driven.
- It helps increase the operational efficiency of projects or processes.
- It also helps in effectively using resources such as human assets.
- It helps in reducing wastage and in cutting operational costs.
- Business analytics directly allows companies to stay ahead of their competition and outperform them.
- Analytics optimises processes and helps in business process automation.
- It also allows companies to replicate successful results and understand how the success was achieved.
- It helps in forecasting and prediction of outcomes.
- Business analysts help monitor performance and evaluate operations through identifiable metrics or Key Performance Indicators(KPI).
- It helps in the identification of anomalies and factors that affect market and customer behaviour.
- Real-time business analytics helps in taking rapid data-centric decisions.
- It helps in improving the sustainability of businesses and projects in the long run.

## 5. Big Data – Overview



ing, and extracting insights from large datasets. This is why big data is a huge deal in this day and age. Companies collect massive chunks of data on a daily basis as they keep operating, and this data consists of multiple complex pieces of information associated with customers, products, performance, finance, etc., that must be maintained properly and then effectively used for future operations. For instance, businesses can use past data collected over many years to predict customer behavior, such as buying patterns. Or, banks can use customers' credit history when deciding upon eligibility. Histories of other customers can also be studied to predict the likelihood of certain events, such as buying substitute products.

Big data is a treasured part of business analytics, and analysts have started getting comfortable working with big data in organizations of all sizes. Big data has also directly encouraged the use of Machine Learning (ML) when working with massive datasets. ML allows data to be extracted without errors, structured and utilized much more effectively.

## 6. Advantages of Big Data For Business Analytics

Here are some advantages of using Big Data for Business Analytics:

- **More Informed Decision Making:**

Big data allows companies to work with a huge amount of user or customer data that allows them to make better decisions. A lot of past or historical data also helps companies predict more accurately.

- **Faster Decision Making:**

Using machine learning, big data can predict and identify patterns rapidly. This speeds up decision-making and allows businesses to use a lot of data very fast. The compiled data can also be processed alongside fresh incoming data, which has helped companies make informed decisions in real-time.



 data from third parties is much more expensive. Also, saving past data enables you to generate only the relevant data and not waste time on generating the same leads or information again. Also, big data, in general, helps businesses cut costs. Thus, the importance of data analytics in business is truly seen when companies increase their revenue with the help of big data.

- **Providing Better Service to Customers:**

With the help of big data, companies can understand customers' buying behavior and can then effectively provide the after-sales services or complementary services that they might require. With the help of an enormous amount of data such as posts, comments, and messages on social media, companies can even figure out customer sentiments and how satisfied these customers are with the company's products or services.

- **Finding New Opportunities:**

Businesses can discover new opportunities with such huge volumes of data. With the help of this data, businesses can come up with major solutions to problems or come up with fresh concepts and product ideas. They might also be able to figure out how to improve sales or reach out to more consumers finally.

- **Having a Competitive Edge over Competition:**

Businesses that use big data are able to project more superior business models and make better predictions that allow them to have the edge over their competitors who are using more traditional methods. Forecasting is more accurate with big data, and companies can directly increase their performance in the market with the help of these advanced insights.

## 7. Process of Business Analytics



ing that without data mining, businesses would not be able to extract cognizable information from structured and especially unstructured data. Data mining is performed with the help of statistical tools or machine learning in order to identify past trends and hidden patterns in data by analysing them. Once the data is processed or mined, it is transferred into data warehouses where it can be shared with multi-dimensional databases. Business analysts are then tasked with examining these patterns and presenting them in charts, plots or graphs.

- **Data Forecasting:** Forecasting is a very important process that involves deep analytics of past or historical data in order to estimate the performance of products, the condition of the market or customer behaviour. This can also help forecast events that require an allocation of budget. Machine learning is crucial for accurate forecasting. Data forecasting is highly used for forecasting market conditions, financial statuses, asset requirements and other future requirements. For more details, please read [\*\*\*Business Forecasting: Meaning, Methods & More\*\*\*](#)
- **Predictive Analytics:** This is similar to data forecasting, however, this is even more advanced as it uses Artificial Intelligence to evaluate risk and potential abnormalities. This allows businesses to make better decisions. Predictive analytics facilitates informed operational decisions that take aberrations, anomalies or potential events into account. Predictive analytics can also help cut ahead of the competition with the power of data. Predictive analytics help marketers and advertisers recommend products and services to customers more effectively as well.
- **Data Visualisation:** This is one of the most important processes that represent insights in cognizable formats such as diagrams, tables, graphs and charts. This helps identify patterns in data manually with ease and makes reporting to non-technical staff and stakeholders easier. Visualisation is also important for projecting the important information in data using the best possible (compact but informative) method from massive datasets.



[f](#) [t](#) [p](#) [in](#) the different stages or  
processes associated with business analytics



Data Mining



Data Forecasting



Predictive Analytics



Data Visualisation

## 8. Scope And Future of Business Analytics



The scope of business analytics is massive, and the future seems bright for people pursuing this field. More than 2.5 quintillion bytes of data are generated every day, thus ensuring that businesses cannot function without business analytics anymore. The world produces more data now in two days than we did in total from the beginning of civilization till 2003. This simply reinforces the fact that if we wish to effectively use this data to enhance the performance of our website, business, product, service, we must rely on business analytics.

53% of companies use business and data analytics in their daily operations, while many smaller enterprises have started adopting analytics ever since the Covid-19 pandemic started. Business analytics is also one of the most desirable jobs now, with companies al-

“ You may also like to read: [\*Scope of Business Analytics In India\*](#) | [\*Business Analytics Future\*](#)

## 9. FAQs: Frequently Asked Questions

### Q1. What are the three types of business analytics?

Technically speaking, the three types of business analytics are descriptive analytics, predictive analytics, and prescriptive analytics. However, when talking about job roles, the three most common types of business analytics (other than general business analytics) are financial analytics, marketing analytics, and operations analytics.

“ You may also like to read in detail: [\*Types of Business Analytics – Types of Analytics With Examples\*](#)

### Q2. What are the elements of business analytics?

The different elements or components of business analytics are data acquisition, data management, data governance, data security, interpretation, identification, insights, prediction, forecasting, data storage, data visualization, and finally, data optimization.

### Q3. Who are the users of business analytics?

Individuals and professionals from all fields and industries are users of business analytics. Common users of business analytics would be businessmen, corporate professionals, analysts, bankers, marketers, advertisers, managers, and website owners.



## 10. Conclusion

The importance of data analytics in business is massive; companies cannot operate effectively in this day and age without relying on data and business analytics. Businesses can reduce wastage, remove errors, and increase revenue with business analytics. Ever since data started being used for making business decisions, the world has changed drastically, with products and services getting better and consumers getting exactly what they want, when they want, without much effort.

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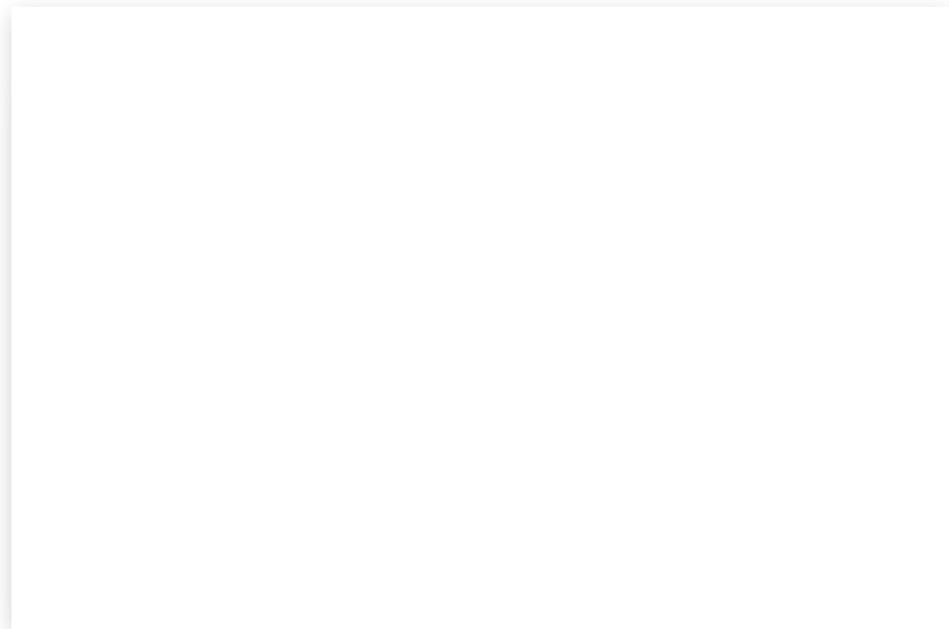
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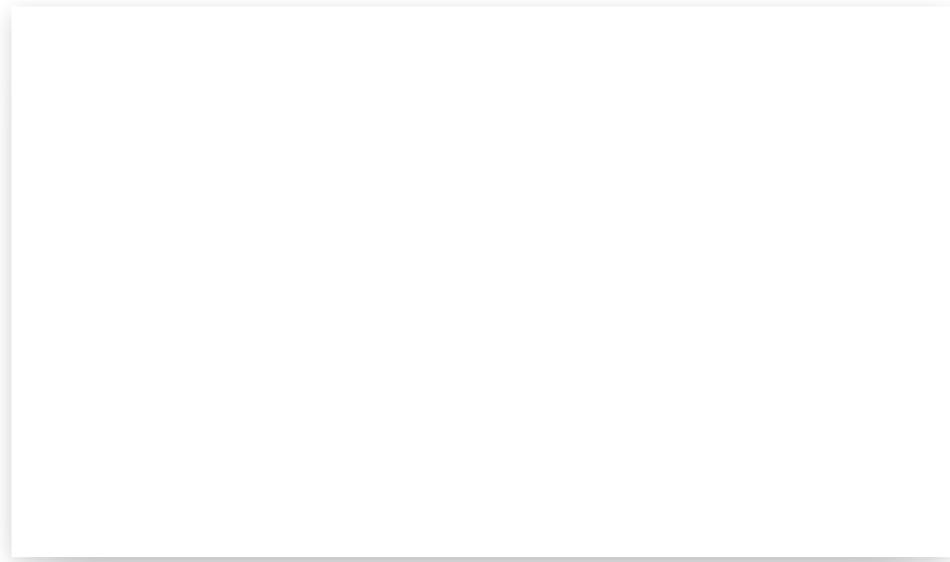
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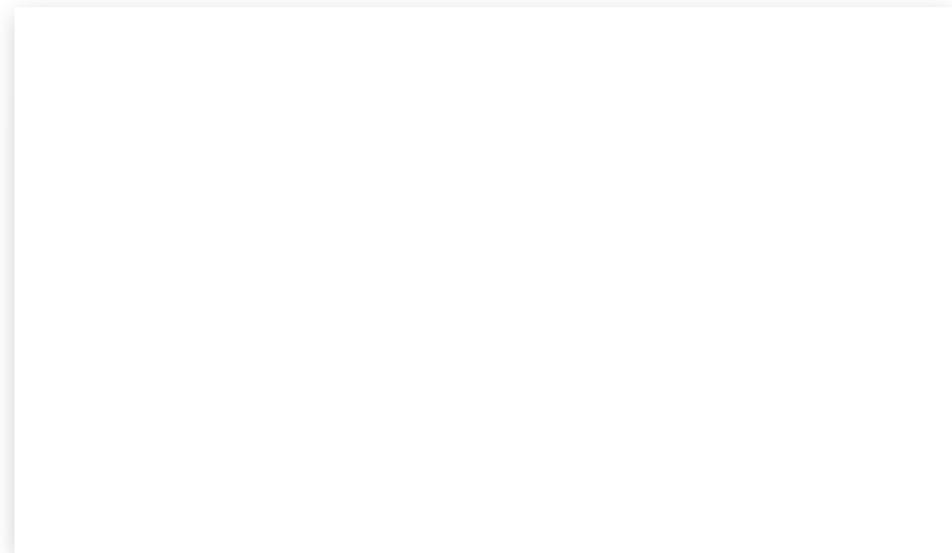
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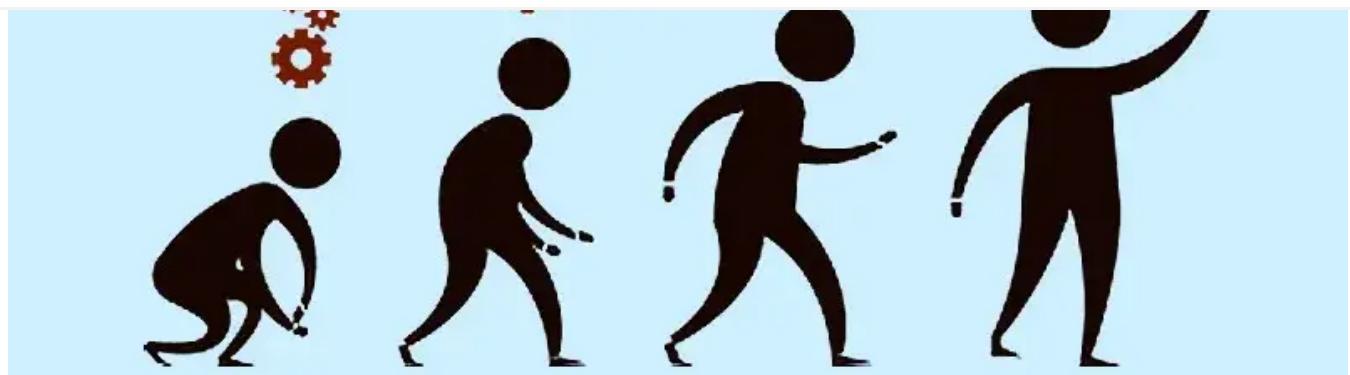
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# The Evolution of Analytics with Data

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We have made tremendous progress in the field of Information & Technology in recent times. Some of the revolutionary feats achieved in the tech-ecosystem are really commendable. *Data* and *Analytics* have been the most commonly used words in the last decade or two. As such, it's important to know why they are inter-related, what roles in the market are currently evolving and how they are reshaping businesses.

Technology often regarded as a boon to those already aware of its potential, can also be a curse to audiences who can't keep up with its rapid growth. Each era has had its moments of breakthrough and an equal share of victims (or as I'd like to call

them *collateral damage*). As of today, every monetary-driven industry completely relies on Data and Analytics for its survival.

This blog is an attempt to look over these different stages : simplifying the various buzzwords, narrating the scenarios which were never explained and keeping an eye on the road that lies ahead. So, without further ado grab your “cheat-day” meal & lets take a walk down the memory lane.

**Analytics 1.0 → Need for Business Intelligence :** This was the uprising of Data warehouse where customer (Business) and production processes (Transactions) were centralised into one huge repository like eCDW (Enterprise Consolidated Data Warehouse) . A real progress was established in gaining an objective, deep understanding of important business phenomena — thereby giving managers the fact-based comprehension to go beyond intuition when making decisions.

The data surrounding eCDW was captured , transformed and queried using ETL & BI tools. The type of analytics exploited during this phase was mainly classified as *Descriptive* (what happened) and .  570 |  3 nething happened).

However , The main limitations observed during this era were that the potential capabilities of data were only utilised within organisations , i.e. , the business intelligence activities addressed only what had happened in the past and offered no predictions about it's trends in the future.

**Analytics 2.0 → Big Data :** The certain drawbacks of the previous era became more prominent by the day as companies stepped out of their comfort-zone and began their pursuit of a wider (*if not better*) approach towards attaining a sophisticated form of analytics. Customers surprisingly reacted well to this new strategy and demanded information from external sources (clickstreams , social media , internet , public initiatives etc) . The need for powerful new tools and the opportunity to profit by providing them — quickly became apparent. Inevitably , the term ‘Big data’ was coined to distinguish from small data, which is generated purely by a firm’s internal transaction systems.

What companies expected from their employees was to help engineer platforms to handle large volumes of data with a fast-processing engine . What they didn’t expect was a huge response from an emerging group of individuals or what is today better known as the “*Open Source Community*”. This was the hallmark of Analytics 2.0.

With the unprecedented backing of the community , Roles like *Big-Data Engineers & Hadoop Administrators* grew in the job-sector and were now critical to every IT organisation. Tech-firms rushed to build new frameworks that were not only capable of ingesting , transforming and processing big-data around eCDW/Data Lakes but also integrating *Predictive* (what is likely to happen) analytics above it. This uses the findings of descriptive and diagnostic analytics to detect tendencies, clusters and exceptions, and to predict future trends, which makes it a valuable tool for forecasting.

In today's tech-ecosystem , I personally think the term big-data has been used, misused & abused on many occasions. So technically, '*big data*' now really means '*all data*' – or just *Data*.

**Analytics 3.0 → Data Enriched Offerings :** The pioneering big data firms began investing in analytics to support customer-facing products, services, and features. They attracted viewers to their websites through better search algorithms, recommendations , suggestions for products to buy, and highly targeted ads, all driven by analytics rooted in enormous amounts of data. The outbreak of the Big-Data phenomena spread like a virus. So, now it's not just tech-firms and online companies that can create products and services from analysis of data, it's practically *every firm* in every industry.

On the other hand, the wide-acceptance for big-data technologies had a mixed impact . While the tech-savvy giants forged ahead by making more money, a majority of other enterprises & non-tech firms suffered miserably at the expense of not-knowing about the data. As a result, a field of study *Data Science* was introduced which used scientific methods, exploratory processes, algorithms and systems to extract knowledge and insights from data in various forms.

Indeed, an interdisciplinary field defined as a “concept to unify statistics, data analysis, machine learning and their related methods” in order to “understand and analyse actual phenomena” with data. In other words , a well-refined data combined with good training models would yield better prediction results. The next-generation of quantitative analysts were called *data scientists*, who possessed both computational and analytical skills.

The tech-industry exploded with the benefits of implementing Data Science techniques and leveraged the full power of *predictive & prescriptive* (what action to

take) analytics ,i.e, eliminate a future problem or take full advantage of a promising trend. Companies began competing on analytics not only in the traditional sense — by improving internal business decisions — but also by creating more valuable *products and services*. This is the essence of Analytics 3.0.

There has been a paradigm shift in how analytics are used today. Companies are scaling at a speed beyond imagination, identifying disruptive services, encouraging more R&D divisions — many of which are strategic in nature. This requires new organisational structure : positions, priorities and capabilities. A closely-knit team of data-driven roles ( Data Scientists , Data Engineers , Solution Architects , Chief Analysts ) when under the same roof, is a guaranteed-recipe for achieving success.

### **Analytics 4.0 → Automated Capabilities :**

There have always been four types of analytics: *descriptive*, which reports on the past; *diagnostic*, which uses the data of the past to study the present; *predictive*, which uses insights based on past data to predict the future; and *prescriptive*, which uses models to specify optimal behaviours and actions. Although , Analytics 3.0 includes all of the above types in a broad sense, it emphasises the last . And it introduces — typically on a small scale — the idea of automated analytics.

Analytics 3.0 provides an opportunity to scale decision-making processes to industrial strength. Creating many more models through machine learning can let an organisation become much more granular and precise in its predictions. Having said that ,the cost & time for deploying such customised models wasn't entirely affordable and necessitated a cheaper or faster approach. The need for automation through intelligent systems finally arrived , and this idea (once deemed as beyond-reach) that loomed on the horizon is where Analytics 4.0 came into existence .

There is no doubt that the use of artificial intelligence, machine learning and deep learning is going to profoundly change knowledge work. We have already seen their innovative capabilities in the form of Neural Machine Translation, Smart Reply, Chat-bots, Meeting Assistants etc ,which will be extensively used for the next couple of years. The data involved here originated from vast heterogenous sources consisting of indigenous types — one that requires complex training methods — and especially those that can sustain (make recommendations, improve decision-making, take appropriate actions) itself. Employing data-mining techniques and machine learning algorithms along with the existing descriptive-predictive-

prescriptive analytics comes to full fruition in this era. This is one reason why *Automated Analytics* is seen as the next stage in analytic maturity.

### Analytics 5.0 → Future of Analytics and What's Next ??? :

Analytics 4.0 is filled with the promise of a utopian society run by machines and managed by peace-loving managers and technologists. We could reframe the threat of *automation* as an opportunity for *augmentation* : combining smart humans and smart machines to achieve an overall better result.

Now, instead of pondering “What tasks currently employed by humans will soon be replaced by machines?” I’d rather optimistically question “What new feats can companies achieve if they have better-thinking machines to assist them? or How can we prevent death tolls in a calamity-prone area with improved evacuation AI routines ? or Why can’t AI-driven e-schools be implemented in poverty-ridden zones ?”

Most organisations that are exploring “*cognitive*” technologies — smart machines that automate aspects of decision-making processes — are just putting a toe in the water. Some are doing pilots to explore the technology. While others are working on the concept of building a Consumer-AI-Controlled platform. These platforms use the idea of Personal AI agents that communicate with other AI services or so called bots to get the job done. There will be no more manual interventions necessary with just an AI-powered system to steer your personal day-to-day activities.

I wouldn’t be surprised to see either of these technologies making giant leaps in the future. Surely, there’s an element of uncertainty tied to them but unlike many, I’m rather optimistic about the future. There’s always something waiting at the end of the road; *If you’re not willing to see what it is, you probably shouldn’t be out there in the first place.*

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“Everything should be made as simple as possible , but not simpler”

Albert Einstein

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