BUSINESS ANALYTICS AND DATA MINING TECHNIQUES USING PREDICTIVE ALGORITHMS TO ENHANCE BUSINESS INTELLIGENCE

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ABSTRACT

The objective of this paper is to present a review literature on what are impacts of Data Mining (DM) and Business Analytics (BA) in enhancing Business Intelligence (BI). The paper highlights various features of DM and BA using predictive algorithms. It involves three steps: explorations, pattern identification and deployment. Business analytics presents itself as an information system that combines different data from internal and external sources from organizations in order to help to improve the knowledge of the managers, as well as the decision making process. The competitive advantage is created by better and greater understanding of the data. It focuses on business and gathers three types of analysis: descriptive, predictive and prescriptive. Data Mining is recognized as computing process of discovering patterns in large data sets involving methods at the intersection of machine learning, statistics, and database systems. Business Intelligence is the hot topic among all industries aiming for relevance. BI emphasizes on detail integration and organizing of data. DM and BA work together to process and analyse data to lighten workload for the user and organization and hence in understanding discovered materials. Predictive algorithm hence plays extensive role in enhancing BI.
Keywords: Business Intelligence, Data Mining, Data Analysis, Predictive Algorithms

I.   INTRODUCTION

Data are now flowing into every sector and function in the global economy, and, like other essential factors of production such as hard assets and human capital, much of modern economic activity simply could not take place without them. The use of Big Data — huge pools of data that can be brought together and analyzed to discern patterns and make better decisions — will become the basis of competition and growth for individual firms, enhancing productivity and creating significant value for the world economy by reducing waste and increasing the quality of products and services.

Analytics allows decision making with the data. This data could be emerging from multiple sources and you might be working with data in Research, Public sector or Business Domains. Business Analytics where we focus on business with analytics. Here the first step is defining the business objective and based on business objective we collect the data and analyze the data and

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finally we visualize the data. Functionalities are Business Requirement, Data Gathering, Data transformation, data analysis and data visualization, Machine Learning, Exploratory Analysis, Reproducible research, etc.

Data mining (knowledge discovery) is the process of analyzing data from different perspectives and summarizing it into useful information - information that can be used to increase revenue, cuts costs, or both. Data mining software is amongst a number of analytical tools for analyzing data. It allows users to analyze data from many different dimensions or angles, categorize it, and summarize the relationships identified. Technically, data mining elicits as the process of finding correlations or patterns among dozens of fields in large relational databases.

Predictive algorithms involveBig data analytics which is a technology which helps turn hidden insights in big data into business value by using advanced analytics techniques in order to support better business decisions, as the hottest new practice in Business Analytics today. According to some surveys, about 80% CEOs or executive teams view big data analytics initiatives have the potential to drive business value such as creating new revenue streams, improving operational efficiency or cutting cost, and over 80% participant organizations do ongoing projects. However, according to another survey, 55% of big data projects do not get completed, and many others fall short of their business objectives.

Our purpose in this paper is to perform a study on how using predictive algorithms aligning with Business Analytics and Data Mining Techniques can be utilized to enhance business intelligence.

II.   BACKGROUND

The task of studying through and finding out certain patterns in business data is not new. 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" and "Business Analytics" 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. In this, the research stated that the process which is designed and used for the purpose of exploring data is called as data mining, This

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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 nontrivial nuggets from the huge volumes of available data.

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 ant 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 SOOK petabytes to 35 zettabytes. 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, emaiIlchat transcripts and web click streams.
➢ Behavioural data: Transaction, usage history, payment history and orders
➢ Descriptive data: Self- declared info, (geo) demographics, characteristics and attributes.

III. BUSINESS ANALYSIS TECHNIQUES

Strategic business analysis deals with pre-project work. This is an extensive method or process of identifying business problems, devising business strategies, objectives, targets and goals helping the top management. It provides management information reporting for effective decision making process. The business analysis techniques which are used are as follows:

- SWOT Analysis
- Requirements Interviews
- Requirements Workshops
- Business Process Modeling

- Use Case Modeling
- Data Modeling

SWOT Analysis: It is an acronym for Strengths, Weaknesses, Threats and Opportunities Analysis. It is an enterprise level analysis method of assessing an organization against these four dimensions. It ultimately drives decision making for changes and improvements to an organizations position in the market. It is important to note that the SWOT Analysis in itself sounds simple but each dimension (Strengths, Weaknesses, Threats and Opportunities) has it's own set of Techniques which can be applied to determine the outcome of each dimension.

The SWOT Analysis is in most cases applied as an Enterprise Level Analysis activity outside of the Project Environment. This means it can occur at any stage when a corporate, department or unit needs to re-assess their internal and external environment in order to re-establish direction and strategy. This Business Analysis Technique can also be applied in other types of situations when it is important to assess a group, function or even individual people against these dimensions.

Requirements Interviews: A lot of people will be very familiar with this Business Analysis Technique. It is the activity of performing a structured interview where the Business Analyst questions, captures, interprets and understands the intention of requirements requested by the interviewee for a particular solution. This business analysis technique may look easy and informal but is in fact a specific skill for a Business Analyst to learn to master in order to be really effective during the interview itself.

The Requirements Interview is so recognized because it is a technique that can be applied by Business Analysts of all skill levels. Common from a stakeholder engagement perspective because the business analyst builds rapport during the interview and hence forms a direct relationship with the individual stakeholder being interviewed. This in turn creates a high stakeholder engagement level for the project and potential future support from that stakeholder. Despite that this business analysis method can be time intensive, it has many soft benefits for the future business analysis activities on the project.

Requirements Workshops: Similarly to the Requirements Interview, the purpose of the Requirements Workshop is to elicit requirements from business stakeholders about what they believe a new solution need to be able to do in order to reach their needs. The difference here is that the Requirements Workshop involves a group of individuals at once and creates a different type of requirements gathering exercise. There are various approaches for conducting a requirements workshop and the most important factor to consider when planning this type of Business Analysis Technique is to consider the desired outcome and hence finding the audience who can provide this outcome to you.

Business Process Modeling: Business Process Modeling is a diagrammatic representation of the sequential workflow of information, processes and decisions for a particular business process.

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There are different notations for Business Process Modeling of which the Business Process Modeling Notation (BPMN) and Unified Modeling Language (UML) Activity diagrams is of the most widely used notations for business process modeling. There are myriad opportunities for a professional to apply this Business Analysis Technique.

Some of the most common times would be during the Analysis Phase of a project when it is important to understand and analyze the current business processes and future business process for a business domain that project is concerned with. It is also very often used to support the implementation of a project and to assist ongoing procedural documentation for systems and business process changes. This is another instance of a Business Analysis Method, which is also used by other professionals for purposes not directly relating to Business Analysis.

Use Case Modeling: In its most simplistic form, the UML Use Case Modeling technique is about illustrating the functions that a new system should be able to perform from a user interaction perspective. It is often used to present the main functions, actors and interactions between the actors and use cases for a new system that is being designed. This is a powerful Business Analysis Technique that is often used by Business Analysts to translate business requirements into functional specifications within the traditional software development project. Coming through a Business Analysis Technique perspective, this method is applied during the detailed requirements specification and solution design stage of a project. It should be noted that this Business Analysis Technique is primarily used with the Software Development type of Technology Project.

Data Modeling: Data Modeling is used to describe entities (things, people, places etc) of which data is to be captured and attributes for each entity to record. It then also visually illustrates how each entity relates to other entities by way of common attributes or combinations of attributes. This is also referred to as entity relationship modeling. Data modelling coming from a Business Analysis Technique perspective is so popular because it is a definitive way to ensure that the data that is captured by the front end of a system is also the data that will be represented on reports for stakeholders. With this technique it is easy to show which data elements will be present in a solution and hence whether certain reports would be achievable as output.

Data base designers who use this technique to design a data base solution can apply this technique to a lower level of detail and does this beyond the scope of a Business Analysis Technique. However, from a Business Analysis Technique view it is a exuberant technique to use to ensure reporting requirements are met by a proposed design.

IV.   DATA MINING TECHNIQUES

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

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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:

- Classification
- Anomaly detection
- Clustering
- Regression
o Association Rule Discovery (Dependency Model)
- Summarization

Classification: Before digging into the hectic modelling phase of the analysis of data the primary step we have to take is classification. Our main objective 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. This classifies the data item in anyone 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). We usually bifurcate 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.

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 evaluated and identified on the previously determined data.

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.

Regression: Regression can be simply called as the "predictive power". Assuming a linear or non-linear model of dependency, regression analysis can be utilized 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 agethe 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.

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 to produce the required revenue and even improve the efficiency of the business. There are far fledged applications related to this method which can help multiple 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.

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.

RESEARCH DOMAINS ON BIG DATA :

- Remote Sensing - big data analytics
- Business Intelligence and analytics

V.   BUSINESS INTELIGENCE

As described by the author 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.

The applications are data-driven and mostly interdisciplinary. Based on this it can correctly be determined that we are now living in the age of big remote sensing data. Furthermore, these data are becoming an economic asset and a new important resource in many applications.

5.1 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. Utilization 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 increases with twice the pace 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 technique 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.

5.2 BUSINESS INTELLIGENCE USING BUSINESS ANALYTICS

Business Analytics collects and analyzes data, employs predictive analytics and generates richly visualized reports in custom dashboards to engender results enhancing the Business Intelligence using predictive algorithms. The aim of these features is to help identify and address an organization's weak points. This is where the similarities end. Business analytics software is used to explore and analyze historical and current data. It utilizes statistical analysis, data mining and quantitative analysis to identify past business trends. It then uses that data for predictive modeling, which can recognize and prepare for future business climates. One of the most powerful aspects of BA is ad-hoc reporting, which allows companies to perform ad-hoc analysis of their data in real-time and, therefore, make quicker business decisions. In effect, business analytics uses predictive analysis to solve problems before they've occurred. Business intelligence solutions are among the most valuable data management tools available. BI solutions seek to collect and analyze current, actionable data with the purpose of providing insights into improving business operations. However, business analytics software is primarily used to analyze historical data to predict business trends, usually with an eye toward improvement and, often, preparation for change.

VI.   PREDICTIVE ALGORITHMS

Predictive algorithms encompasses a variety of statistical techniques from predictive modeling, machine learning, and data mining that analyze current and historical facts to make predictions about future or otherwise unknown events.

In business, predictive models exploit patterns found in historical and transactional data to identify risks and opportunities. Models perceive relationships among many factors to allow assessment of risk or potential associated with a particular set of conditions, guiding decision making for candidate transactions.

The defining functional effect of these technical approaches is that predictive analytics provides a predictive score (probability) for each individual (customer, employee, healthcare patient, product SKU, vehicle, component, machine, or other organizational unit) in order to conclude, inform, or influence organizational processes that pertain across large numbers of individuals, such as in marketing, credit risk assessment, fraud detection, manufacturing, healthcare, and government operations including law enforcement. Predictive analytics is used in actuarial science, marketing, financial services, insurance, telecommunications, retail, travel, mobility[disambiguation needed], healthcare, child protection, pharmaceuticals, capacity planning[citation needed] and other fields. Best of applications is credit scoring, which is used throughout financial services. Scoring models process a customer's credit history, loan application, customer data, etc., in order to rank-order individuals by their likelihood of making future credit payments on time.

Predictive models are depictions of the relation between the specific performance of a unit in a sample and one or more known attributes or features of the unit. The objective of the model is to assess the likelihood that a similar unit in a different sample will exhibit the specific performance. This category covers models in many areas, such as marketing, where they seek out subtle data patterns to answer questions about customer performance, or fraud detection models. Predictive models often perform calculations during live transactions, for example, to evaluate the risk or opportunity of a given customer or transaction, in order to guide a decision. Adhering to the advancements in computing pace, individual agent modeling systems have become capable of simulating human behavior or reactions to given stimuli or scenarios.

The available sample units with known attributes and known performances is referred to as the "training sample". The units in other samples, with known attributes but unknown performances, are referred to as "out of [training] sample" units. The out of sample units do not necessarily bear a chronological relation to the training sample units. For instance, the training sample might uphold literary attributes of masterpieces by Victorian writers, with known attribution, and the out-of sample unit may be newly found writing with unknown authorship; a predictive model may aid in attributing a work to a known author. Another example is given by analysis of blood splatter in simulated crime scenes in which the out of sample unit is the actual blood splatter pattern from a crime scene. The out of sample unit might be from the equivocal time as the training units, from a heretofore time, or from a time in future.

Such predictive models are utilized to engender enhancement in business intelligence under the umbrella of data mining techniques and business analytics.

VII. 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 remortgage 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 and BA in BI.

VIII. APPLICATIONS OF BUSINESS ANALYTICS AND DATA MINING BUSINESS

Data mining adhering to business analysis 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. 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. Data mining has been successfully applied in the following areas.

A. 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. 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 analyzed.
- Risk factor identification: Factors like behavior 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.

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Insurance companies need smarter systems to manage a rapidly changing and complex market. The road to profitability lies in better decision making using predictive algorithms where Business analytics can hold the key to optimized performance, informed decisions, actionable insights and trusted information.

B. *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. 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. The techniques of data mining which could be useful in the retail industry are as follows:

- Establish customer shopping behavior: 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.
- Analyze sales campaign: We can determine the effectiveness of the sales campaign by studying certain factors such as advertisements used and discounts offered.

Applications in line with business analytics towards business intelligence for marketing sector includes studying buying patterns of consumer behavior, analyzing trends, help in identifying the target audience, employing advertising techniques that can appeal to the consumers, forecast supply requirements, etc.

C. *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. Nowadays Rules Visualizer of MineSet and Nicheworks 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.

In data mining technique and business analytics 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.

D. 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. 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.

E. 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. To maintain a proper relationship along with the customer it is utmost important to collect and analyse information.

G. 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. The business alaytics and 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.

IX.   CONCLUSION

This paper discusses the till date effect of business analytics and data mining techniques using predictive agorithms to enhance 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 analytics which helps in making business related decisions. The paper shows enhancement in business intelligence 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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