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Data Mining and Business Intelligence for Better Healthcare Decision

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Abstract: Business intelligence is a subject of business information whose purpose is to make strategies that include new technologies, applications, and practices to collect the targeted information. Data mining is one of the most motivating areas of research and it is become gaining popularity in healthcare organization day by day. Data mining is based on several techniques such as classification, clustering, association, and regression in the health domain. While data mining has several advantages but also has disadvantages. This research-based finding helps any healthcare organization to make the decision that helps the organization to become more popular and demandable.

Keywords: Algorithm, Big Data, Business Intelligence, Data Mining, Financial Operation, Healthcare Industry, Key Performance Indicator

1. Introduction

Technology keeps the human generation's life more advanced and easier day by day. In addition, we now living a technological world where all information related to any subject matter can find out by clicking the mouse button. Consequently, the human generation using that information, and by using that information it is helping the developer and the IT analyst make several applications that are playing a significant role in our daily life. Based on these facts one of the most known subjects today is data mining which is based on several technologies and those technologies help the IT analyst to target the right information in order to give the best service to the people. On the other hand, business intelligence is a subject of business information whose purpose is to make strategies that include new technologies, applications, and practices to collect the targeted information, and analyze that information in order to make the correct business decision that will make the institution more demandable to the people. In the present time and with the development of advanced internet technologies, data mining is known as one of the most motivating areas of research and it is become gaining popularity in healthcare organization day by day. The aim of data mining is to uncover new trends in healthcare organizations which are helpful to all parties associated with this field. In addition, data mining is based on several techniques such as classification, clustering, association, and regression in the health domain. Using these techniques helps the medical researcher and technologist to make the right decision. While data mining has several advantages but also has disadvantages. On the other hand, a healthcare organization is an organization whose aim is to give service to the public hence, most organizations are run by federal funds. However, there are several facts healthcare organizations all time want to make more evidence-based decisions by using less accessible decisions. However, it is true that many organizations firstly did not take BI seriously due

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to the research gap. Consequently, healthcare organizations later find out that they face several facts like lack of decision support capabilities, what is the organization's targeted goal on how to make the service more demandable than other organizations. To solve these root problems healthcare organizations, need to do expand research on BI to make their organization more demandable to the public. This research-based finding helps any healthcare organization to make the decision that helps the organization to become more popular and demandable in any area however, their disadvantages can be seen due to using the BI.

2. Data Mining in healthcare

In order to make the correct decision, the healthcare sector needs data mining which helps them to discover knowledge and the ability to select the targeted patterns. In other words, the most advancing field of research today is data mining hence it requires the most meaningful and useful details from a large collection of data. On the other hand, every human body has a different perspective point of view, for example, the blood group hence, any type of health data needs to do analytical methodology in order to identify vital information which is very essential to make the correct decision. Furthermore, when fraud in health insurance and reduction in the solution of medical care that time data mining plays an important role. Researchers also get benefited by using data mining analysis results such as developing effective healthcare policies, and a recommendation system based on patient health profiles. In order to do this, the healthcare industry needs a rich database system that will store the proper diagnosis result and patient treatment profiles. Based on this fact and due to the huge number of data it is often complicated and complex to analyze hence, the healthcare provider or administrator faces several challenges to make a meaningful decision about patient health status. In other words, the data may be categorized from several points of view such as treatment, hospital records, medical claims, doctor and patient history, etc. Hence, there are a high amount of data and some of them are not necessary (I.O et al., 2018). Therefore, data mining tools give a targeted decision to the management from the result based on analyzing and discovering knowledge from the data. Furthermore, most healthcare organizations follow a term and regulations which consider any type of data of the patient is classified. This is because these data are pointing to patient diseases and those treatments related to the management of diseases. It also helps the patient to make his admission to the hospital more easily, for example, the database can find out what type of health problem the patient currently has and make the admission decision such as whether did patient needs emergency care or need to see the doctor. Furthermore, advanced technologies and data mining techniques help to reduce spending and evaluate the features which are responsible for diseases. To make the healthcare data clean and correct there are several applications the data mining technique follows such as giving importance on collect, storing, preparing, and mining data. It is true that data mining brings a huge advantage to the healthcare sector. For example, the advance in technology and complexity makes data mining strategies difficult. However, researchers need to get data in order to make the correct decision this also applies to the healthcare organization (I.O et al., 2018). Data mining processes system works as a fully automated volume of data and that is uncertain to the cluster of data, anomaly detection, and data dependencies. In brief, the processing system works an input the data of a patient from the database then based on data feature which needs to analyze for diagnosis in order to make more accurate decisions. In summary, the process of data mining is based on the research of data, data collection, data pre-processing, and data transformation (I.O et al., 2018). Today is the age of digital hence, all data of patients are stored in electronic format, and those data include patient details which are known as vast data. Here the complexity and complication saw

due to the increase in data. Based on this fact, due to the fewer staff, it is hard for the healthcare organization to analyze those data if they go on the traditional method. Using the field of mathematics, computer, and statistics make the path easy for the healthcare provider to discover the correct information from the volumes of complex data and make data mining more useful to the healthcare sector. For example, detection of fraud, mismatch of drugs, patient diagnosing profile, treatment, patient disease type, patient survivability rate, etc. On the other hand, data mining also helps the researcher in order to write the research paper and also gives support to the healthcare industry to make the proper decision and fix the best selection of treatments and predictions (I.O et al., 2018).

3. Data mining process:

Data mining one most known facts is knowledge discovery is a process that allows the automatic scanning of high-volume data in order to make usage patterns. However, when the knowledge fact has been determined then the evaluation methods took place which can be improved the data mining process can be refined for future purposes. Here, the new data source will be integrated to get the different types of results. This process is very useful from a low level to a high level. It has been determined that the data mining and knowledge discovery process treated equivalent, however, data mining is an important step in the knowledge discovery process. This process included the use of the database, any selection of data, pre-processing, sub-sampling, and transformation. In addition, data mining with the knowledge discovery process pointed to the algorithmic means which focus on the patterns which are extracted and listed from the targeted data (Taranu, 2015).

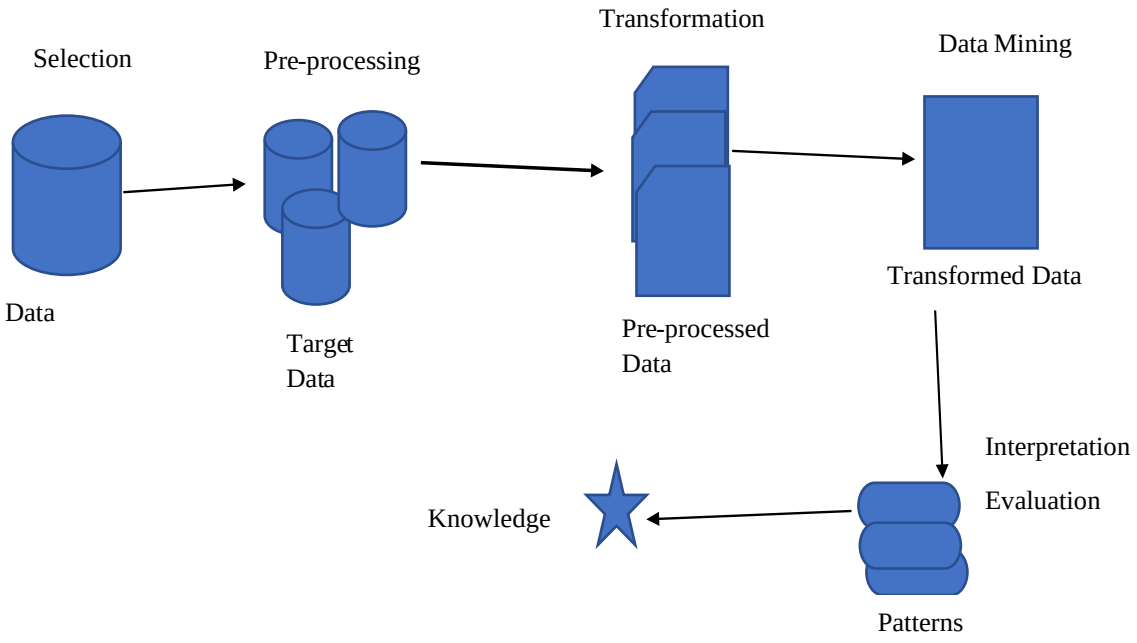

Figure 1. Data mining knowledge discovering process.

Due to the development of memory shortage, the amount of information stored in any organization is known as terabytes. One terabyte pointed on it can store text equivalent to approximately two million books. However, most of the organization did not follow the structure of database management hence, those data were seen that poorly structured with different format levels and most of them are not useful during the critical time occurs in other words, less important data or those data which have no benefit can be seen has been stored to the database. Based on these facts it can

be said that it is important to data need to be processed and analyzed and make the processing action from the information. Hence, researchers use several developed algorithm models for autonomous prediction based on data corresponding to various features. On the other hand, those methods are used for a purpose and every method has advantages also have disadvantages. Hence, the task of data mining can be divided into two ways such as descriptive and predictive. The descriptive task objective after reviewing the data and the entire construction of the Business Intelligence is a technique that helps healthcare organizations to manage their overcome cost and makes accurate decisions when facing fund problems. Through using the BI technique healthcare provider can decrease several frauds however, BI also have disadvantages such as

privacy issue and replacing the doctor. It is true that no one wants to share their own medical record however, by using the BI tools healthcare provider can easily determine that. Hence, organizations need to establish strong privacy terms and conditions, and employees have to abide by them. On the other hand, BI techniques are a part of artificial intelligence hence, it has the judgment to make a decision or have the opportunity to show a better result. As today is the time of finding all information and believing that by using any internet channel hence, the fear is BI taking the doctor position in the healthcare industry. Which is a negative fact of the BI. We still need a Doctor who will analyze the BI data and give his or her concern about the patient, not the software. However, it is true that using the BI technique it is helping the healthcare industry to make the right decision in a timely manner.

4. Application of data mining in healthcare:

It has been recognized that healthcare contains various information to analyze that information it is necessary to apply the data mining application. In other words, everyday healthcare keeps changing based on the situation and other patients' points of view hence, the information system of healthcare is known as complex. A big part of the complex is known as the paperwork such as patient health records and other activities. However, due to the development of technology and all information can be available in an electronic form however, converting that information to knowledge is known as complex work. Based on this fact healthcare organizations need to make an expert analysis of the medical data project however, it is time-consuming and expensive (Taranu, 2015). On the other hand, it is not clear what type of data has been recorded in the database hence, the healthcare organization's success depends on useful information that has been recorded in the database. From the medical research point of view, data mining is based on a hypothesis and the accepted result is based on a set of data without having an obvious hypothesis. Furthermore, the traditional data mining objective is to focus on patterns and trends in data sets while data mining in healthcare objective is to focus more on a minority that is not in accordance with patterns and trends (Taranu, 2015). In addition, standard data mining is based on more focused on describing what is the data about not focusing more on patterns and trends here is the difference between standard and healthcare data mining. This is because healthcare data need a beef description this is because it is related to patient life and death. In addition, a description of data gives more examples and hypotheses to similar related cases which is helpful to the healthcare professional to make the right decision. Based on these facts' healthcare professionals used techniques such as artificial neural networks, decision trees, genetic algorithms, and nearest-neighbours methods (Taranu, 2015). The first technique which is known as artificial neural networks is like a technique that is formed based on a superior learning process in the human brain. In addition, the neural networks pointed to a group of connected input or output units where each connection has its own weight. The second technique is known as the decision tree which

pointed to a graphical representation of the relation which exists between the data and the database. In other words, this process also uses in data classification. This technique is like a tree model hence, it is called by this name. The main purpose of the decision tree is to make classifications and predictions. For example, classified the root node to some leaf node and these nodes are based on if-then condition. On the other hand, tree views are popular among healthcare professional as it is clear and easy to understand. In addition, decision tree algorithms are faster than neural networks and the learning is shorter than the neural networks. Furthermore, the decision tree can be organized as a special form of a ruleset where the character is recognized as a hierarchical organization of rules (Taranu, 2015). The final technique such as genetic algorithms is recognized as genetic modification, mutation, and natural selection. In addition, these are algorithmic optimization strategies that are inspired by the principles observed as a part of natural evolution. The main objective of this technique is to use genetic algorithms to formulate hypotheses which are dependencies between variables form of association rules. Unlike other techniques, there has no learning process. The process is like when new data shows up algorithm analysis objective is to find out the best fit of the database which brings an accurate outcome. This technique often uses in the diagnosis of heart diseases and has an accuracy rate of 97.4% approximately (Taranu, 2015).

5. The benefit of data mining in the healthcare sector:

Data mining bring several advantages to the healthcare industry however, it also brings benefit to the stakeholders too. The first benefit is provided to the care provider. Care providers use data mining to identify effective treatment and best practices in order to develop guidelines and standards of care. The second benefit applies to the patient. Patients who have serious high-risk diseases or chronic conditions can receive better and more affordable healthcare services. In addition, data mining helps design that service under appropriate identification, tracking, and use of appropriate intervention and treatment protocols. The third benefit applies to the healthcare organization. In other words, healthcare organizations use data mining to improve patient satisfaction, develop a patient-centered care service, and make a cost management procedure on how to decrease the cost of several services. In addition, develop a model that will increase operating efficiency while high-quality care maintenance took place. The last benefit applies to all insurance organizations. Insurance organizations use data mining results in order to detect medical insurance fraud and abuse. Consequently, data mining helps them to reduce losses (Archer Software, 2020).

6. Data mining challenges in healthcare:

According to the researcher's point of view, the most significant challenge of data mining in healthcare is to obtain quality and relevant medical data (Tomar & Agarwal, 2013). In addition, it is complex to get precise and complete healthcare data due to patients' less information, and the unable to record those data in an electronic form for technical reasons. Another reason is most of the healthcare data is complex this is because data collected from the laboratory and medical reports and all of the healthcare organizations did not use the same data mining technique. Hence, when a patient went to a new hospital then the healthcare organization felt confused to collect or detect the main source of data of the patient. On the other hand, it is mandatory for the healthcare provider to collect quality and accurate data this is because these data are useful to provide cost-effective healthcare treatments to patients. Another point of view is when a patient comes to the healthcare provider to give a set of questionaries however, the patient is unable to remember or unable to find out what the answer will be is the result of the mismatch of data. In addition, sometimes the healthcare provider

faces difficulties such as missing information and incorrect entries. Which is the result of fewer quality data points to fewer or no useful results. Based on these facts to run a successful data mining process it is essential to have a complete set of medical data that need to analyze. Hence, to make an effective decision it is essential to have the quality and accuracy of the data set. On the other hand, due to privacy concerns healthcare insurance providers are unable to find out about fraud detection. This is because most of the patients did not want to share their medical records also the healthcare provider needs permission from the patient. Another point of view is the cost of the data warehouse is very high. For example, before applying the data mining technique it is mandatory to have accurate data that need to collect and record from different sources in a central data warehouse. This process is a costly and time-consuming process. In addition, a faulty data warehouse did not give an effective data mining result hence, unable to make the accurate decision (Tomar & Agarwal, 2013).

7. Business Intelligence in healthcare:

It is an economic and national concern that healthcare service needs to improve their quality, safety, and efficiency. In addition, it is a subject of interest to the researcher due to the role of technology and ensures healthcare quality and control of cost making an argument with the industry. On the other hand, to deliver a quality health service healthcare providers need to access and use the right information at the right time and patients should have permission to access their healthcare information in order to be able to self-manage their condition (Ashrafi et al., 2014). Based on these facts using advanced technology in the healthcare sector is an opportunity to provide the best healthcare service, however, also needs to consider the transparency of economic activities and the availability of information in a real-time manner. To receive the best healthcare service the healthcare organization currently investing millions in computer systems, diagnostic technology, and preventive care programs in an attempt to meet healthcare quality goals. It is true that those development processes come with a high price tag hence, the prayer and providers in the healthcare industry, both public, and private partnerships are looking into technology that will reduce costs also increase the quality of the health service. The main objective of business intelligence is to help healthcare providers to reduce costs, increase revenue, and develop a model that will improve patient safety and outcomes while complying with several regulations and standards. Another point of view is by using business intelligence healthcare provider has the opportunity of more visibility into their financial operations. For example, identify highly profitable and underutilized services. In addition, monitoring cash flow to make a budget based on annual income is also a part of business intelligence (Villanova University, 2020).

8. Application of Business Intelligence in the healthcare industry

One of the most recognized applications of BI in the healthcare industry is patient care and satisfaction. For example, BI record all data via electronic health record and provide that to the doctor in order to make an accurate decision. In addition, BI also has remote service hence, the doctor can view patient data while staying at home and make a decision when the patient's situation is critical. The second point of view is by using BI tools, software, and applications patient data are more accessible hence, patients have a more personalized view. Consequently, the doctor makes the right decision which also brings benefits the patient in his or her future medical condition (Bruce, 2020). The third point of view is BI help on improving decision-making. This is because BI software has enabled fracture to track Key Performance Indicators (KPIs) whose aim is to adjust the healthcare professional’s performance which is based on precise information and examination of knowledge.

The fourth application is better cost allocation. For example, when a BI user such as a healthcare professional targets the information via available tools then the person has a better idea to address risks, makes the suggestion to avoid risk and provide the solution, and makes a forecast model for the near future. The fifth application is claiming management procedures. BI technology targets all records and monitors cases for health insurance hence, it also helps the reaction times against claims. In addition, it also provides a safeguard to the insurance agencies during deceitful cases and arranges the best cost for treatment. Furthermore, BI also analysis insurance companies' income and other expenditures to improve estimation as well (Bruce, 2020). In the present time, there are several business intelligence tools have been used by healthcare organizers. One of them is known as Domo. Domo is recognized as cloud-based business management software which analysis various information sources such as excel sheets, databases, and online available data. Another fracture of Domo software gives both micro and macro-level visibility and examination. Hence, the organizer can easily make money adjustments and determine their rate of profitability and investment return percentage. Another recognized BI software is science software whose objective is to analyze unique databases and produce relevant future business forecast results. In addition, when the analysis has been done the software structured all information into a predefined standard format. The client can use that information and make a decision that can be the view from a different filter (Bruce, 2020).

Conclusion

In modern times data mining consider the most advanced approach to making accurate decisions. In addition, it is playing a great important role in the area of medicine also healthcare organizations understand the demand for needs of data mining. On the other hand, using the best practice of data mining helps the healthcare professional to make a successful decision which will improve the success of the organization and patients' point of view. To make a successful and accurate decision data mining needs appropriate technology and analytical technique as well as system tracking and a backup facility. Once the data mining started it keep collecting data and represent the continuous cycle of knowledge discovery. While data mining faces several challenges such as data accuracy, and the higher cost of management, however, solving these challenges can open the door or create a good business strategy for the organization. Business Intelligence is a technique that helps healthcare organizations to manage their overcome of cost and makes accurate decisions when facing fund problems. Through using the BI technique healthcare provider can decrease several frauds however, BI also have disadvantages such as privacy issue and replacing doctor. It is true that no one wants to share their own medical record however, by using the BI tools healthcare provider can easily determine that. Hence, organizations need to establish strong privacy terms and conditions, and employees must abide by them. On the other hand, BI techniques are a part of artificial intelligence hence, it has the judgment to make a decision or have the opportunity to show a better result. As today is the time of finding all information and believing that by using any internet channel hence, the fear is BI taking the doctor position in the healthcare industry. Which is a negative fact of the BI. We still need a doctor who will analyze the BI data and give his or her concern about the patient, not the software. However, it is true that using the BI technique is helping the healthcare industry to make the right decision in a timely manner.

References

[1] Ashrafi, N., Kelleher, L., & Kuilboer, J. (2014). The Impact of Business Intelligence on Healthcare Delivery in the USA. 9. doi:Interdisciplinary Journal of Information, Knowledge, and Management

[2] Business Intelligence in Healthcare. (2020). Retrieved from https://www.villanovau.com/resources/bi/business-intelligence-in-healthcare/

[3] Bruce, D. (2020, July 02). 6 Applications of Business Intelligence in Healthcare Industry. Retrieved from https://www.knowledgenile.com/blogs/business-intelligencehealthcare-industry/

[4] How does data mining help healthcare? (2020, April 29). Retrieved from https://archersoft.com/blog/how-does-data-mining-help-healthcare

[5] Harper, D. (2019). Benefits of Business Intelligence in Healthcare. Retrieved from https://datafloq.com/read/benefits-business-intelligence-in-healthcare/6156

[6] I.O, O., O.L, P., O.O, O., & K.T, O. (2018). A Review on Data Mining in Healthcare. 7(9). doi:International Journal of Advanced Research in Computer Engineering & Technology

[7] M. (2020, April 27). Business Intelligence for Healthcare Industry. Retrieved from https://www.mobifilia.com/business-intelligence-for-healthcare-industry/

[8] Solutions, A. T. (2019, May 10). 8 Benefits of Business Intelligence in Healthcare Sector. Retrieved from https://www.teplar.com/blog/8-benefits-of-business-intelligence-inhealthcare-sector/

[9] Taranu, I. (2015). Data mining in healthcare: Decision making and precision. VI. doi:Database Systems Journal

[10] Tomar, D., & Agarwal, S. (2013). A survey on Data Mining approaches for Healthcare. 5, 241-266. doi:International Journal of Bio-Science and Bio-Technology

[11] Young, A., & Delgado, R. (2016). The Pros and Cons of Big Data in the Healthcare Industry. Retrieved from https://www.healthtechzone.com/topics/healthcare/articles/2016/11/18/427248-pros-cons-big-data-the-healthcare-industry.htm