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How Should Data Mining & Analytics Be Used in Health Care?

Introduction

As technology continues to advance, the collection, storage, and analysis of data reaches unprecedented heights. IT professionals, researchers, and even students can take data accumulated from nearly any transaction, activity, or organization and manipulate it to discover trends which can improve processes and products. This increased prevalence of data mining and analytics is also present in healthcare. This presence causes controversy regarding whether or not the benefits outweigh the drawbacks of using data manipulation operations on medical data. Some stakeholders feel that by identifying trends in data, creating model-type algorithms, and connecting various stakeholder entities, researchers are enabling doctors to provide better care which results in improved health outcomes for patients. However, some physicians feel that the autonomy and innovation required of medical professionals are hindered because of the establishment of taxonomies of care activities and the implementation of excessive quality control measures. In addition, much concern is present over potential violation and misuse of personal medical data. The purpose of this paper is to examine both the benefits and drawbacks of data analytics in healthcare by analyzing case studies of its use, so that the reader is given a complete and in depth analysis of the issue. When researching for this paper, I was looking for answers to these questions: How is data mining used to improve processes and practices in healthcare? What objections do various stakeholders have in regards to medical data mining?

What are the expectations for data analytics in health care in the future? First, I discuss the current and past benefits of medical data mining, then, I address the drawbacks of such practices, and finally, I examine what the future of data manipulation practices may hold and its potential effects on the healthcare industry.

Below are articles obtained predominantly from databases that provide examples of the uses of trends that resulted from medical data mining, analyze negative outcomes that can arise from the manipulation of personal medical data, and highlight advances in data mining practices and what those innovations could mean in terms of healthcare. The sources below are all from academic journals, so the viewpoints expressed are seemingly non-biased in nature. The articles address the issue question by providing different perspectives and specific examples of the benefits and drawbacks of data analytics in healthcare.

Bibliography

Gutierrez, Jennifer C., et al. "Characterizing Primary Care Visit Activities at Veterans Health Administration Clinics." *Journal of Healthcare Management* 60.1 (2015): 30-42. Academic Search Complete. Web. 30 Jan. 2015.

In her article "Characterizing Primary Care Visit Activities at Veterans Health Administration Clinics", Jennifer C. Gutierrez, a project manager at the Center for Evaluation of Patient Aligned Care Teams, analyzes a research study conducted on primary care provider (PCP) activities and attempts to prove the identified taxonomy's worth in improving healthcare. Gutierrez introduces the desire for increases in efficiency in primary care activities, discussing the particular motivations of medical home practices including physician expertise and use of resources. Gutierrez qualifies her claims with the

example of a study that was performed by videotaping 27 PCPs during office visits and the taxonomy of provider activities that was then defined. Gutierrez proposes team-based care as a model in which members of an interdisciplinary team are united, which pulls focus and immense responsibility away from the PCP. This model, according to Gutierrez, results in each team member operating at the top of their license, sharing responsibility equally, and providing the best possible care to patients.

This article will allow me to present an easily understood, nontechnical example of how commonplace research studies coupled with data analytics can allow regulatory agencies and doctors to make incremental improvements in healthcare. From a technical standpoint, the article presents important and cutting edge aspects of the uses of information technology. Instead of “normal”, easily quantified data, this research study outlines qualitative activities and formats them so that that the data gathered can be queried and trends can be identified to improve practices.

Hoon, Jin, Kim Seoungcheon, and Kim Jinhong. "Decision Factors on Effective Liver Patient Data Prediction." *International Journal of Bio-Science & Bio-Technology* 6.4 (2014): 167-177. Academic Search Complete. Web. 6 Feb. 2015.

In his article, "Decision Factors On Effective Liver Patient Data Prediction", Hoon Jin, a professor from the Department of Computer Engineering at Sungkyunkwan University in South Korea, evaluates the results of an analysis of classification algorithms believed to lead to better prediction of liver disease from data obtained from liver disease patients and advocates the importance of careful selection of the algorithms and evaluation factors used to mine data and interpret results. Jin introduces the topic of

medical data mining in the context of the help data mining algorithms can lend to physicians in the diagnosis of patients. Jin qualifies his assertion of the benefits of data mining algorithms by evaluating the results of a study done on classification algorithms specifically selected to mine data regarding liver disease. He explains the transformation of the use of data mining techniques by tracing their origin in artificial intelligence to their use in the clinical treatment process today, aiding physicians in their diagnosing and treatment of patients. Jin emphasizes the danger of misuse of data mining algorithms in diagnostic procedures and asserts that the varying success of these practices is directly tied to careful selection of the algorithm used to analyze a specific data set.

I feel that this article provides a very unique example of clinical research done with data mining practices. It also gives an intense evaluation into various ways to evaluate data mining practices. The value it will add to the paper is of a highly technical and industry specific nature that I feel will fortify the integrity of the information I present and bring it to a level of higher academic caliber.

Price, Tom. "Big Data and Privacy." CQ Researcher 25 Oct. 2013: 909-32. Web. 5 Feb. 2015.

In his article "Big Data & Privacy" from CQ Researcher, Tom Price, a Washington-based freelance journalist who focuses on the public affairs aspects of education, technology, and business, questions whether or not the use of personal information should be restricted and provides a fairly objective analysis of whether the benefits of big data outweigh the risks to individuals' privacy. Price defines the concept of big data by referring to it as "the collection and analysis of enormous amounts of information by supercomputers". Price then explains some of the positive impacts related

to big data by pointing out the advances it has created in a wide variety of fields such as medicine, business, and even crime fighting. He also introduced the controversy surrounding the use of big data by stating its proven potential to invade individuals' privacy. Price highlights two specific examples of entities that can take advantage of personal data including companies working to market products and government agencies conducting surveillance operations. Lastly, Price presents an in depth analysis into whether the benefits of big data outweigh the risks by juxtaposing a personal story of an individual who was unhappy with an article found about him with a simple google search and an example of how facial recognition technologies have made such a profound impact on crime.

I feel that this article provides an excellent overview of the topic of big data and the privacy concerns that can surround the technology driven concept. Though the article is not on the topic of medical data mining specifically, I intend to use it as an introductory source to give readers a society-wide view of the implications of data mining and an enhanced understanding of the issues concerning personal data privacy outside of healthcare.

Rajaretnam, Thilla. "Data Mining And Data Matching: Regulatory And Ethical Considerations Relating To Privacy And Confidentiality In Medical Data." *Journal Of International Commercial Law & Technology* 9.4 (2014): 294-310. Academic Search Complete. Web. 29 Jan. 2015.

In her article, "Data Mining And Data Matching: Regulatory And Ethical Considerations Relating To Privacy And Confidentiality In Medical Data", Thilla

Rajaretnam, an associate lecturer at the School of Law at the University of Western Sydney in Australia, examines the aspects that surround medical data mining practices, the benefits and ethical drawbacks of their increasing prevalence, and advocates a balance be achieved between public and private interests. Rajaretnam presents reasons for interest in the subject of medical data mining, pointing out the rising trend of promotion of overall well-being and the fact that protecting one's medical data is similar to protecting personal information about one's "self". Rajaretnam highlights the difference between the handling of medical data in the past compared to how the "information harvesting" technologies available today collect more information than patients are often aware they are "releasing". She also mentions key benefits associated with the increased use of information technology in medical practices: physicians are able to facilitate more early-detection/preventative measures and long-term care is enhanced. Lastly, Rajaretnam spends much of her focus on the ethical, privacy, and confidentiality concerns that arise when this data is used for initiatives outside its original, intended purpose.

I feel that this article could be extremely useful in the issue analysis paper because it raises interesting concerns about the increased use of data mining in medical practice. The ethical implications raised in this article will help to round out the "pros and cons" I present and make the issue analysis as a whole more complete.

Zhao, Yunhai and Ying Yin. "Interactive Data Mining Framework For Chinese Traditional Therapeutic Evaluation." *Journal Of Chemical & Pharmaceutical Research* 6.7 (2014): 1070-1075. Academic Search Complete. Web. 30 Jan. 2015.

In his article, "Interactive Data Mining Framework For Chinese Traditional Therapeutic Evaluation", Yuhai Zhao, a professor from the Department of Computer Science and Engineering at Northeastern University in Shenyang, China, analyzes the various uses of data mining techniques and advocates for an interactive data mining framework to expand the adaptive capacity of its practices. Zhao presents the importance of data mining in Chinese medicine by highlighting its use to diagnose pneumonia, which is common in China. Zhao also explains that previous methods to mine the data and produce clinical diagnoses were labor intensive and not necessarily applicable for high level interpretation. Zhao lists the limitations that often arise with medical data mining and then explains how their propositions will eliminate these issues. Zhao outlines the main contributions of the research project: he defined the measure to gauge interest, reducing the unimportant rules; he proposed two new patterns to model the data based on an interestingness measure; he proposed a new clustering model; and he proposed use of two new patterns to perform causal analysis of the medical data set. Lastly, Zhao asserts how his proposition replaces the previous evaluation methods used in Chinese medicine and yields better results. Zhao emphasizes that the interactive data mining framework discovered will automatically supplement the therapeutic evaluation method to maximize the adaptive capacity of data mining for use in medicine.

I feel that this article will be extremely beneficial to the issue analysis paper because it raises an advanced aspect of the subject matter I have chosen. Instead of only relying on the larger, better known aspects of this issue, I will be able to take my evaluation a step further and demonstrate that data mining methods are being adapted to be more useful and less inconvenient so that the benefits that result from these practices

are only being enhanced. This article presents the opportunity for me to address a common concern from the technical perspective of this issue.