Big Data Analytics in Healthcare: A Critical Analysis(2019)

-Dibya JyotiBora

In the current day's healthcare system, the adaptation of digitization of medical data, such as data related to patients' diagnosis, generates a big volume of data in a short period of time. To analyze this huge volume of medical data, we need techniques that have the power of statistical analysis to predict or extract hidden important information out of the data. Therefore, the need for big data analytics in healthcare imaging has increased more rapidly. In this chapter, an analytical study on big data analytics in healthcare is carried out. This study includes all possible terminology related to the idea of big data, healthcare data, and architectural context for big data analytics, with different tools and platforms discussed in detail. A review of some recent noteworthy contributions in the field is also presented. Lastly, it summarizes different challenges to improve big data applications in healthcare and move it to an advanced level.

ADVANTAGES:

- *Improve big data applications in healthcare*

Big Data Analytics for Preventive Medicine (2019)

-Guandong Xu

Medical data is one of the most rewarding and yet most complicated data to analyze. How can healthcare providers use modern data analytics tools and technologies to analyze and create value from complex data? Data analytics, with its promise to efficiently discover valuable pattern by analyzing large amount of unstructured, heterogeneous, non-standard and incomplete healthcare data. It does not only forecast but also helps in decision making and is increasingly noticed as breakthrough in ongoing advancement with the goal is to improve the quality of patient care and reduces the healthcare cost. The aim of this study is to provide a comprehensive and structured overview of extensive research on the advancement of data analytics methods for disease prevention. This review first introduces disease prevention and its challenges followed by traditional prevention methodologies. We summarize state-of-the-art data analytics algorithms used for classification of disease, clustering (unusually high incidence of a particular disease), anomalies detection (detection of disease) and association as well as their respective advantages, drawbacks and guidelines for selection of specific model followed by discussion on recent development and successful application of disease prevention methods. The article concludes with open research challenges and recommendations.

Hospital Readmissions as a Measure of Quality of Health Care(2020)

-Mark Taragin, MD, MPH

We reviewed the recent literature on hospital readmissions and found that most of them are believed to be caused by patient frailty and progression of chronic disease. However, from 9% to 48% of all readmissions have been judged to be preventable because they were associated with indicators of substandard care during the index hospitalization, such as poor

resolution of the main problem, unstable therapy at discharge, and inadequate postdischarge care. Furthermore, randomized prospective trials have shown that 12% to 75% of all readmissions can be prevented by patient education, predischarge assessment, and domiciliary aftercare. We conclude that most readmissions seem to be caused by unmodifiable causes, and that, pending an agreed-on method to adjust for confounders, global readmission rates are not a useful indicator of quality of care. However, high readmission rates of patients with defined conditions, such as diabetes and bronchial asthma, may identify quality-of-care problems. A focus on the specific needs of such patients may lead to the creation of more responsive health care systems for the chronically ill.

Efficiency measurement of health care: a review of non-parametric methods and applications(2019)

-N. Maniadakis

There has been increasing interest in measuring the productive performance of health care services, since the mid-1980s. This paper reviews this literature and, in particular, the concept and measurement of efficiency and productivity. Concerning measurement, we focus on the use of Data Envelopment Analysis (DEA), a technique particularly appropriate when multiple outputs are produced from multiple inputs. Applications to hospitals and to the wider context of general health care are reviewed and the empirical evidence from both the USA and Europe (EU) is that public rather than private provision is more efficient.

Achieving Integration in Mixed Methods Designs—Principles and Practices(2013)

-John W. Creswell

Mixed methods research offers powerful tools for investigating complex processes and systems in health and health care. This article describes integration principles and practices at three levels in mixed methods research and provides illustrative examples. Integration at the study design level occurs through three basic mixed method designs—exploratory sequential, explanatory sequential, and convergent—and through four advanced frameworks—multistage, intervention, case study, and participatory. Integration at the methods level occurs through four approaches. In connecting, one database links to the other through sampling. With building, one database informs the data collection approach of the other. When merging, the two databases are brought together for analysis. With embedding, data collection and analysis link at multiple points. Integration at the interpretation and reporting level occurs through narrative, data transformation, and joint display. The fit of integration describes the extent the qualitative and quantitative findings cohere. Understanding these principles and practices of integration can help health services researchers leverage the strengths of mixed methods.

RFID analytics for hospital ward management

-Chun-Hung Cheng

In this paper, we present an RFID-enabled platform for hospital ward management. Active RFID tags are attached to individuals and assets in the wards. Active RFID readers communicate with the tags continuously and automatically to keep track of the real-time information about the locations of the tagged objects. The data regarding the locations and other transmitted information are stored in the ward management system. This platform enables capabilities of real-time monitoring and tracking of individuals and assets, reporting of ward statistics, and providing intelligence and analytics for hospital ward management. All of these capabilities benefit hospital ward management by enhanced patient safety, increased operational efficiency and throughput, and mitigation of risk of infectious disease widespread. A prototype developed based on our proposed architecture of the platform was tested in a pilot study, which was conducted in two medical wards of the intensive care unit of one of the largest public general hospitals in Hong Kong. This pilot study demonstrates the feasibility of the implementation of this RFID-enabled platform for practical use in hospital wards. Furthermore, the data collected from the pilot study are used to provide data analytics for hospital ward management.

ADVANTAGES:

- *RFID* ***avoids the limitations of barcode scanning****, which requires line-of-sight access to each barcode and can only be used to scan one item at a time.*
- *Instead, RFID tags do not require line-of-site, and multiple RFID tags can be detected and read remotely and simultaneously*

Future Trends of the Healthcare Data Predictive Analytics using Soft Computing Techniques in Data Science(2019)

-Sasikala Dhamodaran

Predictive Analytics, Soft Computing (SC) and Optimization, Data Mining and Data Science are rapidly becoming some of the most-discussed, perhaps utmost glorified topics in healthcare business. Artificial Intelligence, Machine Learning, Artificial Neural Networks, Fuzzy Logic, Expert Systems, etc., is well-studied disciplines with a long history of success in many industries. Healthcare can acquire treasured sessions from this prior achievement to startup the efficacy of predictive analytics for refining patient care, chronic disease management, hospital administration and supply chain efficiencies. The prospects that presently occurs for healthcare systems is to state what "predictive analytics" stands for to them and how can it be cast off furthermost excellently to cause further enhancements. In all industries including healthcare, prediction plays a best worthwhile role when that data is passed on as accomplishments. The inclinations to mediate the vital data is in harnessing the power of historical and real-time data with visions from forecasting those data based on the times ahead. Importantly, to best gauge efficacy and value, both the predictor and the intervention must be integrated within the same system and workflow where the trend occurs. A valuable report of the organized publicity and expectation of predictive

analytics in healthcare through a blend of psychology, digital technology, and entrepreneurship is available for real-time implementation for the good of the public. Review and evaluation on these disciplines pave ways to open up new arenas envisaging the future trends of Predictive analytics, Data Mining and Science and Soft Computing (SC) in healthcare, stepping strongly into pervasive computing, ambient intelligence, ubiquitous computing and many more automated technical concepts and computing's ahead.

ADVANTAGES:

- *This allows researchers to try to solve problems that aren't possible to be solved by traditional computational models.*
- *The main advantage is that they solve the problems in parallel, artificial neural networks use electrical signals to communicate.*
- *synergistically used to mimic the reasoning and decision making of a human.*

Health Prediction Analytics Using Deep Learning Methods and Applications(2021)

-Eiad Yafi

Deep learning (DL) gives you methodologies, approaches, and apparatuses that can help resolving analytic and predictive hitches in a miscellany of medicinal areas and used for the inquiry of the wild of controlled edges and their mixtures for forecast of illness development, elimination of medicinal information for consequence investigation, remedy guidance and provision, and for enduring organization. It is also getting used for statistics examination, consisting of discovery of proportions inside the statistics by way of rightly trade with flawed data, explanation of incessant records used within the strenuous care unit, and brainy troubling next in actual and ordered nursing. Deep learning helps in gaining knowledge is based totally on fashions that have proven their superior potential to research complex patterns from high dimensional, noisy, and temporal EHR information. This chapter presents the methods and applications with their advantages and disadvantages in health prediction analytics. This chapter shall give in-depth details about the DL new styles and the knowledge related to information processing that includes clustering, forecasting, path evaluation, and predictive evaluation. This chapter shall discuss the current and future use of DL algorithms in the area of health prediction analytics for the promoting the sustainable health in the society.

ADVANTAGES:

- *Allows for healthcare workers to quickly analyze data and plan a course of treatment that will work best for their patients.*
- *Saving time and producing better outcomes.*
- *The Need for Lots of Data. ...*
- *Neural Networks at the Core of Deep Learning are Black Boxes*

Outcomes of Percutaneous and Paddle Lead Implantation for Spinal Cord Stimulation: A Comparative Analysis of Complications, Reoperation Rates, and Health-Care Costs(2013)

-BeatriceUgiliweneza

Spinal cord stimulation (SCS) is a well-established modality for the treatment of chronic pain, and can utilize percutaneous or paddle leads. While percutaneous leads are less invasive, they have been shown to have higher lead migration rates. In this study, we compared the long-term outcomes and health-care costs associated with paddle and percutaneous lead implantation. The study cohort was comprised of 13,774 patients. At 90 days following the initial procedure, patients in the SCS paddle group were more likely to develop a postoperative complication than patients receiving percutaneous systems (3.4% vs. 2.2%, p = 0.0005). Two-year (6.3% vs. 3.5%, p = 0.0056) and long-term (five+ years) (22.9% vs. 8.5%, p < 0.0008) reoperation rates were significantly higher in those with percutaneous lead systems. However, long-term health-care costs were similar for those receiving paddle and percutaneous leads ($169,768 vs. $186,139, p = 0.30).
While the implantation of paddle leads is associated with slightly higher initial postoperative complications, these leads are associated with significantly lower long-term reoperation rates. Nonetheless, long-term health-care costs are similar between paddle and percutaneous leads. Additional improvements in SCS technologies that address the shortcomings of current systems are needed to reduce the risk of reoperation due to hardware failure. Further study is required to evaluate the efficacy of newer percutaneous and paddle SCS systems and examine their comparative outcomes.
ADVANTAGES:

- *Professional fees for surgeons, assistants, and anesthesiologists.*
- *Hospital case costs, including staff, equipment and overhead.*
- *Additional materials for breast reconstruction.*

Emerging trends in IoT and big data analytics for biomedical and health care technologies(2020)

-DebabrataBiswas

The recent revolutions in Internet of Things (IoT) and big data analytics have unlocked promising possibilities in biomedical and health care technologies. The current chapter deals with theoretical, methodological, validated, and empirical concepts with exciting examples related to the subject. First, the application of IoT and big data in the analysis of a vast image database generated every day from various sources by big data combined with machine-learning algorithms and other forms of artificial intelligence, to generate structured information for application in remote diagnostics, is explained with examples. Further emerging trends of telemedicine using artificial intelligence technique in robotics health care have been discussed. The flexibility and adaptability of AI-based telemedicine provide the endless supports for health care development can be observed in the

literature. The advancement of telerobotic surgery and the importance of the Internet of Robotic Things (IoRT) have been discussed briefly. Furthermore, details on wearable devices already available targeting the biomedical and health care applications that are capable of collecting, analyzing by standard protocols by machine intelligence for predictions of health-related issues are described. Lastly, the final expansion and evolution of these technologies in the modern health care system and biomedical research, starting with personalized drug designing to targeted drug delivery and beyond it, is described.

ADVANTAGES:

- *Good for personal safety and security*
- *Big Data healthcare that the industry has experienced are translated into terms of improved patient experience, prediction of epidemics*
- *avoidance of preventable deaths*
- *improvement of the quality of life*

Analysis of Research in Healthcare Data Analytics(2016)

- Mohammad Ahmad Alkhatib
- Amir Talaei-Khoei
- Amir Hossein Ghapanchi

This paper aims to proof that healthcare data analytics techniques are not efficient enough and suitable anymore these days in order to manage big data issue and improve healthcare data analytics due to the rapid growth and evolution of technology. Moreover, it's also aims to promise professionals of a better quality of medical results, as well as reduce time needed to analyze healthcare data by keeping systems up to-date and sorting medical data in a logical structure along with accessing and retrieving patient's historical data fast and smoothly. Stakeholder 2 (Doctors and nurses).

In order to meet our goals, the proposed study is going to discuss critically weaknesses, disadvantages, problems and gaps of traditional healthcare data analytics techniques in order to manage healthcare big data. Also, it's going to develop a healthcare data analytic technique that will promise for a better medical practice and healthcare data predictive analytics based on filling gaps of traditional healthcare data analytics techniques and overcoming its problems.

Advantages:

- *It will reduce their time and efforts.*
- *Its really valuable.*
- *Retrieving historical and old data quickly.*

Disadvantages:

- *Its really stressful.*

Utilizing health analytics in improving the performance of healthcare services(2016)

-Mohamed Khalifa
-Ibrahim Zabani

This study describes in details the processes implemented in the ER performance improvement at King Faisal Specialist Hospital and Research Center, Jeddah, Saudi Arabia. The executive management of the medical and clinical affairs of the hospital decided to utilize health analytics methods to identify areas of deficiency and suggest potential improvements then implement solutions and finally monitor ER using two main key performance indicators.

The ER LOS for ER patients, reflecting the efficiency of performance, and the percent-age of patients leaving the ER without treatment,including both patients who left without being seen and those who left before complete treatment,reflecting the effectiveness of ER performance.

Advantage:

- *Achieving better quality and performance.*
- *Effectiveness, efficiency, availability, accessibility.*
- *Timeliness, equity, safety.*

Disadvantage:

- *It examined the effect of only two solutions on the performance of the ER implementing a Fast-Track area for low acuity ER patients and adding an internal waiting area.*
- *It examined the improvement of ER performance along only two indicators.*

Understanding its capabilities and potential benefits for healthcare organizations(2018)

-Yichuan Wang

To date, health care industry has not fully grasped the potential Benefits to be gained from big data analytics. While the constantly growing body of academic research on big data analytics is mostly technology oriented, a better

understanding of the strategic implications of big data is urgently needed. To address this lack, this study examines the historical development, architectural design and component functionalities of big data analytics.

From content analysis of 26 big data implementation cases in healthcare, we were able to identify five big data analytics capabilities: analytical capability for patterns of care, unstructured data analytical capability, decision support capability, predictive capability, and traceability. We also mapped the benefits driven by big data analytics in terms of information technology (IT) infrastructure, operational, organizational, managerial and strategic areas. In addition, we recommend five strategies for healthcare organizations that are considering to adopt big data analytics technologies. Our findings will help healthcare organizations understand the big data analytics capabilities and potential benefits and support them seeking to formulate more effective data-driven analytics strategies.

Process data analytics for hospital case-mix planning(2022)

-Robert Andrews

The composition and volume of patients treated in a hospital, i.e., the patient case-mix, directly impacts resource utilisation. Despite advances in technology, existing case-mix planning approaches are mostly manual. In this paper, we report on a solution that was developed in collaboration with the Queensland Children's Hospital for supporting its case-mix planning using process mining.

We investigated How can process mining capabilities be used to inform hospital case-mix planning?How can process data be used to assess hospital capacity assessment and inform hospital case-mix planning?

Advantage:

- *An automated workflow to support both process mining analysis, and capacity assessment.*
- *A process mining analysis designed to detect process performance and variations.*
- *A novel capacity assessment model based on limiting-resource saturation.*

Pandemic Analytics(2021)

-Nishita Mehta
-Sharvari Shukla

Emergence of coronavirus in December 2019 and its spread across the world in the following months has made it a global health concern. The uncertainty about its evolution, transmission and effect of SARS-CoV-2, has left the countries

and their governments in a worrisome state. Ambiguity about the strategies that would work towards mitigating the impact of virus has prompted them to use data-driven methods. Several countries started applying big data and advanced analytics technology for management of the crisis. This study aims to understand how different nations have employed analytics to deal with COVID-19. This paper reviews various strategies employed by different governments and organizations across nations that use advanced analytics to tackle pandemic. Big data and analytical tools provide various solutions like detection of existing COVID-19 cases, prediction of future outbreak, anticipation of potential preventive and therapeutic agents, and assistance in informed decision-making. By examining the different ways and areas where data analytics has been utilized, this study provides the other nations with the progressive scheme to address the pandemic.

Advantage:

- *Identify abnormal chest X-rays in COVID-19 patients.*
- *Identify highly potential compound for COVID-19 treatment.*

Disadvantage:

- *This review provides an overview of country-specifc measures taken by those nations which are either gravely affected or those which have addressed the crisis at its onset and avoided the larger damage.*
- *Lack of historical data.*

Innovations in Genomics and Big Data Analytics for Personalized Medicine and Health Care(2022)

-Mubashir Hassan
-Faryal Mehwish Awan

Big data in health care is a fast-growing field and a new paradigm that is transforming case-based studies to large-scale, data-driven research. As big data is dependent on the advancement of new data standards, technology, and relevant research, the future development of big data applications holds foreseeable promise in the modern day health care revolution. Enormously large, rapidly growing collections of biomedical omics-data (genomics, proteomics, transcriptomics, metabolomics, glycomics, etc.) and clinical data create major challenges and opportunities for their analysis and interpretation and open new computational gateways to address these issues.

The design of new robust algorithms that are most suitable to properly analyze this big data by taking into account individual variability in genes has enabled the creation of precision (personalized) medicine.

Advantages

- *Electronic Health Records.*
- *Risk and Disease Management through Big Data.*

Disadvantages

- *Lack of structure.*

- *Noise Accumulation.*

Big data analytics in healthcare: a systematic literature review

Sayantan Khanra Amandeep Dhir The current study performs a systematic literature review (SLR) to synthesise prior research on the applicability of big data analytics (BDA) in healthcare. The SLR examines the outcomes of 41 studies, and presents them in a comprehensive framework. The findings from this study suggest that applications of BDA in healthcare can be observed from five perspectives, namely, health awareness among the general public, interactions among stakeholders in the healthcare ecosystem, hospital management practices, treatment of specific medical conditions, and technology in healthcare service delivery. This SLR recommends actionable future research agendas for scholars and valuable implications for theory and practice.

Advantages

- *Gradually increasing with the growing volume of big data*
- *Healthcare may face various challenges*

Healthcare data analytics: using a metadata annotation approach for integrating electronic hospital records

-Boyi xu

The data in electronic medical records (EMR) are complex in structure. They are independent, yet related to each other. In order to improve information access through the use of EMR, annotating work on these data is necessary. The annotation on metadata, the resource data which contain a meta-model of the database, is the basis of the annotating work if a semi-automated or an automated annotating approach which aims at making the database more accessible is expected. In this study, a method has been proposed to transform the terms which cannot be matched directly by changing them literally but maintaining their semantics, and then annotating them indirectly. After the transforming work, a refinement method which is reducible to phrase sense disambiguation (PSD) is employed to ensure accuracy. A pilot study on a hospital database has been conducted to test the accuracy and effectiveness of the proposed method.

Advantage:

- *Improved patient interactions.*
- *Increased health indicators.*

Disadvantage:

- *It takes time and costs money.*
- *Inconsistency and inefficiency.*

Decisions Through Data: Analytics in Healthcare

--Wills, Mary J.

The amount of data in healthcare is increasing at an astonishing rate. However, in general, the industry has not deployed the level of data management and analysis necessary to make use of those data. As a result, healthcare executives face the risk of being overwhelmed by a flood of unusable data. In this essay I argue that, in order to extract actionable information, leaders must take advantage of the promise of data analytics.Small data, predictive modeling expansion, and real-time analytics are three forms of data analytics. On the basis of my analysis for this study, I recommend all three for adoption. Recognizing the uniqueness of each organization's situation, I also suggest that practices, hospitals, and healthcare systems examine small data and conduct real-time analytics and that large-scale organizations managing populations of patients adopt predictive modeling. I found that all three solutions assist in the collection, management, and analysis of raw data to improve the quality of care and decrease costs.

Advantage:

- *Enhanced patient experiences*
- *Better decision making in procedures*

Disadvantage:

- *Low quality of data.*
- *Lack of commitment and patience*

Predictive Big Data Analytics in Healthcare

- P. Suresh Kumar

In today's world the massive set of data is generated from different organizations throughout the world. This huge and heterogeneous data is called Big Data. Big Data Analytics offers tremendous insights to different organizations especially in healthcare. The traditional database architectures are not up to the mark to face the challenge with huge data, which is pouring into organizations today, and it creates a big havoc. Big Data plays an important role in achieving predictive analysis in the healthcare domain. Big Data can handle huge explosion of data, which is found in many medical organizations. Big Data Analytics plays a major role in solving issues and challenges arises in healthcare domain. This paper gives an overview of storing and retrieval methods, Big Data tools and techniques used in healthcare clouds, role of Big Data Analytics in healthcare and discusses the benefits, outlooks in nascent fields of predictive analytics, faces challenges and provides solutions. The results also shows the astronomical role of Big Data Analytics in healthcare.

Advantages:

- *Preventative care*
- *Ensures to reduce overall healthcare costs.*

Disadvantages:

- *Complexity & Bias.*
- *Replacing Doctors*