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Big data security and privacy in healthcare: A Review

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Abstract

The ever-increasing integration of highly diverse enabled data generating technologies in medical, biomedical and healthcare fields and the growing availability of data at the central location that can be used in need of any organization from pharmaceutical manufacturers to health insurance companies to hospitals have primarily make healthcare organizations and all its sub-sectors in face of a flood of big data as never before experienced. While this data is being hailed as the key to improving health outcomes, gain valuable insights and lowering costs, the security and privacy issues are so overwhelming that healthcare industry is unable to take full advantage of it with its current resources. Managing and harnessing the analytical power of big data, however, is vital to the success of all healthcare organizations. It is in this context that this paper aims to present the state-of-the-art security and privacy issues in big data as applied to healthcare industry and discuss some available data privacy, data security, users' accessing mechanisms and strategies.

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Keywords: Big Data, Privacy and security , Big data in healthcare , privacy preserving

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1. Introduction

The current trend toward digitizing healthcare workflows and moving to electronic patient records has seen a paradigm shift in the healthcare industry. The quantity of clinical data that are available electronically will be then dramatically increased in terms of complexity, diversity and timeliness, resulting what is known as big data. Driven by mandatory requirements and the potential to improve care, save lives and lower costs, big data hold the promise of supporting a wide range of unprecedented opportunities and use cases, including these key examples: clinical decision support, health insurance, disease surveillance, population health management, adverse events monitoring, and treatment optimization for diseases affecting multiple organ systems[1,2]

Even though the adoption of big data technologies in healthcare sector carries many benefits and promises, it raises also some barriers and challenges. Indeed, the concerns over the sensitive information security and privacy are increased year by year because of several growing trends in healthcare, such as clinician mobility and wireless networking, health information exchange, cloud computing and so on. Moreover, healthcare organizations found that a reactive, bottom-up, technology-centric approach to determining security and privacy requirements is not adequate to protect the organization and its patients [3].

To prevent breaches of sensitive information and other types of security incidents, a proactive, preventive approach and measures must be taken by every healthcare organization with attention to future security and privacy needs.

In this paper, we will discuss some successful and interesting related works. We will also present risks to the security of health data and discuss some newer technologies and redressal of these risks using new techniques. Then, we will focus on the privacy issue in healthcare, and mention various laws and regulations established by different regulatory bodies as well as some feasible methods and techniques used to ensure the patient's privacy. Finally, we will present some limitations of the proposed techniques and approaches to deal with security and privacy risks before concluding the paper and highlighting the future work that we plan to carry on.

2. Related works

Seamless integration of highly diverse big data technologies in healthcare can facilitate faster and safer throughput of patients, enable to gain deeper insights into the clinical and organizational processes, create greater efficiencies and help improve patient flow, safety, quality of care and the overall patient experience meanwhile contain costs.

Such was the case with the UNC Health Care (UNCHC), which is a not-for-profit integrated healthcare system in North Carolina that has implemented a new system allowing clinicians to rapidly access and analyze unstructured patient data using natural-language processing. In fact, UNCHC has accessed and analyzed huge quantities of unstructured content contained in patient medical records to extract insights and predictors of readmission risk for timely intervention and providing safer care for high-risk patients and reduce re-admissions. [4]

An other example in United States is the Indiana Health Information Exchange, which is a non-profit organization, provides a secure and robust technology network of health information linking more than 90 hospitals, community health clinics, rehabilitation centers and other healthcare providers in Indiana. It allows medical information to follow the patient hosted in one doctor office or only in a hospital system. [5]

One more example, is Kaiser Permanente medical network based in California, which has more than 9 million members, estimated to manage large volumes of data ranging from 26,5 Petabytes to 44 Petabytes. [6]

Big data analytics is used also in Canada, e.g. the infant hospital of Toronto. This hospital succeeded to improve the outcomes for newborns prone to serious hospital infections.

In Europe this time, exactly in Italy, the Italian Medicines agency collects and analyzes a large amount of clinical data concerning expensive new medicines as part of a national profitability program. Based on the results, it may reassess the medicines prices and market access terms. [7]

After Europe, Canada, Australia, Russia, and Latin America, Sophia Genetics [8], global leader in Data-Driven Medicine,announced at the recent 2017 Annual Meeting of the American College of Medical Genetics and Genomics (ACMG) that its artificial intelligence has been adopted by African hospitals to advance patient care across the continent.

In Morocco for instance, PharmaProcess in Casablanca, ImmCell, The Al Azhar Oncology Center and The Riad Biology Center in Rabat are some medical institutions at the forefront of innovation that have started integrating Sophia to speed and analyze genomic data to identify disease-causing mutations in patients' genomic profiles, and decide on the most effective care. As new users of SOPHiA, they become part of a larger network of 260 hospitals in 46 countries

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