

Chapter 77

Big Data and Machine Learning: A Way to Improve Outcomes in Population Health Management

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ABSTRACT

IoT, big data, and artificial intelligence are currently three of the most relevant and trending pieces for innovation and predictive analysis in healthcare. Many healthcare organizations are already working on developing their own home-centric data collection networks and intelligent big data analytics systems based on machine-learning principles. The benefit of using IoT, big data, and artificial intelligence for community and population health is better health outcomes for the population and communities. The new generation of machine-learning algorithms can use large standardized data sets generated in healthcare to improve the effectiveness of public health interventions. A lot of these data come from sensors, devices, electronic health records (EHR), data generated by public health nurses, mobile data, social media, and the internet. This chapter shows a high-level implementation of a complete solution of IoT, big data, and machine learning implemented in the city of Cartagena, Colombia for hypertensive patients by using an eHealth sensor and Amazon Web Services components.

INTRODUCTION

Big Data and artificial intelligence are currently two of the most important and trending pieces for innovation and predictive analysis in health care. For big data, Internet of Things (IoT) is one of the primary sources for data acquisition nowadays in health care, allowing patients with network connectivity to send and receive data in real-time to patient-centric platforms that collect and monitor patient information. The health care industry represents significant opportunities for machine learning (ML), big data and

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IoT. These paradigms, tools, and techniques are helping providers around the world to produce better outcomes for patients, communities and population health management.

Because many health care organizations are already working on developing their own intelligent big data analytics systems based on machine learning principles, this paper will discuss how these two components are the new pillars of population health management, value-based care and upcoming challenges in health care.

We are experiencing a new era of information in health care, a decade of progress in digitalization of medical records, usage of health wearables and monitoring devices. Electronic pharmaceutical services, insurance claims, conversations about health in social media and years of research of organizations aggregating data in electronic databases has generated according to Harvard business review magazine since 2012, 2.5 quintillion terabytes of data every day. This vast amount of data generated and collected comes in multiple forms making the extraction and integration a real challenge. The actual value of big data and IoT can be captured easily in health care and is very important to review how this data can be usable, searchable and actionable by the health care industry and specifically in the area of population health management. This collection, integration, and treatment of data will require collaboration between the public and private sector to enable the research community to better access, manage, and utilize IoT objects (smart devices, sensors, smart beds, etc.) and big data.

IoT is gaining more attention every day, and the demand for intelligent and connected devices provides a new level of opportunities to collect data at home and improve the interaction with the health care professionals.

On the other hand, generating new knowledge and predictive analysis is where Machine learning takes action in our article. The generation of machine learning (ML) algorithms that can use these immense data sets generated in health care and collected by interconnected devices might improve the quality and efficiency in several health care areas such as readmissions, treatment optimization, and population health management.

This article will show how the primary goal of health care data analytics is the combination of technologies, strategies, and techniques that allow analyzing clinical data from different sources to determine appropriate insights to improve the outcome of health care and to improve population health management. This article also shows how transforming this knowledge into practice is another challenge, this will require a change in current practices and most important practice-changing decisions.

For several years researchers have been working with health care organizations trying to improve the process of data collection, data aggregation, data analysis and decision-making process. A lot of them has succeeded enabling clinicians and health care facilities to generate insights from big data and the use of machine learning algorithms straight to the care of an individual patient or to a group of people by analyzing the data of their treatment, their socio – economic environment and their health habits. The expectation is to show what is out there that works and for whom, the complexities, needs, and challenges.

BACKGROUND

Population health management is the aggregation of patient data across multiple health information technology resources, the analysis of that data and the actions that care providers can use to improve clinical and financial outcomes of a group of individuals (Kindig, 2003). A population health manage-

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