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Big data in healthcare: A new frontier in personalized medicine

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The electronic medical record (EMR) generates information on multiple aspects of patient care. Enormous data sets are now available describing patient behaviors, signs, and symptoms of diseases, human-derived information, insurance claims data and pharmacy refill records, providers notes, and imaging. Regular database management systems we have seen in the past are not able to handle these huge datasets. To manage the substantial amounts of data collected about anyone given patient, providers have begun to utilize Big Data Analytics as the primary method for handling this copious amount of data. Figure 1 shows the general process of big data in the healthcare area. Data is collected not only from the EMR, but also frequently the patient uses sensors, social media, and smartphones to generate data. For the healthcare provider, it can be overwhelming to mine the data for any specific piece of information that may be critical to the patient's care. Big Data, however, can handle voluminous amounts of heterogeneous data; structured, semi-structured, and unstructured. Much of healthcare data is now either unstructured such as medical notes, nursing notes, or other provider-written information, or semi-structured data. A report delivered to the U.S. Congress in August 2012 defines big data as "a term that describes large volumes of high velocity, complex, and variable data that require advanced techniques and technologies to enable the capture, storage, distribution, management, and analysis of the information." Acute myocardial infarction (AMI) is the number one cause of death in the US. An AMI occurs when blood flow to the heart muscle is disrupted, causing the heart muscle to become damaged and/or die. Most heart attacks are caused by a reduction in oxygen-rich red blood cells; the heart muscle begins to arrest in as few as six to eight minutes without oxygen, potentially leading to death. Atherosclerosis, a build-up of plaque in the arteries over many years, is a common cause. The healthcare costs associated with patients who are diagnosed with the cardiovascular disease is extensive and can be reduced using modern methods of dataset handling and more effective, personalized treatment plans such as Big Data analytics. The EMR has revolutionized dataset management. Data is cheaper, larger, and includes a broader patient population. Data is noisy, heterogeneous, diverse, and longitudinal. Big data is used to harness data as most healthcare organizations discover opportunities to better understand and predict customer behaviors and interests (i.e., personalized medicine). Big data surpasses the processing capacity of traditional systems. Data is too big, moves too fast, or doesn't fit the strictures of conventional database architectures. Big data fosters novel opportunities to predict and/or more rapidly respond to critical clinical events, generating better health outcomes, and more efficient cost management. The key for reducing the mortality and morbidity associated with cardiovascular disease is found in using big data to mine the enormous amounts of data: omics data, phenotype data, social media, insurance claims information, the electronic medical record (EMR), etc. Apache Hadoop is an open-source software framework written in Java used primarily for distributed processing and storage of enormous datasets on computer clusters. Hadoop Distributed File System (HDFS) supports cloud computing using Hadoop. The Text Mining based Hadoop platform is used to create more precise information about comorbidities by converting the patient's unstructured generated data to structured data. Disease prediction, prevention, and personalized medicine is a result. Figure 2 details the architecture of big data in healthcare.

Biography

Dr. Alexander is an RN with over 25 years of healthcare experience in multiple specialties, including healthcare management. She graduated from the University of Phoenix, Phoenix, Arizona, the USA with a dual Master's in Nursing and Healthcare Administration and Samford University, in Birmingham, Alabama, the USA with an executive Doctorate of Healthcare Management. She is currently Chief Executive Officer and Primary Research Scientist for Information Technology & Healthcare Solutions, a small research and consulting firm. She also serves as 2017-2018 Management Division Chair for the Association of Technology, Management, and Applied Engineering. She was the recipient of the Rudskill Scholarship at the 2017 ATMAE Conference and was invited to become a member of Epsilon Pi Tau, an honorary society for technology professionals. She has published over 40 peer-reviewed journal articles, has acted as Managing Editor for the International Journal of Automated Identification Technology Journal, is a reviewer for the Journal of Nursing Research and the International Journal of Engineering and Applied Sciences, is an editor for SciPub, an Associate Editor for an Open Access Engineering Journal, and has been invited to attend, conduct workshops, and act as a keynote speaker at numerous healthcare and Big Data symposiums. Research focus areas include: big data analytics, cybersecurity, telemedicine, and biometrics, etc.

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