Chapter 1.26
Realizing Knowledge Assets in the Medical Sciences with Data Mining:
An Overview

Adam Fadlalla
Cleveland State University, USA

Nilmini Wickramasinghe
Cleveland State University, USA

ABSTRACT

This chapter provides insight into various areas within the medical field that strive to take advantage of different data mining techniques in order to realize the full potential of their knowledge assets. Specifically, this is done by discussing many of the limitations associated with conventional methods of diagnosis and showing how data mining can be used to improve these methods. Comparative analyses of different techniques associated with various areas within the medical field are outlined in order to identify the right technique for particular medical specialties. Furthermore, suggestions are provided to appropriately utilize the various data mining techniques thereby leading to effective and efficient knowledge management and knowledge utilization. In this chapter we highlight the potential of data mining in improving the exploratory as well as the predictive capabilities of conventional diagnostic methods in medical science.

INTRODUCTION

Knowledge management is an emerging business approach aimed at solving current business challenges to increase efficiency and effectiveness of core business processes while simultaneously fostering continuous creativity and innovation. Specifically, knowledge management through the use of various tools, processes and techniques combines germane organizational data, information and knowledge to create business value and enable an organization to capitalize on its intangible (e.g., knowledge) and intellectual assets so that it can effectively achieve its primary business goals as well as maximize its core business competencies (Swan et al., 1999; Davenport & Prusak, 1998). The need for knowledge management is based on a paradigm shift in the business environment where knowledge is central to organizational performance (Drucker, 1993).

Knowledge management offers organizations many tools, techniques and strategies to apply to

their existing business processes. In essence then, knowledge management not only involves the production of information but also the capture of data at the source, the transmission and analysis of this data as well as the communication of information based on or derived from the data to those who can act on it (Swan et al., 1999). Fundamental to knowledge management is effectively integrating people, processes and technologies.

A pivotal technique in knowledge management is data mining which is used to discover new knowledge from existing data and information and thus grow the extant knowledge asset of the organization. This is particularly relevant to health care because not only is health care a knowledge-based industry, but it is also currently experiencing exponential growth in the collection of data and information primarily due to new legislative initiatives such as Managed Care and HIPAA (Health Information Portability and Accountability Act) in the US. This then makes it imperative for medical science to incorporate the benefits of this technique. We address this imperative by first discussing basic concepts of data mining and how they relate to the medical sciences. Next we elaborate upon key data mining techniques as well as their advantages and disadvantages and how they contribute to the building of important knowledge assets within health care.

BACKGROUND TO DATA MINING

In the literature, data mining is generally described at two levels: a broad perspective and a narrow perspective. While the broader perspective equates data mining to the process of Knowledge Discovery in Databases (KDD), the narrow perspective sees data mining as a step within this KDD process. In either case data mining can be defined as, *"The nontrivial extraction of implicit, previously unknown, and potentially useful information from data"* (Frawley et al.,

1992). Data mining uses machine learning, as well as statistical and visualization techniques to discover and present knowledge in a form that is easily comprehensible to humans. Data mining involves sifting through huge amounts of data and extracting the relevant pieces of data for the particular analysis of a problem. More than just conventional data analysis (such as basic statistical methods), the technique makes heavy use of artificial intelligence. Often the emphasis is not as much on the extracting of data but more on the generating of a hypothesis, as in the case of exploratory data mining. Data mining also uses sophisticated statistical analysis and modeling techniques, which allow users to find useful information such as trends and patterns hidden in their business data. Data mining is one of the latest technologies to assist users deal with the abundance of data that they have collected over time. For example, this technique will help optimize business decisions, increase the value of each customer, enhance communication, and improve customer satisfaction. The retail industry has been using data mining technology to understand customer buying patterns, product warranty management, detection of fraud, and identification of good credit risks. Data Mining has become more popular over time due to the following reasons:

1. The main reason for the popularity of various data mining techniques is due to the large amount of data already collected and newly appearing data that requires processing beyond traditional approaches. The amount of data collected by various businesses, scientific, medical and governmental organizations around the world is enormous. It is impossible for human analysts to cope with the ever-growing and overwhelming amounts of data.

2. When a person analyses the data, he/she is liable to make errors due to the inadequacy of the human brain (i.e., the bounded ratio-

10 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/realizing-knowledge-assets-medical-sciences/26226

Related Content

GUI-CAD Tool for Segmentation and Classification of Abnormalities in Lung CT Image
V. Vijaya Kishoreand R.V.S. Satyanarayana (2019). *International Journal of Biomedical and Clinical Engineering (pp. 9-31).*
www.irma-international.org/article/gui-cad-tool-for-segmentation-and-classification-of-abnormalities-in-lung-ct-image/219304

Development of Specific Gamma Secretase Inhibitors
Jessica Ahmed (2009). *Handbook of Research on Systems Biology Applications in Medicine (pp. 423-437).*
www.irma-international.org/chapter/development-specific-gamma-secretase-inhibitors/21547

Gait Event Detection System for the Control of Lower Limb Exoskeleton: Review and Future Requirements
Mohanavelu Kalathe, Sakshi Agarwal, Vinutha Sampaathand Jayanth Daniel (2021). *International Journal of Biomedical and Clinical Engineering (pp. 14-28).*
www.irma-international.org/article/gait-event-detection-system-for-the-control-of-lower-limb-exoskeleton/282492

Assistive Technologies, Tools and Resources for the Access and Use of Information and Communication Technologies by People with Disabilities
Betania Groba, Thais Pousadaand Laura Nieto (2011). *Handbook of Research on Personal Autonomy Technologies and Disability Informatics (pp. 1-15).*
www.irma-international.org/chapter/assistive-technologies-tools-resources-access/48271

Drowsiness Detection by the Systems Dynamic Approach of Oculomotor Systems
Dabbu Suman, Malini Mudigonda, B. Ram Reddyand Yashwanth Vyza (2022). *International Journal of Biomedical and Clinical Engineering (pp. 1-27).*
www.irma-international.org/article/drowsiness-detection-by-the-systems-dynamic-approach-of-oculomotor-systems/295866