Chapter 67
Artificial Neural Learning Based on Big Data Process for eHealth Applications

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ABSTRACT

The complexity of the clinical context requires systems with the capability to make decisions based on reduced sets of data. Moreover, the adoption of mobile and ubiquitous devices could provide personal health-related information. In line with this, eHealth application faces several challenges so as to provide accurate and reliable data to both healthcare professionals and patients. This chapter focuses on computational learning on the healthcare systems presenting different classification processes to obtain knowledge from data. Finally, a case study based on a radial basis function neural network aiming the estimation of ECG waveform is explained. The presented model revealed its adaptability and suitability to support clinical decision making. However, complementary studies should be addressed to enable the model to predict the upper and lower points related to upward and downward deflections.

INTRODUCTION

The ubiquity of mobile devices and the Internet raised the paradigm of the new care model based more on contacts than on visits (Escarrabill, Marti, & Torrente, 2011). The ability to interact with the system anywhere and at anytime thoroughly changes the coordinates of time and place and offers invaluable opportunities to the healthcare delivery and management which lead to many opportunities as well as many challenges arising from the availability, accessibility and plasticity of information and tools to access information. In fact, despite the Internet provide a new medium for information storage, sharing, processing and distribution, the exponential growth and heterogeneity of web information represents a complex, large-scale, dynamic and fast-changing tasks to present data on accurately and timely fashion,

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and therefore meeting demands for quality and productivity on different applications and contexts. This topic is even more important when data is the main support for clinical knowledge and decision-making on distributed architectures delivered based on the web for many different purposes such as: screening, diagnosis, treatment and monitoring. The technological improvement that occurred in recent years enable the development of computerised decision support systems supported by three main foundations:

- **Data Acquisition:** Based on cheap and tiny sensors, microprocessors and mobile devices;
- **Data Storage:** Cheap disk storage, and storage virtualization;
- **Data Distribution:** Easier and faster delivery using Internet.

The adoption of computerised systems on healthcare highly depends on the accurate and reliable knowledge which results from the collected and processed data, mostly acquired from different sources and devices such as sensors or mobile phones. The abundance of these devices coupled with the progress made in wireless communication, lead to its adoption on healthcare systems as a preferred means to collect data. However, they are not designed to obtain a large amount of data that require its submission to remote databases and thus enable the integration and process of information in which the knowledge is based. In addition, mobile and dynamic environments require that standard data mining algorithms must be modified appropriately aiming to enable time critical intelligent, data analysis on streams of continuous data (Krishnaswamy, Loke, & Zaslavsky, 2002). On the healthcare context a user friendly systems are required not only for extracting information based with minimum input from user, but also with the capability to offer personal health related information.

Thus, seems to be promising the development of new methods and techniques with the capability to reduce and/or synthesize the collected data and therefore, enabling the system to produce decisions based on a small amount of data. Typically, a function approximation is applied to determine the appropriate subset of data that provide representative and accurate explanation ability of the entire sample.

Therefore, this chapter focuses on computational learning on the healthcare context and presents a case study with it application. The chapter is organized as follows: The first section describes different clinical systems and their classification process to knowledge acquisition by computers. Moreover, neural networks techniques are presented and described in detail highlighting their mathematical explanation. Then, the second section presents a case study based on experimental research including a description of its mathematical concepts. Finally, the last section concludes the chapter and summarizes the main points.

BACKGROUND

Nowadays the clinical and hospital environment are equipped with several devices and services for monitoring and data acquisition that in most cases perform continuous acquisition of medical parameters. The huge amount of collected and stored data, results in a large amount of data needed for evaluation and medical treatment, and all indications are that this trend will continue to increase. The medical data are usually associated with characteristics such as high dimensionality, multiple classes, missing and noisy data, systemic and human errors, deriving from the different nature of medical information (Lavrač, 1999; Tanwani, Afridi, Shafiq, & Farooq, 2009).

In order to assist health professionals in decision support and minimizing diagnosis errors, the classification techniques have been used increasingly in medical solutions and services in various areas in