Chapter 61
Classifying Diabetes Disease Using Feedforward MLP Neural Networks

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ABSTRACT

Diagnosing chronic diseases is about making accurate and quick decisions based on contradictory information and constantly evolving knowledge. Hence, there has been a persistent need to help health practitioners in making correct decisions. Diabetes is a common chronic disease. It is a global health-care threat and the eighth leading cause of death in the world. Modern artificial intelligence techniques are being used in diagnosing chronic diseases including artificial neural networks. In this chapter, a feedforward multilayer-perceptron neural network has been implemented to help health practitioners in classifying diabetes. Through the work, an algorithm was proposed in purpose of determining the number of hidden layers and neurons in a MLP. Based on the algorithm, two topologies have been introduced. Both topologies exhibited good classification accuracies with a slightly higher accuracy for the MLP with only one hidden layer. The data set was obtained from King Abdullah University Hospital in Jordan.

INTRODUCTION

Healthcare is a major concern of communities and individuals. It significantly contributes in countries' economies. Information technology has spread widely in health care industry in the last few decades. Healthcare Information Technology or e-Health is the application of information processing involving both computer hardware and software that deals with the storage, retrieval, sharing, and use of health care information, data, and knowledge for communication and decision making (Brailer & Thompson, 2004). Despite the dramatic growth in the last few decades, the continuous research and the nonstopping

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achievements in the health care information technology industry proof that this field still in its infancy and many other several research could be conducted. Health-care Information Technology systems employ several different methods. These systems can be electronic medical records (EMRS), electronic health records (EHRS), personal health record (PHR), payer-based health record, computerized physician order entry (CPOE), clinical decision support, and E-prescribing (Bray, 2010). Nowadays, Clinical Decision Support Systems (CDSSs) are mostly in demand by healthcare practitioners as they usually perform intelligently and helps in early detection of chronic diseases (Sharma & Virmani, 2017).

The medical domain is characterized by contradictory information and constantly evolving knowledge. Hence, it was of utmost important to help diagnosticians to make correct decisions (El-Sappagh & Elmogy, 2016). Generally, Decision Support Systems (DSS) enable decision makers to utilize knowledge and data to support and meet their demands for decision-making (El-Gayar, Deokar, & Tao, 2011).

CDSSs are information systems that help healthcare practitioners in making medical deci-sions about patients using relative patient and clinical data (Dinevski, Bele, Šarenac, Rajkovič, Šušteršic, 2011). The use of such systems helps in reducing medical errors, minimizing treatment cost, and improving patient's health (Golemati, Mougiakakou, Stoitsis, Valavanis, Nikita, 2005). In 2005, Garg et al. Stated that CDSSs improved practitioners' performance in 64% of the studies, and patients' outcomes in 13% of them (Garg, et al., 2005). In CDSSs, Artificial intelligence plays a vital role in the applied techniques. These techniques falls under one of two categories; knowledge-based and non-knowledge based systems (Abbasi & Kashiyarndi, 2006). Knowledge-based systems contain knowledge about very specific tasks and facts, and consist of knowledge base, infer-ence engine, and a mechanism to communicate (Abbasi & Kashiyarndi, 2006). Rule-based expert systems and Bayesian Network are examples on the knowledge-based systems. Non-knowledge-based systems employ Machine learning techniques instead, like neural Networks and genetic Algorithms. Unfortunately, there is no mutual model that can be adjusted for the diagnosis of all kinds of diseases (Mokeddem, Atmani, & Mokaddem, 2014). In health care systems, Machine learning used to learn from description of previously treated patients and help practitioners to diagnose objectively and reliably.

In sum, various intelligent techniques could be used to implement CDSS, which one to select depends on the problem domain, the probable solution, the amount of data available, the cost of the system, the required efficiency, researcher choice and purpose, and many other parameters (Abbasi & Kashiyarndi, 2006). In medicine, CDSS can help in monitoring, alerting, interpreting, assisting, diagnosing, and managing decision support (Pestotnik, 2005).

Neural networks are one of the best solutions in complex, multiple variable systems wherein applying ordinary rule-based programming and following an algorithmic solution is an improbable task. Moreover, The ANNs are suitable where traditional classification methods fail due to noisy or incomplete data. In medicine, Artificial Neural Networks (ANNs) are a hot area of concern in the fields of diagnosis, biomedical analysis, image analysis, and drug development (Tsakona, Paschali, Tsolis, & Skapetis, 2013).

Diagnosis, in medicine, is the recognition of a disease. In traditional methods, clinical practitioners need to deal with huge amount of data of various types which cannot be handled by the human experts. Being the first step in the treatment process, diagnosis is critical and any error in this step can lead to catastrophic consequences, beside the probable delay where conventional methods may last for weeks or even months. What makes things worse is the lack of inexperienced specialists in the diagnosis of a specific disease especially in the developing countries. To summarize, incorrect diagnosis may waste time, resources, quality of health, and even human life (Wasyluk & Raś, 2010). Hence, computer-based methods are becoming inevitable in the diagnosis process due to its efficiency, accuracy, reliability,