Chapter 6
A General Medical Diagnosis System Formed by Artificial Neural Networks and Swarm Intelligence Techniques

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ABSTRACT

One of the most popular applications of artificial intelligence within the medical field is developing medical diagnosis systems. Because artificial-intelligence-based techniques are able to use pre-data and instant data flow for making predictions, it is an easy task to design intelligent systems that can give advice to people or perform diagnosis-based decision making. So, it has been an important research interest to design and develop intelligent systems, which are able to make diagnoses for medical purposes. In this sense, the objective of this chapter is to introduce a general medical diagnosis system that can be used for detecting diseases. In detail, the system employs artificial neural networks and swarm-intelligence-based techniques to form a general framework of intelligent diagnosis. The chapter briefly focuses on the infrastructure of the system and discusses its diagnosis potential.

INTRODUCTION

The field of Biomedical Engineering is rapidly improving with unstoppable innovations in different technologies. It is clear that innovations in computer and electronics technologies have a remarkable role on the improvement of the Biomedical Engineering. Of course, discoveries and inventions within the research works of medical – health is the main triggering factor of all these improvements. On the other hand, Artificial Intelligence has a good role in changing the way of solutions on Biomedical Engineering problems and it seems that this scientific field of the future will always have a great potential in the people's future. Not only Biomedical Engineering but also almost all other fields in the life are now associated with intelligent solution approaches, methods, and techniques introduced – suggested by the Artificial Intelligence.

If we examine the research works performed within the field of Biomedical Engineering, it can be seen that there is a big diversity of different works (Bonato, 2003; Bronzino, 1999; Enderle & Bronzino, 2012; Guimard et al., 2007; Kutz, 2003; Melchels et al., 2010). In time, there have been a great influence by the Artificial Intelligence into Biomedical Engineering and finally, the era of intelligent Biomedical Engineering applications has begun. Since first applications, there have been many different improvements and developments that can be associated with billions of research works. Among all of these works, the research interest on designing and developing intelligent medical diagnosis systems has a good popularity because the expert support mechanism of Artificial Intelligence based solutions can be employed in an easy and practical way. Because there are many different diseases to be considered, it is important for the researchers to design an effective enough system to deal with that diagnosis problems. There are different kinds of intelligent medical diagnosis oriented studies in the associated literatures (Amato et al., 2013; Bennett & Hauser, 2013; Choi et al., 2017; Kononenko, 2001; Londhe, 2017; Miller, 2012; Papaioannou et al., 2016; Patel et al., 2009; Polat et al., 2006; Rajan, 2017; Waal, 2017). One of widely chosen way to perform intelligent diagnosis is based on running Machine Learning techniques to learn previously something about pre-data and apply the trained system over newly encountered problem instances. Here, it is important to focus on which instances affect the objective disease and which kind of information do researchers need as something like an expert knowledge towards diagnosis.

In this chapter, it is aimed to introduce a general medical diagnosis system that can be used for detecting diseases. In detail, the system employs Artificial Neural Networks (ANN) and Swarm Intelligence (SI) based techniques to form a general framework of intelligent diagnosis. As default, the designed system employs five different SI techniques: Artificial Bee Colony (ABC), Cuckoo Search (CS), Particle Swarm Optimization (PSO), Genetic Algorithm (GA), and Differential Evaluation Algorithm (DE). As it can be understood, training processes of the formed ANN model is done with these algorithms. Except from the main structure of the system for diagnosis operations, it also employs a coding framework called as Intelli-Diagnose Partial Programming (IDP2), which is the key element of the developed system. The chapter briefly focuses on infrastructure of the system and discusses about its diagnosis potentials. The authors think that the work is an alternative contribution to the associated literatures, as based on a traditional but effectively supported with the IDP2.

Based on the topic and objective of the chapter, the remaining content is organized as follows: The next, second section provides explanations regarding to infrastructure of the system. In this context, it employs some essential information for the ANN and the SI related optimization algorithms for the training phase of ANN models. Following that, the third section is devoted to the coding framework of the developed system. In detail, some essential codes and their functions within the IDP2 are expressed briefly. After that section, the chapter is ended by discussing about conclusions and some future work under the fourth section.

INFRASTRUCTURE OF THE DIAGNOSIS SYTEM

The designed and developed system along this study employs a simple form of the ANN technique that can be trained by SI optimization techniques. In order to understand better about the employed techniques, this section provides some essential information about them as provided under the following sub-titles.

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