Chapter 6
Improvement of Variant Adaptable LSTM Trained With Metaheuristic Algorithms for Healthcare Analysis

Tarik A. Rashid
University of Kurdistan Hewler, Iraq & Salahaddin University – Erbil, Iraq

Mokhtar Mohammadi
University of Human Development, Iraq

Mohammad K. Hassan
University of Kurdistan Hewler, Iraq

Kym Fraser
University of Kurdistan Hewler, Iraq & University of South Australia, Australia

ABSTRACT

Recently, the population of the world has increased along with health problems. Diabetes mellitus disease as an example causes issues to the health of many patients globally. The task of this chapter is to develop a dynamic and intelligent decision support system for patients with different diseases, and it aims at examining machine-learning techniques supported by optimization techniques. Artificial neural networks have been used in healthcare for several decades. Most research works utilize multilayer layer perceptron (MLP) trained with back propagation (BP) learning algorithm to achieve diabetes mellitus classification. Nonetheless, MLP has some drawbacks, such as, convergence, which can be slow; local minima can affect the training process. It is hard to scale and cannot be used with time series data sets. To overcome these drawbacks, long short-term memory (LSTM) is suggested, which is a more advanced form of recurrent neural networks. In this chapter, adaptable LSTM trained with two optimizing algorithms instead of the back propagation learning algorithm is presented. The optimization algorithms are biogeography-based optimization (BBO) and genetic algorithm (GA). Dataset is collected locally and another benchmark dataset is used as well. Finally, the datasets fed into adaptable models; LSTM with BBO (LSTMBBO) and LSTM with GA (LSTMGA) for classification purposes. The experimental and testing results are compared and they are promising. This system helps physicians and doctors to provide proper health treatment for patients with diabetes mellitus. Details of source code and implementation of our system can be obtained in the following link "https://github.com/hamakamal/LSTM."

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INTRODUCTION

Many pieces of research have been carried out to provide the prediction, detection, and classifications for many diseases. According to international diabetes federation, the number of people suffered from diabetes mellitus has increased lately to 225 million people worldwide (Pradhan, Ranjit & Sahu, 2011). Providing the system that can help doctors and patients with diabetes to predict this disease is a big step toward solving many problems in an early stage. This chapter aims to use machine learnings optimization algorithms to enhance doctor's decisions. Artificial neural networks (ANN) considered as the most popular one among all. ANN can have different algorithms for training (Peretto, 1992). There are many classes of neural networks, which classified according to their learning algorithms. Most research works used the multilayer perceptron feed-forwarded trained with back propagation algorithm or its variants to achieve diabetes mellitus classification. In this chapter work, an MLP is used, as it is a class of feed-forward artificial neural network. MLP consists of three layers, where each neuron uses a nonlinear activation function except for neurons at the input layer. However, training multilayer perceptron is slow in terms of convergence and falling easily into local minima (Park, 2006). Thus, recurrent neural networks are used to overcome these problems and obtaining more accuracy in the result. Recurrent neural networks consist of feedback connection so that the activations can flow round in a loop and recurrent neural networks have many forms in terms of architecture. One type of recurrent neural network consists of a standard multilayer perceptron plus loop and capable of having some sort of memory. Recurrent neural networks can memorize relevant events over time and also can deal with arbitrary input data, not just static input data only which makes recurrent networks in principle more powerful than multilayer perceptron (Shanker, 1996). Standard recurrent neural network algorithms for learning to store information over time take too long and lack of long-term dependency. To overcome these problems in standard recurrent neural networks, LSTM proposed which is a more advanced form of recurrent neural networks and a particular type of a recurrent neural network in which they are capable of learning long-term dependencies or avoiding long-term dependency problem (Hochreiter, 2001; Schmidhuber et al., 2007; Schmidhuber, 1997). LSTM unit contains a cell, an input gate, an output gate, and a forget gate. Each of the three gates can be thought of as a conventional artificial neuron, as in a multilayer neural network. LSTM is very useful and more accurate than a standard recurrent neural network, which is why big companies like Apple and Microsoft have used it (Zifan & Gharibzadeh, 2006). As for optimization techniques, two algorithms are used in this work to optimize LSTM. BBO used as the main algorithm, which is an evolutionary algorithm, and GA used as the second. Datasets collected locally and another dataset used for evaluations purposes.

This chapter organized as follows: Section 2 describes the background and previous research works. Details and types of diabetes presented in section 3. Section 4 provides details about ANN in general. Details about classifiers presented in section 5. In section 6, optimizers explained. Details about the methodology, process of data collection, simulation and results presented in section 7, and finally, the conclusion and future works presented in section 8.

BACKGROUND

Diabetes mellitus is a most separated disease in world nowadays. In the past most research works are just focusing identifying the types of diabetes, but these identification is not enough to solve the problem because there is a problem of prediction of glucose rate in the blood also finding relationship