Chapter 7
Intelligent Decision Support System for Fetal Delivery using Soft Computing Techniques

R. R. Janghel
Indian Institute of Information Technology and Management Gwalior, India

Anupam Shukla
Indian Institute of Information Technology and Management Gwalior, India

Ritu Tiwari
Indian Institute of Information Technology and Management Gwalior, India

ABSTRACT

In the present work an attempt is made to develop an intelligent decision support system (IDSS) using the pathological attributes to predict the fetal delivery to be done normal or by surgical procedure. The pathological tests like Blood Sugar (BR), Blood pressure (BP), Resistivity Index (RI) and systolic / Diastolic (S/P) ratio will be recorded at the time of delivery. All attributes lie within a specific range for normal patient. The database consists of the attributes for cases 2 (i.e. normal and surgical delivery). Soft computing technique namely Artificial Neural Networks (ANN) are used for simulator. The attributes from dataset are used for training & testing of ANN models. Three models of ANN are trained using Back-Propagation Algorithm (BPA), Radial Basis Function Network (RBFN), Learning Vector Quantization Network (LVQN) and one hybrid approach is Adaptive Neuro-Fuzzy Inference System (ANFIS). The designing factors have been changed to get the optimized model, which gives highest recognition score. The optimized models of BPA, RBFN, LVQN and ANFIS gave accuracies of 93.75, 99.00, 87.50 and 99.50% respectively. Hence in our present research the ANFIS is the model whom efficiency and result are best.The ANFIS is the best network for mentioned problem. This system will assist doctor to take decision at the critical time of fetal delivery.

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INTRODUCTION

The motivation behind the present research work is that much less have been contributed so far in literature with regard to fetal delivery. Further the proposed system use intelligent techniques with sound improvement in efficiency.

The present research shall assist the doctor to take right decisions in many complex situations where when a minor mistake can lead to death of the patient. The three ANN architectures, Back-Propagation Network (BPN), Radial Basis Function Networks (RBFN), and Learning Vector Quantization Networks (LVQN) and Adaptive Neuro-Fuzzy Inference System (ANFIS) are used here.

A Back-Propagation Network is a multi-layered feed-forward neural network, making use of Back-propagation algorithm, which involves giving the input vector to the network, comparison of the desired and the network output for the input vector, changing each weight by an amount equal to the derivative of the error with respect to that weight times some learning rate (Shukla Anupam 2009).

RBFN consists of three different layers- an input layer, a hidden layer and an output layer. The hidden units are known as Radial centers and have the same dimensions as that of the input vector. The transformation from the Input space to the hidden space is non-linear whereas the transformation from the hidden unit space to the output space is linear. In the hidden neurons, usually Gaussian activation function is used (Yegnanarayana B. 2003,Orr M.J.L 1996). We use a parameter called spread which controls the network performance. Larger spread means a smoother function approximation.

Learning vector quantization (LVQ) Network consists of an input layer, a competitive layer and a linear layer. For an input, the neurons in the competitive layer compete with each other and the neuron with the most positive output becomes the winning neuron. The weights of the winning neuron (a row of the input weight matrix) are adjusted with the Kohonen learning rule. The only requirement in this network is that the competitive layer must have enough neurons, and each class must be assigned enough competitive neurons (Ghosh, A 2005). Neural Network and fuzzy Toolbox of MATLAB are used (MATLAB, 2000). The ANFIS model can construct an input-output mapping based on both the fuzzy if-then rules and the stipulated input-output data pairs. The if-then rules of SFIM are often applied for obtaining the inference on an imprecise model. A conclusion can be reached in the indefinite system, which is better than human experience. These if-then rules based on stipulated input-output training data pairs suitable membership function (MF) are then produced. The ANFIS model employs the neural network training procedure to adjust the membership function and associated parameter that approaches the desired data sets (Jian-Da Wu 2009).

BACKGROUND

The expert systems are tremendously used in health care involving predicting and diagnosing a particular disease. Medical expert systems are useful in certain situations where either the case is quite complex or there are no medical experts readily available for patients (Zaheeruddin, Garima 2006,Fahad Shahbaz Khan 2008). In past decades, various methods and systems have been proposed to efficiently expertise from domain experts. The time scales into consideration, such that the variant of disease symptoms in different time scales can be precisely expressed (Gwo-Haur Hwang 2006). The use of a fuzzy expert system to predict the need for advanced neonatal resuscitation efforts in the delivery room. This system relates the maternal medical, obstetric and neonatal characteristics to the clinical conditions of the newborn (Braz J Med Biol Res 2004). The diagnosis and management of neonatal birth injuries has been developed for the