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Backpropagation in HL7 in Medical Informatics to Analysis Speed of Sending Data

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Abstract - In this paper, analysis the speed of sending message in Healthcare standard 7 with the use of back propagation in neural network. Various algorithms are define in backpropagtion in neural network we can use trainlm algorithm for sending message purpose. This algorithm appears to be fastest method for training moderate sized feedforward neural network. It has a very efficient matlab implementation. The need of trainlm algorithm are used for analysis, increase the speed of sending message faster and accurately and more efficiently. The proposed work is used in healthcare medical data. With the use of backpropagation in health care standard seven (HL7) sending message between two systems. To increase the speed of the healthcare sending data we can use Train LM algorithm. Train LM algorithm is more fastest algorithm it can be increase efficiency and improve accuracy of the system and also provide real time application. To increase speed of sending message these algorithm used. With the use of this algorithm it can be decreasing time of sending message to the other system.

Keywords : *medical informatics, HL7, backpropagation.*

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I. Introduction

Medical informatics is the sub-discipline of health informatics that directly impacts the patient – physician relationship. It focuses on the information technology that enables the effective collection of data using technology tools to develop medical knowledge and to facilitate the delivery of patient medical care. The goal of medical informatics is to ensure access to critical patient medical information at the precise time and place it is needed to make medical decisions. Medical informatics also focuses on the management of medical data for research and education.

a) Healthcare Standards

Healthcare standards provides framework for exchanging, integration, sharing and retrieval's of EHR. These standards define how information is packed and communicate from one party to another, setting the languages, structure and data types. HL7 standards support clinical practice and the management, delivery, and evaluation of health services, and are recognized as the most commonly used in the world. Healthcare provides seven standards to perform various functionalities. The latest standard implement in Healthcare is Health Level Seven (HL1-7) is a standard series of predefined logical formats for packaging healthcare data into messages to be transmitted among computer system.

b) Neural Networks

Are originally modelled as a computational model to mimic the way the brain works. Brain is made from small functional units called neurons. A neural has a cell body, several short dendrites and single long axon. By the dendrites and axon several neurons connected. Dendrites take various signals and pass to the other neurons as a input signal. These input increase or decrease to the electrical potential of the cell body and if it is reaches a threshold, a electric pulse is sent to the axon and the output occurs.

II. Types of Neural Network

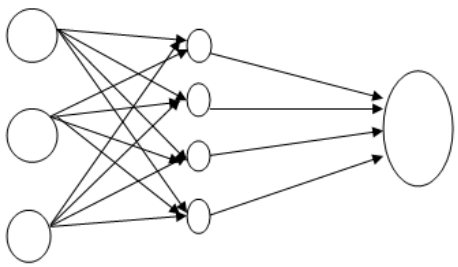
a) Biological Neural Network

Are made up of real biological neurons that are connected or functionally related in a nervous system. In the field of neuroscience they often identified groups of neurons that perform a specific physiological function in laboratory analysis.

b) Artificial Neural Network

Are composed of interconnecting artificial neurons (programming constructs that mimic the properties of biological neurons).it is used for solving artificial intelligence problems without necessary creating a model of a real biological system.

3 layers in neural network I/P, hidden layer and O/P.



Input Hidden layer Output

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c) Backpropagation

It is an abbreviation for "backward propagation of errors" is a common method of training artificial neural network. It is an error function and supervised learning method and generalisation of the delta rule. It requires a dataset of the desired O/P of many I/Ps making up the training set. It is most useful for feed forward network. For better understanding, the back propagation learning algorithm can be divided into 2 phases:-

- Phase1- Propagation
- Phase 2- Weight updates

Various algorithms in backpropagation neural network:

i. *Backprogation using Gradient Decent*

It is relative simply implementation, standard method and generally work well but slow and inefficient.

ii. *Simulating Annealing*

It is a global minimum can guarantee of optimal solution but it is slower than gradient decent and also much more complicated implementation.

iii. *Genetic Algorithm*

Faster than simulated annealing and also less like to get stuck in local minima but it is slower than gradient descent and also memory intensive for large network.

iv. *Simplex Algorithm*

It is similar to gradient decent but faster and easy to implement but does not gurantee a global minima.

v. *Train LM Algorithm*

It is much faster than all algorithm and also used to calculate performance easily implement in matlab. It used to solve the fitting problem and also provide fastest many mode sizes feed forward network.

III. Methodology

a) Levenberg–Marquardt Algorithm

In order to make sure that the approximated Hessian matrix JTJ is invertible.

Levenberg–Marquardt algorithm introduces another approximation to Hessian matrix:

$$\boldsymbol{H} \approx \boldsymbol{J}^T\boldsymbol{J} + \mu\boldsymbol{I} \tag{1.1}$$

where

μ is always positive, called combination coefficient.

I is the identity matrix.

From Equation 1.1, one may notice that the elements on the main diagonal of the Hessian matrix will be larger than zero. Therefore, with this approximation (Equation 1.1), it can be sure that matrix H is always invertible.

$$\boldsymbol{w}_{k+1} = \boldsymbol{w}_k - \left(\boldsymbol{J}_k^T\boldsymbol{J}_k\right)^{-1}\boldsymbol{J}_k\boldsymbol{e}_k \tag{1.2}$$

By combining Equations 1.1 and 1.2, the update rule of Levenberg–Marquardt algorithm can be presented as

$$\boldsymbol{w}_{k+1} = \boldsymbol{w}_k - \left(\boldsymbol{J}_k^T\boldsymbol{J}_k + \mu\boldsymbol{I}\right)^{-1}\boldsymbol{J}_k\boldsymbol{e}_k \tag{1.3}$$

As the combination of the steepest descent algorithm and the Gauss–Newton algorithm, the Levenberg– Marquardt algorithm switches between the two algorithms during the training process. When the combination coefficient μ is very small (nearly zero).

Equation (1.1) approaching to Equation (1.2) and Gauss–Newton algorithm is used. When combination coefficient μ is very large, Equation 1.1 approximates to

$$\boldsymbol{w}_{k+1} = \boldsymbol{w}_k - \alpha\boldsymbol{g}_k \tag{1.4}$$

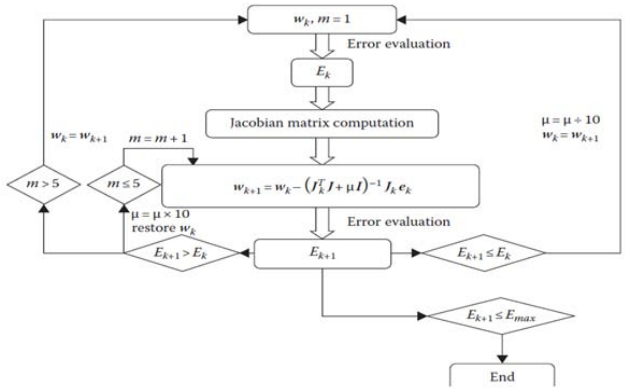
and the steepest descent method is used. If the combination coefficient μ in Equation 12.25 is very big, it can be interpreted as the learning coefficient in the steepest descent method (1.4).

$$\alpha = \frac{1}{\mu}$$

The training process using Levenberg–Marquardt algorithm could be designed as follows:

i. With the initial weights (randomly generated), evaluate the total error (SSE).
ii. Do an update as directed by Equation 1.1 to adjust weights.
iii. With the new weights, evaluate the total error.
iv. If the current total error is increased as a result of the update, then retract the step (such as reset the weight vector to the precious value) and increase combination coefficient μ by a factor of 10 or by some other factors. Then go to step ii and try an update again.
v. If the current total error is decreased as a result of the update, then accept the step (such as keep the new weight vector as the current one) and decrease the combination coefficient μ by a factor of 10 or by the same factor as step iv.
vi. Go to step ii with the new weights until the current total error is smaller than the required value.

The flowchart of the above procedure is



IV. Conclusion

To analyzing the speed of sending messages between the systems. Improving the quality and accuracy of the message sending in HL7 standard. Less time require exchanging data between systems. It can be based on real time application. Provide efficient and accurate data. Train LM algorithm easily implement in matlab and provide better result as compare to all other backpropagation algorithms. Fastest method for training moderate sized feed forward neural network. In the future we can also work on Dicom images to increase the speed of sending image fastly and best quality with use of this algorithm.

V. Future Scope

In future work, also more improve the speed of sending message with some another network and also more distortion measures and feature domains will be used as the image samples. Also, the relationship between the metrics adopted for the combination will be further investigated to find the best combination among them. More experiments are needed to validate properties of the network such as it optimum number of neurons in hidden layers, validation etc. Performance comparison of LMBP with other networks should also be discussed.

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