

Analysis of Fat & Water Soluble Vitamins in Human Body Using Neuro-Fuzzy Approach

Dr. Jeegar A. Trivedi

Dept. of Computer Science & Technology, Sardar Patel University, Vallabh Vidyanagar, Gujarat, India

Abstract

The paper presents design and development of neuro-fuzzy based decision making system that helps in analysis of fat and water soluble vitamins level in human body. Artificial neural network is hybridized with fuzzy logic in order to get a neuro-fuzzy approach. This system will guide your daily nutrition details that your body needs for healthy life living. This system will give all briefly advices that if one (patient) can not capable for go to the hospital/clinic as well. This system will provide necessary guidance or advice according to the patient query. The advice generated by the system is less time consuming and useful in our daily life style. The knowledge base of the project includes domain expert knowledge, field knowledge, gathered from various books as well as internet and the recent trends to maintain healthy human body. Artificial neural network is a computational model that simulates the learning process of human being and fuzzy logic deals with interpretation of parameters that might not be clearly defined in the give context. In this paper artificial neural network and fuzzy logic together generates analytical system for water and fat soluble vitamins present in human body.

Keywords

Artificial Neural Network, Fuzzy Logic, Neuro-Fuzzy System, Vitamins, Advisory System

I. Introduction

The aim of the work done in this paper is to perform analysis of water and fat soluble vitamins in human body using an artificial neural network. There are two aspects that can be made in this context. The first aspect is concerned with computer science and the other is concerned with the biological aspect. The computer science aspect would be to try finding ways to improve the results i.e. finding the artificial neural network (ANN) that produces the best analysis. On the other hand the biological aspect would examine water and fat soluble vitamins on different biological criteria after examining them in order to see if it is possible to draw any conclusions about the different results. A graphical user interface is developed in C# language that helps the user to enter the appropriate level of vitamins in their body in an interactive fashion. The code library was also used in generating system based on neuro-fuzzy approach as shown by J.A. Trivedi et al. [2] – [5]. Based on the input provided by the user, the system generates required advice to its user. The advised can be saved in locally in word document for future use.

II. Methodology

The artificial neural network developed is a fully connected feed forward network that uses back propagation learning method under supervised condition. Artificial neural network consists of three layers fully connected with each other [1]. Input layer specifies input that is given to artificial neural network. Output layer is the layer that generates result from developed artificial neural network. There can be one or more hidden layer where the actual learning takes place with the help of learning algorithms. Vitamins levels in human body varies mainly on three factors age, gender and normal values of vitamins level in milli or micro gram retained by human body. If vitamins level are too less or too high then they can produce certain types of diseases in human body. Thus it is advisable to have normal level of vitamins in human body. Two separate artificial neural networks were developed for fat and water soluble vitamins respectively. Each artificial neural network consisted of age and different vitamins as input layer neurons in artificial neural network. Three hidden layers of five neurons each were incorporated for learning and back track of error in learning.

Output layer consisted of three neurons specifying whether the combine vitamin level were below or higher than required level or at normal level. The same neural networks were simulated with Java NNS[8] in order to verify the results. The artificial neural networks of fat and water soluble vitamins are presented in fig.1 and fig. 2 respectively.

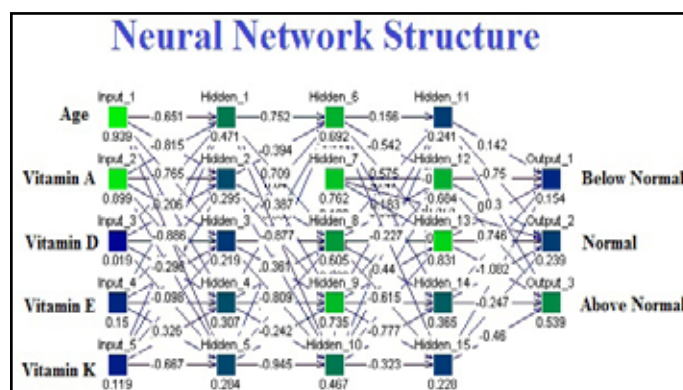


Fig. 1: Artificial Neural Network for Fat Soluble Vitamins

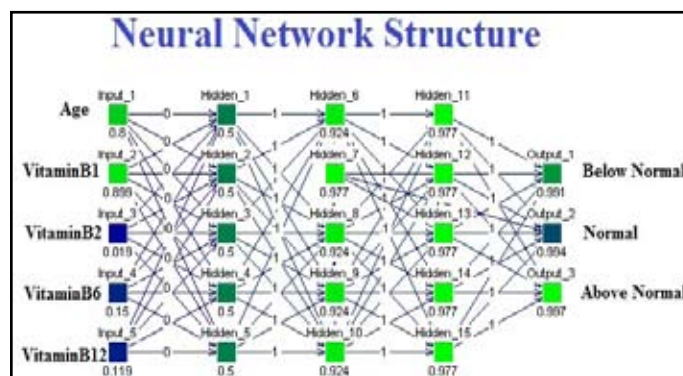


Fig. 2: Artificial Neural Network for Water Soluble Vitamins

After rigorous training of both the artificial neural network from the data gathered from pathological laboratories, following test result were generated that are presented in table 1, 2, 3 and 4 respectively.

Table 1: Input Data for ANN of Water Soluble Vitamin

Field Name	Value
Age	0.7
Vitamin B1	0.3
Vitamin B2	0.4
Vitamin B6	0.6
Vitamin B12	0.6

Table 2 : Output Data for ANN of Water Soluble Vitamin

Field Name	Value
Below Normal	0.46
Normal	0.69
Above Normal	0.38

Table 3: Input Data for ANN of Fat Soluble Vitamin

Field Name	Value
Age	0.7
Vitamin A	0.8
Vitamin D	0.001
Vitamin E	0.86
Vitamin K	0.6

Table 4 : Output Data for ANN of Fat Soluble Vitamin

Field Name	Value
Below Normal	0.33
Normal	0.72
Above Normal	0.38

Here we can observe according to provided training set and learning iteration thousand times, our neural network is providing the required output. The parameter age is divided by value hundred in order to convert it into range from 0 to 1. Here the major factors are the threshold value and the running time for algorithm. As you decrease threshold you may get more categories but the efficiency in the final decision making gets reduced. On trial and error basis and checking, we have decide threshold value to be 0.6, of course the value can be changed as and when required by administrator due to dynamic nature of the system.

The outputs of artificial neural network are merged with fuzzy logic in order to generate an advice which is in english language and human understandable form [6], [7], [9], furthermore this advice can be downloaded in form of word document and can be saved for future use. The sample code snippet for fuzzy logic is presented in fig. 3 below

```

if (age > 0.05F && age <= 0.08F)
{
if (vitb2 > 0.015F)
{
advice = advice + "The person has high level of vitamin B2."
+ "\n Vitamin b2 caused ariboflavinosis disease, Symptoms may include cheilosis
(cracks in the lips)."
+ "\n high sensitivity to sunlight, impaired growth, burning and itching of the eyes.
Excess riboflavin is excreted"
+ "\n through the urine (often temporarily causing urine to turn a bright yellow color
several hours after taking it)."
}
}
    
```

Fig. 3: Fuzzy Logic Code Snippet

III. Test Cases

The following test case incorporates advice for water soluble vitamin level in human body. Fig. 4 presents the input parameters for water soluble vitamins entered by user.

Fig. 4: Input for water soluble vitamins

Fig.5 represents the advice generated by the system on the basis of input provided in fig. 4.

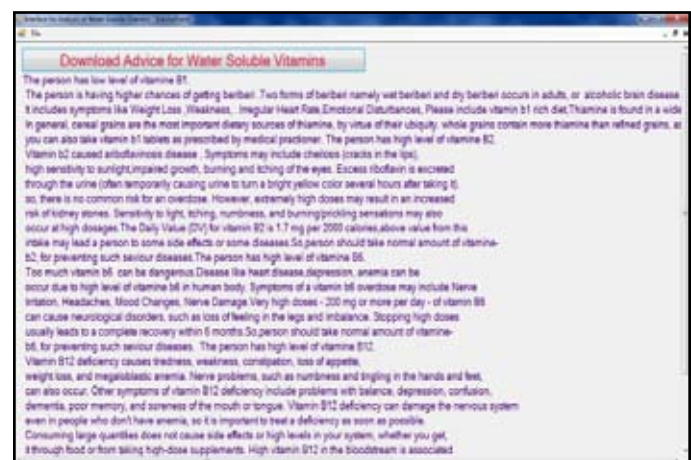


Fig. 5: Output advice generated for water soluble vitamins

Fig. 6 presents the input parameters for fat soluble vitamins

Fig. 6: Input for fat soluble vitamins

Fig. 7 depicts the advice generated by the system for fat soluble vitamins

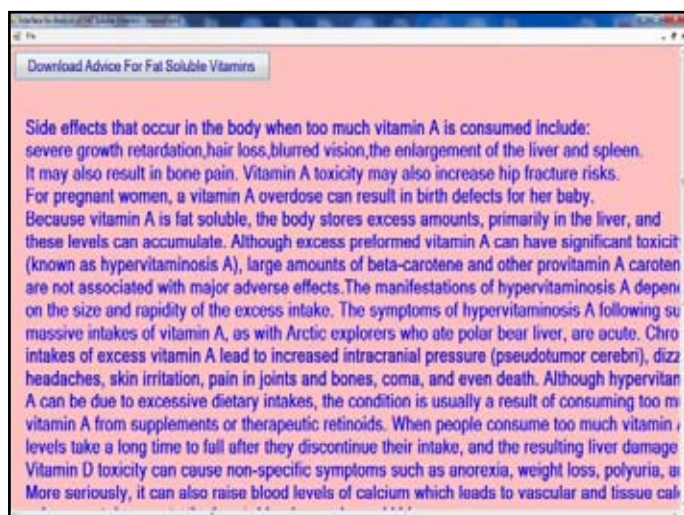


Fig. 7: Output advice generated for fat soluble vitamins

IV. Conclusions

This system provides Age and Gender related data of all input vitamins user. By this he/she can easily get the knowledge about their diet or get prevention from the disease that should be caused in future.

Medicational analysis of nutrients in human body is time consuming and demand large resources. So in order to remove these types of drawbacks computational methods are used. Artificial neural networks are currently the next promising area of interest. It is believed that artificial neural networks will have extensive application to biomedical problems in the next few years. Already, it has been successfully applied to various areas of medicine, such as diagnostic systems, biochemical analysis, image analysis, and drug development. By hybridizing fuzzy logic with artificial neural network, it is shown that regular analysis of water and fat soluble vitamins in human body will focus on habits for dietary as well as supplementary intake of food items which will keep human body fit and increase the overall average life span. The same system can be applied to other vitamins and with some

minor modification it can be applied for mineral. If the system is developed on larger scale, then it can be used to analyze complete body check up program. Hence regular advice from this system will produce better life style.

References

- [1] J S R Jang, C T Sun and E Mizutani, *Neuro-fuzzy Soft Computing*, Prentice Hall of India Ltd, pp. 27-33, 1997.
- [2] Jeegar A Trivedi, and Priti Srinivas Sajja, "Framework for automatic development of type-2 fuzzy, neuro and neuro-fuzzy systems", *International Journal of Advanced Computer Science and Applications*, vol.2, no.1, pp.131-137, 2011.
- [3] Jeegar A Trivedi, and Priti Srinivas Sajja, "Improving Efficiency of Round Robin Scheduling Using Neuro Fuzzy Approach", *International Journal of Research and Reviews in Computer Science (IJRRCS)*, Vol. 2, No. 2, pp. 308-311, ISSN: 2079-2557, April 2011.
- [4] Jeegar A Trivedi, and Priti Srinivas Sajja, "Neuro-Fuzzy Advisory System for Banks with Type 2 Fuzzy Approach", *National Journal of System and Information Technology*, Vol. 4, No.1, pp. 62-68, ISSN: 0974-3308, June 2011.
- [5] Jeegar A Trivedi, and Priti Srinivas Sajja, "Online Guidance for Effective Investment Using Type 2 Fuzzy-Neuro Advisory System", *International Journal of Computer Science and Information Technologies (IJCSIT)*, Vol. 2 No. 2, pp. 799-803, ISSN: 0975-9646, March 2011.
- [6] L.A. Zadeh, "The concept of a linguistic variable and its application to approximate reasoning", *Information Sciences*, vol. 8, pp. 43-80, 1975.
- [7] Mendel JM *Advances in Type-2 Fuzzy Sets and Systems: Information Sciences*, vol. 177, pp. 84-110, 2007.
- [8] <http://www.ra.cs.uni-uebingen.de/software/JavaNNS/> retrived on 18-9-2013.
- [9] SN Sivanandam SN, Deepa SN, *Principles Of Soft Computing*, Wiley, ISBN 10: 81-265-1075-7, pp.318-322, 2007.

Author's Profile



Dr. Jeegar A Trivedi is working as a Asst. Prof in the Department of Computer Science & Technology at Sardar Patel University, India. His research area's lies in the fields of Artificial Neural Network, Fuzzy and Type - 2 Fuzzy Logic and Neuro-Fuzzy systems.