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Effect of Meditation and Cognitive Factor for the Measurement of Level of Consciousness: ANN Computational Model

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Abstract: ***Environment of a person over a period of time influence his domain of social activities and generate certain level of positive and negative mental tendencies. The net algebraic effect of these tendencies is considered as a measure of reflection on consciousness level in the material world of reality. The present paper explores the reflection of human activities on the development of consciousness level in terms of positive and negative mental tendencies. The observed subjective information existing in a human frame of cognition of the sample considered for the study has been utilized to develop a simple ANN neuronal model to predict consciousness level of large number of population. A questionnaire identifying the state of a person in four selected human activities viz. social, personal, official and spiritual were designed. The people who were asked to meditate also showed high degree of consciousness after the stipulated period in comparison with those who didn't.***

Keywords: Consciousness; Meditation; ANN; Modeling

1. Introduction

Consciousness has been the central theme from the beginning of philosophical thoughts and traditional esoteric practices. Extreme complexity of the phenomenon of consciousness and scientific methodological difficulties had marginalized the issue of consciousness in the field of theological sciences. The first scientific attempts to enlighten the phenomenon of consciousness appeared only in psychology through development of psychophysics and theories of personality. The hierarchy of biological neural networks at sub-cellular micro tubular cytoskeleton level lead to a kind of interface of neural and quantum level [***Hameroff 1994***]. The concept of quantum mechanics and wave function reduction of the whole cognitive process was developed in to a computer algorithm. Feynman propagator quantum approach includes an analogous mathematical formalism as the Hopfield associative neural network [***Perus 1996***]. The mentioned analogy opened the views how quantum parallel processing level gives rise classical parallel processing [***Neumann 1955***] which is closely related to fundamental nature of consciousness [***Giulini et al 1996***] and other holistic manifestations of consciousness, like transitional states [***Perus 2000***]. Fundamental field-related macroscopic Hopfield-like quantum-informational basis of the underlying quantum-holographic paradigm were considered, with implication that whole psychosomatics might be considered as a quantum hologram, both on the level of individual and collective consciousness [***Rakovic et al 2009***]. Studies have also shown that there is the significant effect of Yoga and Meditation on different dimensions of consciousness quotient (***Ahuja, 2013***). Research has increasingly focused on the benefits of meditation in everyday life and performance. Mindfulness in particular improves attention, working memory capacity, and reading comprehension (***Agarwal et al, 2013, Kramer et.al.2013)*** Importance of the impact of fundamentals of ethical life style like physical, ethical, community work and spiritual has been highlighted for the positive personality development. A better life style improves attention, thoughts and perception with exceptional control over one's mind leading to intellectual, moral and personal growth ultimately enhancing consciousness level. The consciousness if related to the various domains of human activities then how do they relate? What activities increase the human consciousness? What element subjects change mind? Such questions are important and to be answered. The present communication reports the evaluation of the impact of some fundamentals of ethical life style of the selected human sample (647) on the level of consciousness and to develop an Artificial Neural Network Model as a scientific paradigm to predict consciousness level of large number peoples. Artificial neural network (ANN) being reliable, robust, and salient characteristics in capturing the nonlinear relationships of variables in complex systems, has been successfully employed in the present theological studies

2. Methodology

A five points self preparatory questionnaire (social index scale) was designed to measure the consciousness level in terms of positive and negative mental tendencies inculcated in the human subjects (n= 647). Effect of variables like personality, social traits, work ethics and religious activates was observed against the control group (n= 25). Healthy

adults of the age group 20-55 years were randomized to six weeks of training of control group are introduced to the control room 30 minutes before starting the **Hole in the Wall** type of concentration with comfortable sitting position similar to that utilized during meditation. They were also exposed to a selfless social activity. Out of Forty-nine questions, 29 were addressed to fetch information regarding four identified human activities while 20 questions to seek information about 10 identified mental tendencies (five each for positive and negative).

ANN Structure

Neural Network Toolbox Neuro Solution6.0 ® mathematical software was used. A single-layer ANN model was designed considering personality, social traits, work ethics religious activities as input variables while positive and negative mental tendencies as output with sigmoid axon transfer function. Network represents functional relationship between inputs and output, provided sigmoid layer has enough neurons. Levenberg- Marquardt algorithm is fastest training algorithm for network of moderate size, therefore, used in the present study.

Back propagation training algorithm

The back propagation algorithm is a generalization of the least mean square algorithm modifying network weights to minimize the mean square error between the desired and actual outputs of the network. Back propagation uses supervised learning in which the network is trained using data for which inputs as well as desired outputs are frozen and used to compute output values for new input samples. Start with randomly selected weights while MSE is unsatisfactory and computational bounds are not exceeded, do for each input pattern. The input is propagated through the ANN to the output and error e_k on a single output neuron k is calculated as: $e_k = d_k - y_k$, where y_k is the calculated output and d_k is the desired output of neuron k. This error value is used to calculate a δ_k value, which is again used for adjusting the weights .The δ_k value is calculated by: $\delta_k = e_k\, g'(y_k)$, where g' is derived activation function. The δ_k value and δ_j values were calculated for proceeding layers. The δ_j values of the previous layer are calculated from the δ_k values of this layer by the following equation: $\delta_j = ng'(y_j)\Sigma\, \delta_k W_j K$, where K = 0,1,2……n, where K is the number of neurons and η is the learning rate parameter. Using δ values, the δw values are calculated by: $\delta w_{jk} = \delta_j\, y_k$. The δw_{jk} value is used to adjust the weight w_{jk}, by $w_{jk} = w_{jk} + \delta w_{jk}$ and the back propagation algorithm moves on to the next input and adjusts the weight according to the output. The process goes on until a certain stop criteria is reached. The stop criteria are typically determined by measuring the mean square error of the training data.

3. Results and Discussions

Evaluation of the impact of some fundamentals of ethical life style like physical, ethical, community work and spiritual of the selected human sample has been studied on the alteration in consciousness level. The study demonstrates that out of 647 multi ethnic sample, 40% population shows statistically significant positive relation, 23% moderately associated while 25% negatively associated with moral ethics and positive attitude.

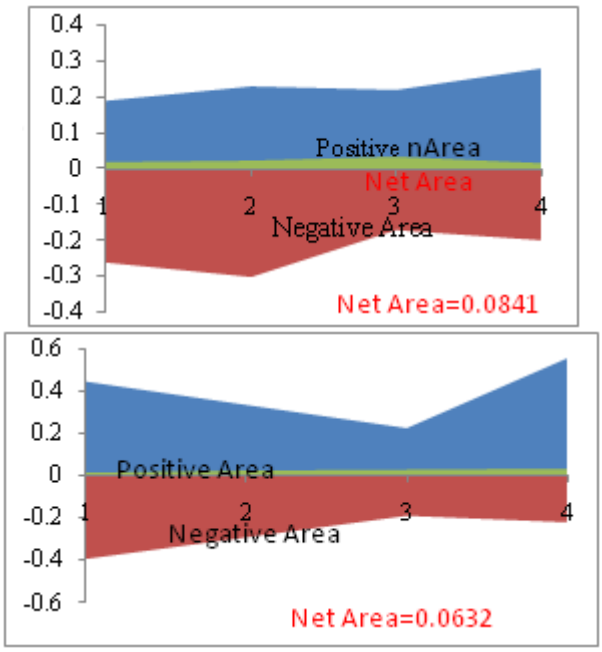


Figure 1: a,b depict net area of an individual attitude for negative and positive mental tendencies.

The people who were asked to meditate showed high degree of consciousness after the stipulated period in comparison with those who didn't. Interestingly, those who are continuously and actively participating in voluntary social service also without demanding any recognition and are performing spiritual activities for more than a year have higher net positive reflection compared to those who have either just started such life style or have been following it for 6 weeks. Initially the data of control group was scrutinized by applying descriptive status by mean, standard deviation to all the variables considered for the present study. The significance of difference between mean score was obtained by computing each value of the subject. The interaction effect of all the variables has been correlated. The statistically significant social index level was found to be high (p>.05) among those individuals who are practicing meditation daily. On the other hand those who were not performing meditation regularly were less correlated while value for non mediating group is not found to be significant.

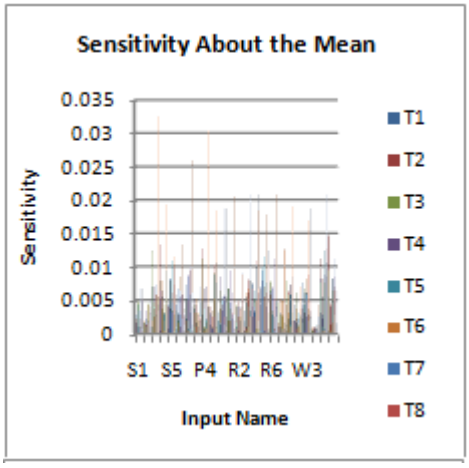


Figure 2: 4-2 Network Architecture

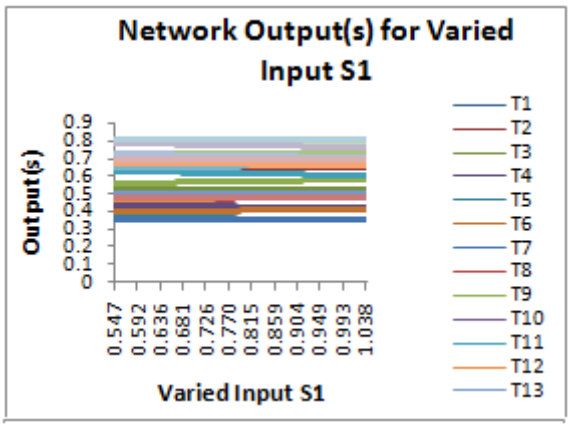


Figure 3: a,b depicts effectiveness of the input variable personality, religious activity, social traits work ethics on the level of consciousness which is the function of negative and positive mental tendencies.

ANN model based on single layer recurrent back propagation algorithm was applied to train the Neural Network. During training, the output vector is computed by a forward pass in which the input is propagated forward through the network to compute the output value of each unit.

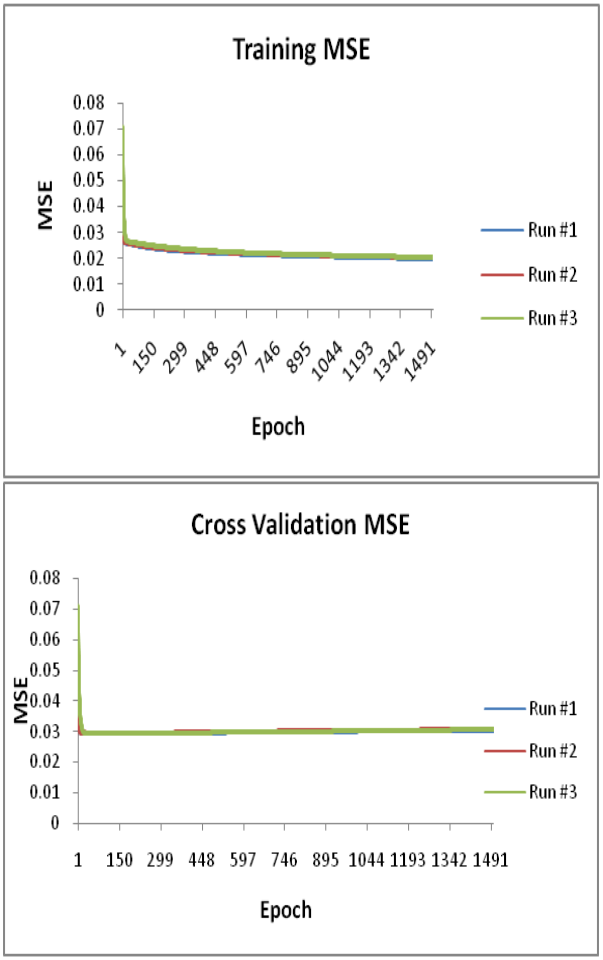
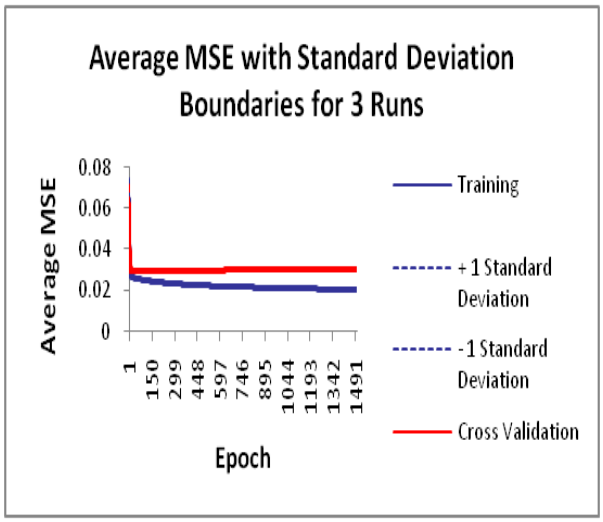


Figure 4: a,b depicts shows training MSE and cross validation error were computed for traning and cross validation data and it was minimized through three iterations.



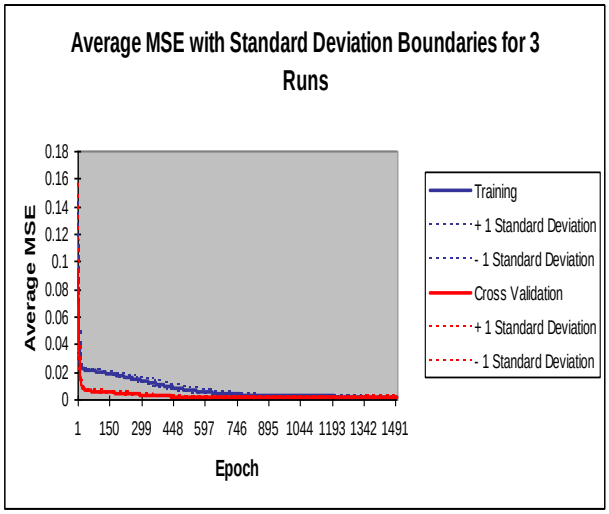


Figure 5: a,b depicts average MSE for with standard deviation for input and output variable were optimized with 1500 epoch .07 momentum

The output vector is then compared with the desired vector which resulted into error signal for each output unit. In order to minimize the error, appropriate adjustments were made for each of the weights of the network. After several such iterations, the network was trained to give the desired output for a given input vector. The single layer network structure included ten hidden neurons, describing the dynamics of input variables. The sigmoid axon was considered transfer function with 0.7 momentums. The performance of network simulation was evaluated in terms of mean square error (MSE) criterion. The MSE for the training and cross validation data sets were found at the ninth place of decimal.

A sensitivity analysis was conducted to determine the degree of effectiveness of variables. Performance of the group of input vectors included personality, social traits, work ethics religious activities while positive and negative mental tendencies as output with sigmoid axon transfer function, resulted into the evaluation of performance based on 60 % data for training, 20 % data for testing and 20 % data for cross validation at 1500 Epoch with 0.70000 momentums. The minimum MSE in the group of four variables was determined for training and cross validation are 0.006237719 and 0.007242542 respectively.

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