A STUDY ON WEIGHTEDMULTI-EXPERT NEURAL NETWORKS IN SOCIAL PROBLEM

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ABSTRACT

In this article, the authors attempt to study the problems faced by brick makers using Weighted multi expert neural networks (Wt.M.E.N.N.). The study of brick makers who work as bonded labourers in places around Chennai has been carried out in this paper.

Key words: Neural Networks, Multi-expert, Social.

Mathematics Subject Classification: 03B52, 62A86, 92B20.

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1. INTRODUCTION TO WEIGHTED MULTI EXPERT NEURAL NETWORK:

Definition: 1.1A neural network is a computational structure that is inspired by observed process in natural network of biological neurons in the brain. It consists of simple computational units, called neurons that are highly interconnected. Each interconnection has a strength that is expressed by a number referred as weight.

Definition: 1.2 The bias defines the value of the weighted sum of inputs around which the output of neuron is most sensitive to changes in the sum.

Now we proceed on to define the notion of Weighted Multi Expert Neural Network.

In Neural Network bias plays an important role. So we take the bias as an input with value -1 and its corresponding weight is the sum of the average of the other input weights.
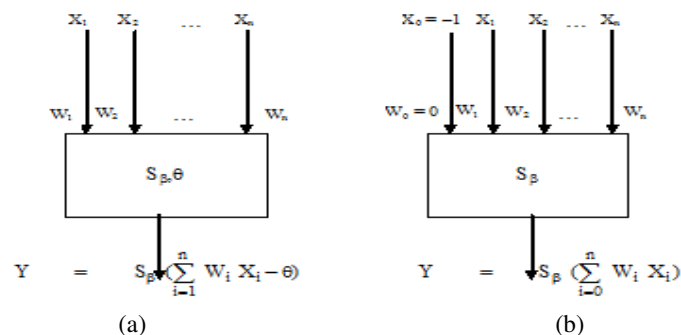
In general, using this newly constructed Weighted Multi Expert Neural Network (Wt. M.E.N.N.), we can extend to `n' number of experts.

The class of sigmoid function S_β, defined by the formula.

$$S_\beta(a) = (1 + \exp\{-\beta a\})^{-1}$$

Then, the output of the neuron is defined by

$$Y = S_\beta\left(\sum_{i=1}^{n} W_i\, X_i - \theta\right)$$

Fig. 1.1: Two equivalent representation of a neuron activated by a sigmoid function S_β with bias θ.
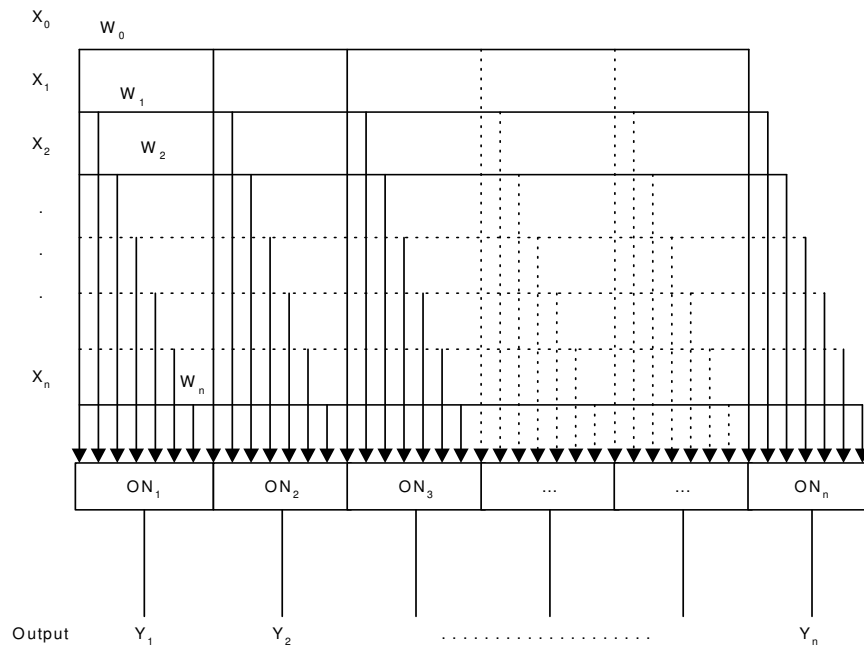
where β is a positive constant (Steepness parameter), θ is called the bias of the neuron, since θ the bias is considered as an input, $x_0 = -1$ and the associated weight $w_0 = \theta$.

Then the output now is given by

$$Y = S_\beta \left(\sum_{i=0}^{n} W_i \, X_i \right),$$ where W_i is the weights given by the experts and

$S_\beta(a) = (1 + \exp\{-\beta a\})^{-1}.$

The multi expert neural network system with opinion's weights

2. DESCRIPTION AND JUSTIFICATION:

The study of brick makers who serve as bonded labourers has been carried out with the following motivations.
1. Most of them are agriculturist coolies who have taken up this profession and have become bonded for their sheer existences.
2. The main difference between usual bonded labour and these bonded labourers.
(i) They work as bonded labour only for six months and they are bonded only for the period from January to July.
(ii) They become bonded as family only for Rs.7,000 to Rs.10,000 which is paid as the money for them in advance. They are not given any money for every day work, which is about 10 to 12 hours a day.
(iii) They pay as interest in terms of made bricks.

Thus after six month they are free so they go back to their home. The living conditions of them are not so poor for they are happy for they get some means to exist.

Since the information pertaining to them happen, to be very vague(i.e.) the data happens to be an unsupervised one we are at the outset justified in adopting the multi expert neural networks. We have given only 7 experts opinion in this paper.

3. ADAPTATION OF THE WT.M.E.N.N. TO THE PROBLEM:

Here we describe the problem together with the assumed notations and construct the neural network based on the experts opinion on a few factors like.

X_1	-	Agricultural Failure,
X_2	-	Poverty
X_3	-	Illiteracy
X_4	-	Family depts.
X_5	-	Unemployment / Underemployment.

Each input $X_0, X_1, \ldots, X_5$ are associated with real numbers called the weights, namely $W_0, W_1, \ldots, W_5$ whose value lie in the interval [0,1]. We have obtained 7 experts opinion, the corresponding weightage are given by the following table:

	W_0	W_1	W_2	W_3	W_4	W_5
Expert 1	0.73	0.80	0.70	0.60	0.50	0.40
Expert 2	0.52	0.75	0.82	0.73	0.70	0.50
Expert 3	0.63	0.60	0.50	0.62	0.80	0.70
Expert 4	0.80	0.67	0.73	0.58	0.72	0.60
Expert 5	0.78	0.50	0.87	0.74	0.60	0.72
Expert 6	0.69	0.73	0.72	0.63	0.71	0.53
Expert 7	0.75	0.68	0.47	0.72	0.68	0.43

The average of the weightage are given by the experts namely $E_1,\ E_2 \ldots E_7$.

E_1	E_2	E_3	E_4	E_5	E_6	E_7
0.60	0.70	0.64	0.66	0.69	0.66	0.59

By taking the input as the average of the weightage given by the experts and the value of bias is kept as in the case of neural network to be –1 .

X_0	X_1	X_2	X_3	X_4	X_5
-1	0.68	0.69	0.66	0.67	0.55

In general, using this newly constructed Weighted Multi Expert Neural Network (Wt.M.E.N.N.), we can extend to 7 number of experts say E_1,

$E_2, \ldots , E_7$ and their corresponding output is given by,

$$Y_i \ = \ S_\beta \left(\sum_{i=0}^{7} W_i \ X_i \right),$$ where W_i is the weights given by the experts and

$S_\beta(a) = (1 + \exp\{-\beta a\})^{-1}.$

We now model this by the weighted multi expert neural network (Wt.M.E.N.N) and in our opinion this Wt.M.E.N.N, takes the weight of every expert equally even before the data is processed for result.

The multi expert neural network system of experts opinion with weightages of the seven experts
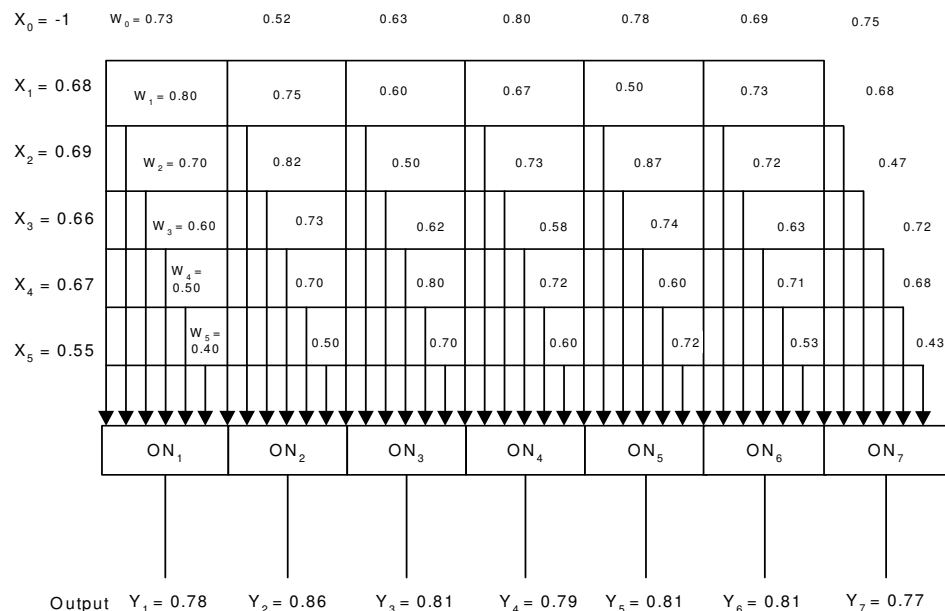
From the output, we see that the over all opinion of the experts regarding the bonded labour happen to be > 0.5.

Thus to make a fuzzy analysis we using the same experts define the fuzzy set μ taking the opinion of the experts, E_1, ... , E_7 as the universal set E .

The membership function μ given by the experts:

$\mu : E \rightarrow [0, 1]$ where $E = \{E_1 \ldots E_7\}$

$$\mu(E) = \begin{cases} 0 & \text{if} & E_i < 0.5 \\ 0.70 & \text{if} & 0.5 \leq E_i < 0.6 \\ 0.80 & \text{if} & 0.6 \leq E_i < 0.7 \\ 0.90 & \text{if} & 0.7 \leq E_i < 0.8 \\ 1.00 & \text{if} & 0.8 \leq E_i < 1.0 \end{cases}$$

where $i = 1, 2, ..., 7$

Now using the fuzzy membership grade given by the same experts and the output got from the Wt.M.E.N.N., we draw it comparison table of fuzzy set value and it output from Wt. M.E.N.N.

	Average Weight	Wt. M.E.N.N.	Fuzzy set value μ[E]	Difference between Wt. M.E.N.N. and μ[E]
Expert 1	0.60	0.78	0.80	0.02
Expert 2	0.70	0.86	0.90	0.04
Expert 3	0.64	0.81	0.80	0.01
Expert 4	0.66	0.79	0.80	0.01
Expert 5	0.69	0.81	0.80	0.01
Expert 6	0.66	0.81	0.80	0.01
Expert 7	0.59	0.77	0.70	0.07

4. RESULTS AND DISCUSSIONS:

We now once again using the opinion of the experts we agree to accept an opinion (say) or neglect it according as the difference is less than or equal to 0.05 or great than 0.05. Thus, we now obtain the following conclusions from our study.
1. Failure of agriculture and poor yield is the major reason for these people to become bonded labour.

2. It is a pity to note that they are willing to work even for more than 12 hours without any grudge for an amount of Rs.7, 000 to Rs.10,000 for six month as the bonded labourers. As the agriculturist coolies, they cannot earn this sum evenfor a year.

3. However they are tried due to over work.

4. Some of them are still unaware of the fact the extra bricks they do is the interest they pay interms of labour for the advance received to be bonded for six months..

5. They feel that they have to become bonded due to acute poverty and family debts.

6. The Government can intervene and sees that the adults can work but the children must be spared of child labour.

REFERENCES:

[1] **Buckley, J.J. and Y. Hayashi**, "Fuzzy neural networks: a survey", Fuzzy *sets andsystems*, 66(1), 1994d, 1-13.

[2] **George J. Klir** and **Bo Yuan,** *Fuzzy sets and fuzzy logic theory and Applications,* Prentice – Hall of India Private Limited, New Delhi, 1997.

[3]   **Hayashi, Y. J.J. Buckley** and **E.Czogala,** *Fuzzy neural network with Fuzzy signals and weights,* International Journal of Intelligent Systems, Vol.8 (4), 1993,527 – 537.

[4]   **Narayanamoorthy, S.,** A Fuzzy Analysis Of The Socio Economic Problems Faced By Bonded Labourers In Tamil Nadu, Unpublished Ph.D Thesis, University of Madras, (2007).

[5]   **VasanthaKandasamy.W.B.,Indira,V**., "Applications of Fuzzy Cognitive Maps to determine the Maximum Utility of Route", *Journal of Fuzzy Maths. publ. by the International Fuzzy Mathematical Institute,* 8(5), 2000, 65-67.

[6]   **Vasantha Kandasamy. W.B., Antony Raj, S., and Victor Devadoss, A**. "Some new fuzzy techniques", *Journal of Math & Comp. Sci. (Math.ser.), 17(*2), 2004 , 157- 160.

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