

ANN model to predict the occupational stress of Professional Educator's

Naveen Kumar Pandey, Dr. Pranav Pandya, and Dr. Abhay Saxena

Abstract--Stress is common illnesses which can be easily discover in every individual of society at present, excessive work load, changing lifestyle, job insecurity and many glitches lead to stress and other disorders. Every single field today Academics, IT, banking are loaded with hampered of work and the employee working over there suffering from various stress and other healthy issues. Educators are the backbone of society and they guide the future of nations but unfortunately these days the academicians of different strata either from primary or higher education too suffering from various health problems. Work overload, to manage different teaching aids, management pressure and job insecurity specifically of private sector leads them to psychotic and psychological disorder. In this paper we are going to propose a model to examine and predict the occupational stress of the professional educators through Artificial Neural Network Techniques. The purpose of the study is to find out the various factors of occupational stress and prediction of stress level of the higher education teachers. Later with the help of trained Neural network model we are able to predict the occupational stress of the educators through various algorithm.

Keyword--Artificial Neural Network, Occupational Stress, Professional Educators

Professional Educators: Educators impart in higher education (College and University)

I. INTRODUCTION

IN this modern era stress is a common ailment found in every single. The reason for stress could be several and in diverse fields it has different facets. Whether its Academics, IT sector and Service sector every single soul is engrossed with certain nature of mental and physical diseases. In the field of academics as well the professional educators are also gripped with certain stress low inner satisfaction regarding policies and salary, management pressure, workload and traumatic working environment which leads to psychotic and physiological disorder. Occupational stress is one of the foremost health threats of the modern workplace. Occupational stress and stressful working atmosphere leads to low productivity and absenteeism.

Naveen Kumar Pandey is Research Scholar, Dept. of Computer Science, Dev Sanskriti Vishwavidyalaya, Shantikunj, Haridwar, Uttarakhand (M.N. +918881442246, email- naveen.dsvv@gmail.com)

Dr. Pranav Pandya, is Honorable Chancellor, Dev Sanskriti Vishwavidyalaya, Shantikunj, Haridwar, Uttarakhand, email- pranav.pandya@gmail.com

Dr. Abhay Saxena Is Professor and Head in Dept. of Computer Science, Dev Sanskriti Vishwavidyalaya, Shantikunj, Haridwar, Uttarakhand (M.N. +919258369624, email- abhaysaxena2009@gmail.com)

Diseases like OCD (obsessive compulsive disorder), anxiety, stress and adjustment disorder affect your mind as well as the entire body. If these ailments one can identify at the right time then the problem will be cure formerly reaching to the level of pinnacle. To eradicate this problem one has to be aware about his/her health so that positive actions will be taken before situation get more worse and leads to some major physiological and psychological complaints.

After review of literature it had been found that many researches have been done on the teacher's occupational stress in India but they are only based on statistical analysis and psychological parameters, i.e. (Naina Sabherwal and Deeya Ahuja Et.Al., 2015) has tried to find out the occupational stress among faculty members in higher education institution and the results showed that the determinants of stress among the administrators are numerous and varied, with compilation of results, time pressures, lack of infrastructure, student's indiscipline and poor pay prospects as a very high ranked stressors[11]. (Chaly PE, Anand SPJ, Reddy et. al, 2014) results showed, Out of 504 software professionals and 504 school teachers, for 23% of software professionals and 85% of school teachers, stress was Not a Problem in their life. 71% of software professionals and 15% of school teachers were in Moderate Stress level [12]. (G. Lokanadha Reddy and R. Poornima, 2012) the results revealed that majority of the university teachers are experiencing moderate and high levels of occupational stress and 86 percent of teachers have professional burnout[13]. (Pandey, N.P, Saxena, A.,2015) "teacher's occupational stress: a review study in national & international scenario" have conducted the review study and find out factors of occupational stress[14].

We were not able to find any occupational stress measurement through ANN technique during review of literature. In this study we have tried to measure and predict the Occupational Stress Level of educators by using Artificial Neural Network techniques so that they can identify and cure themselves on time before encountering with some major chronic diseases. We do feel that this model would be beneficial for the HR managers, Psychologist to keep their human resources well and shaped.

Occupational stress: (Cincinnati, 1999) had defined Occupational Stress as the "harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources, or needs of the worker"[1] in another word we can state that Stress related with job or occupation is called occupational stress. Occupational stress refers to a condition where occupation associated factors intermingle with employee to change, disrupts or enhance his

psychological and physiological surroundings such that the person is forced to deviate from normal functioning. The person cannot work efficiently due to stress. An employee's job role is composed of quality work life and is responsible for bringing in maximum amount of job satisfaction or minimum amount of job stress & anxiety. As (P., 2012) finding states that Occupational stress usually results from conflicting incompatible or unclear expectation that is derived from work environment [5]. (Cooper, 1983), has developed a concise yet complete list of six sources of work stress, Job Conditions - Quantitative & qualitative work overload, people decisions, physical danger, and techno stress. Role Stress - Role ambiguity, sex bias and sex-role stereotypes. Interpersonal Factors - Poor work and social support systems, lack of management concern for the worker, political rivalry, jealousy, or anger. Career Development - Under promotion, over promotion, job security, frustrated ambitions. Organizational Structure - Rigid and impersonal structure, political battles, inadequate supervision or training, non-participative decision making. Home-work Interface - Spillover, lack of support from spouse, marital conflict, dual career stress [2].

Artificial Neural Network: The term neural network was traditionally used which refers to a network or circuit of biological neurons. The modern usage of the term often refers to artificial neural networks, which are composed of artificial neurons or nodes. Thus the term may refer to either biological neural networks, made up of real biological neurons, or artificial neural networks, for solving artificial intelligence problems (Monterola, 2008)[4]. These artificial networks may be used for predictive modeling, adaptive control and applications where they can be trained via a dataset (Saxena A. B., 2012)[7]. There are numerous fields where ANN techniques are being applied i.e. medical field, education sector, entertainment, games, security etc. Psychology is one of the emerging fields where ANN techniques are being used to assess human behavior, personality traits prediction and prediction of stress level, Human capacity assessment through time series prediction[8] (Saxena, Pandya, & Bhatt, 2012). Assessment of Human Capacity based on Conjugated Gradient Techniques using Artificial Neural Network (Saxena & Pandya, 2013)[9] these researches are the best examples of that.

II. RESEARCH METHODOLOGY

Input Parameter (Independent Variable): In this research paper we have selected 12 input parameter which also denoted as input variable, these parameter are Role Overload, Role ambiguity, Role Conflict, Unreasonable Group and Political Pressure, Under participation, Powerlessness, Poor peer relations intrinsic, Impoverishment, Low status, Strenuous working conditions, Unprofitability, Personal Problem/ Family Problem

Output Parameter (Dependent Variable): Level of Occupational Stress of the employee

Sample size- 50 (DSVV Academic Staff)

Sampling Techniques: Simple Random Sampling

Tools Used: **MATLAB:** Used to analyze data, develop algorithms, and create models and applications. **OSI:** Occupational Stress Index, Prepared By A.K. Srivastava & Dr. A.P. Singh, BHU, The scale had 46 items each to be rated on the five-point scale. Out of 46 items, 28 are "true keyed" and the balance 18 is "false keyed".

Artificial Neural Network Modeling Parameter:

Network Type- Feed Forward Backpropagation

Training Function – TRAINLM, TRAINGDM, TRAINGDA, TRAINSCG, TRAINCGB, TRAINCGP, TRAINCGF, TRAINGD, TRAINGDX, TRAINBFG

Adaption Learning Function – LEARNGDM

Performance function: MSE "Mean squared error" is a network performance function. It measures the network's performance according to the mean of squared errors., MSEREG "Mean squared error w/reg performance function", is a network performance function. It measures network performance as the weight sum of two factors: the mean squared error and the mean squared weight and bias values.

Number of Layer – 2

Number of Neurons -10

III. RESULT ANALYSIS AND DISCUSSION

Performance Analysis chart of an ANN Models (Based on MSE "Mean Squire Error")

TABLE I
SHOWS THE VALUE OF MSE OF THE DIFFERENT ANN MODELS

ANN Model	Training Function	MSE value	Best Validation	At Epoch	Regression value
Network 1	TRAINLM	0.0021	0.011784	6	0.99841
Network 2	TRAINGDM	0.0218	0.073831	1000	0.98517
Network 3	TRAINGDA	0.00686	0.0010781	107	0.9957
Network 4	TRAINSCG	0.0103	0.00133	2	0.96308
Network 5	TRAINCGB	0.285	1.6318	54	0.99622
Network 6	TRAINCGP	1.51	7.7242e	46	0.98228
Network 7	TRAINCGF	0.0293	0.0085791	3	0.96886
Network 8	TRAINGD	0.0253	1.5424e	53	0.988806
Network 9	TRAINGDX	0.0632	0.091017	36	0.9464
Network 10	TRAINBFG	0.689	0.025302	6	0.96729

Performance Graph and Regression Plot of the ANN Models (Based on MSE Function):

Network 1: Training Function – TRAINLM, Network Performance function is MSE and all parameters of the network is same as mentioned in the NN Modeling Parameter section.

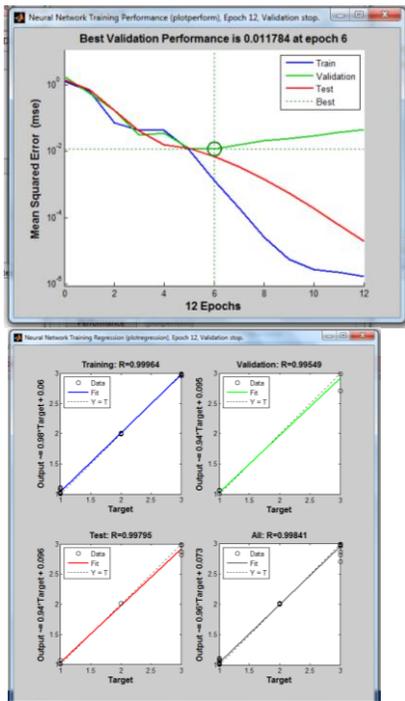


Fig. 1 (a) shows the best validation performance (b) shows regression plot of the network

Network2: Training Function – TRAINGDM , Network Performance function is MSE and all parameters of the network is same as mentioned in the NN Modeling Parameter section.

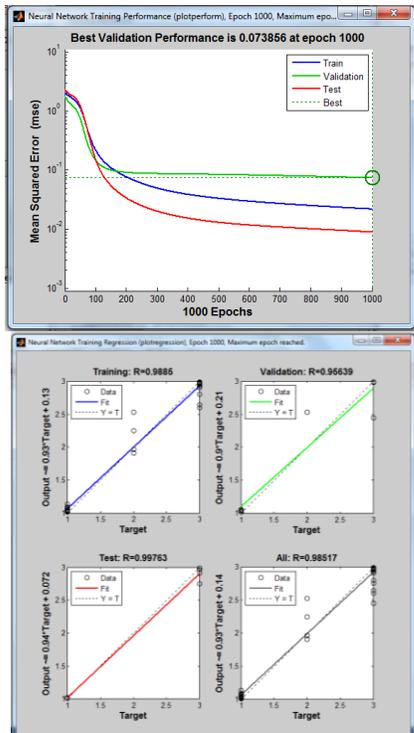


Fig. 2 (a) shows the best validation performance (b) shows regression plot of the network

Network3: Training Function – TRAINGDA , Network Performance function is MSE and all parameters of the network is same as mentioned in the NN Modeling Parameter section.

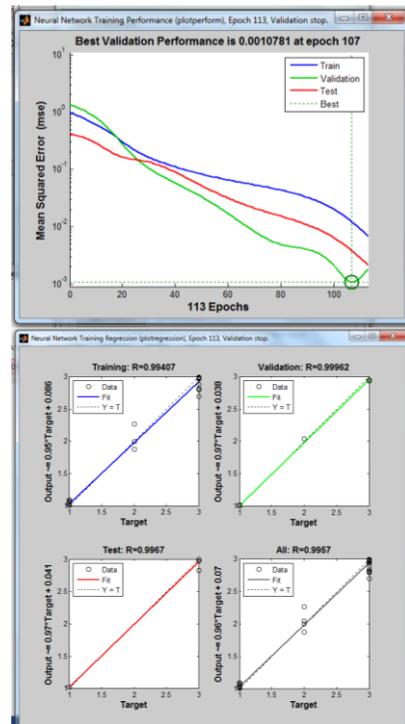


Fig. 3 (a) shows the best validation performance (b) shows regression plot of the network

Network4: Training Function – TRAINSCG , Network Performance function is MSE and all parameters of the network is same as mentioned in the NN Modeling Parameter section.

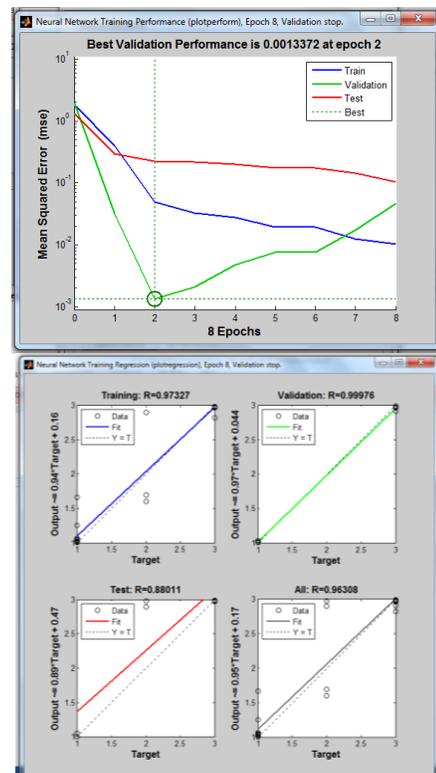


Fig. 4 (a) shows the best validation performance (b) shows regression plot of the network

Network5: Training Function – TRAINCGB, Network Performance function is MSE and all parameters of the network is same as mentioned in the NN Modeling Parameter section.

network is same as mentioned in the NN Modeling Parameter section.

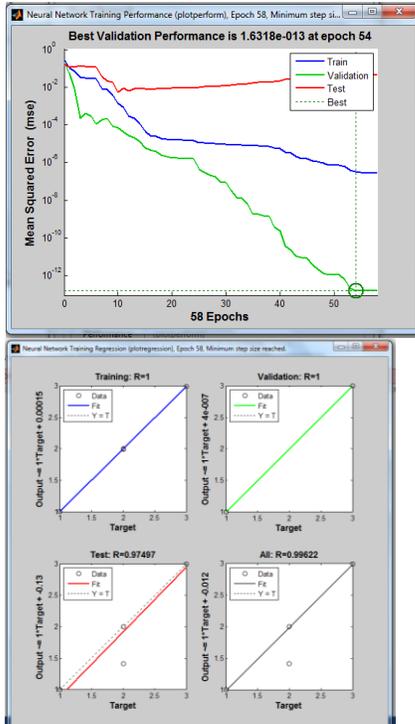


Fig. 5 (a) shows the best validation performance (b) shows regression plot of the network

Network6: Training Function – TRAINCGP, Network Performance function is MSE and all parameters of the network is same as mentioned in the NN Modeling Parameter section.

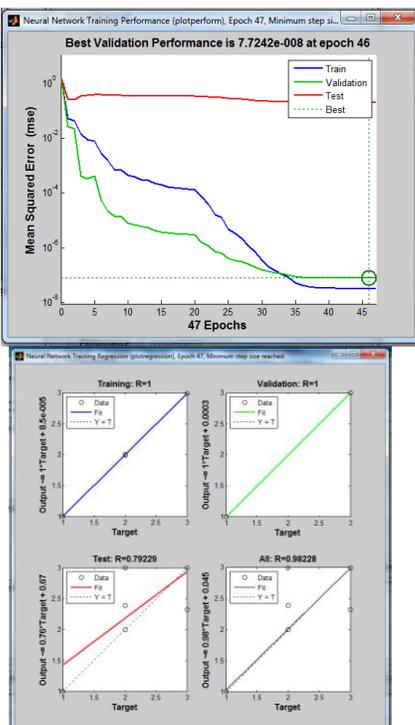


Fig. 6 (a) shows the best validation performance (b) shows regression plot of the network

Network7: Training Function – TRAINCGF, Network Performance function is MSE and all parameters of the

network is same as mentioned in the NN Modeling Parameter section.

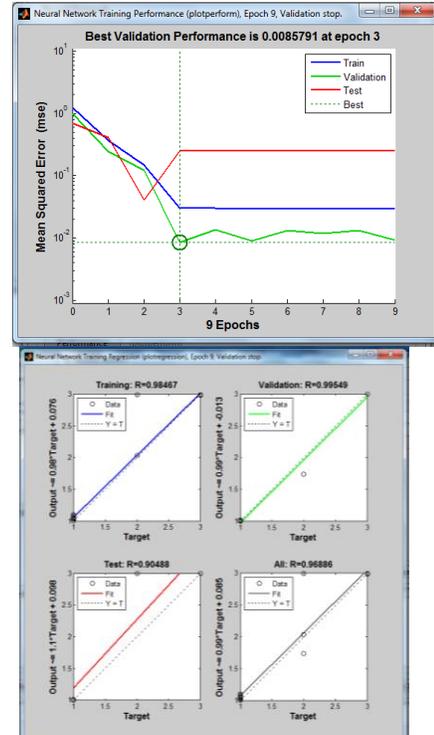


Fig. 7 (a) shows the best validation performance (b) shows regression plot of the network

Network8: Training Function – TRAINGD, Network Performance function is MSE and all parameters of the network is same as mentioned in the NN Modeling Parameter section.

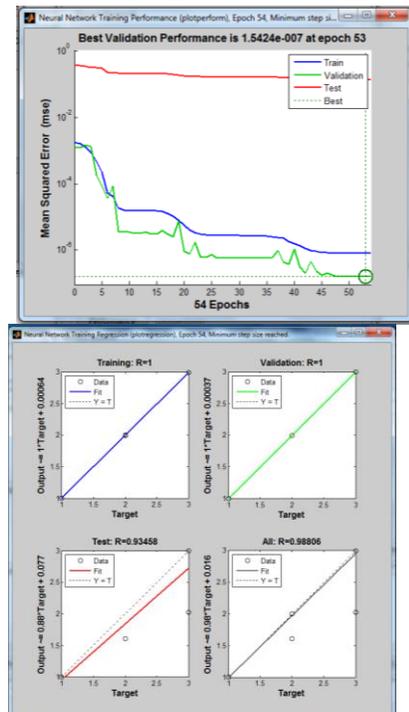


Fig. 8 (a) shows the best validation performance (b) shows regression plot of the network

Network9: Training Function – TRAINGD, Network Performance function is MSE and all parameters of the

network is same as mentioned in the NN Modeling Parameter section.

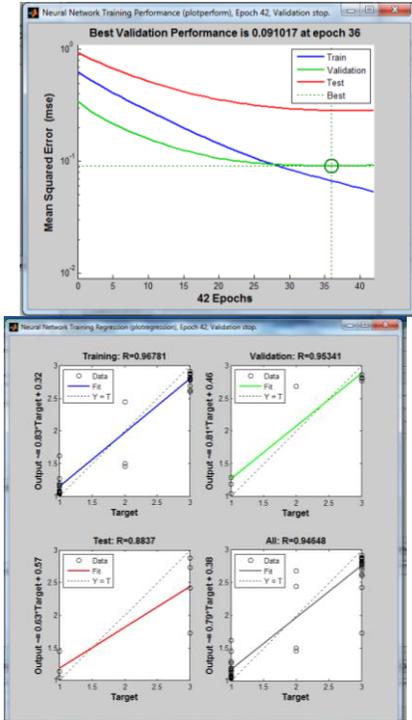


Fig. 9 (a) shows the best validation performance (b) shows regression plot of the network

Network10: Training Function – TRAINBFG, Network Performance function is MSE and all parameters of the network is same as mentioned in the NN Modeling Parameter section.

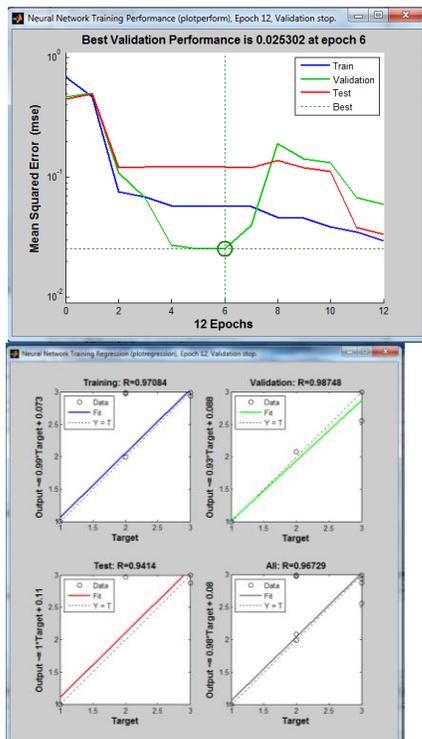


Fig. 10 (a) shows the best validation performance (b) shows regression plot of the network

Performance Analysis chart of an ANN Models (Based on MSEREG “Mean squared error w/reg performance function”): for the generalization of the result we had generated MSEREG value from selected Network Model which are mentioned in the table.

TABLE II
SHOWS THE VALUE OF MSEREG OF THE SELECTED ANN MODELS

ANN Model	Training Function	Best Validation MSEREG value	At Epoch	Regression value
Network 1	TRAINLM	0.64423	9	0.99945
Network 2	TRAINGDM	0.040285	764	0.98517
Network 3	TRAINGDA	0.028731	136	0.99294
Network 5	TRAINCGB	0.0050722	37	0.99145
Network 8	TRAINGD	0.12474	131	0.93556

Performance Graph and Regression Plot of the ANN Models (Based on MSEREG Function):

Network1:

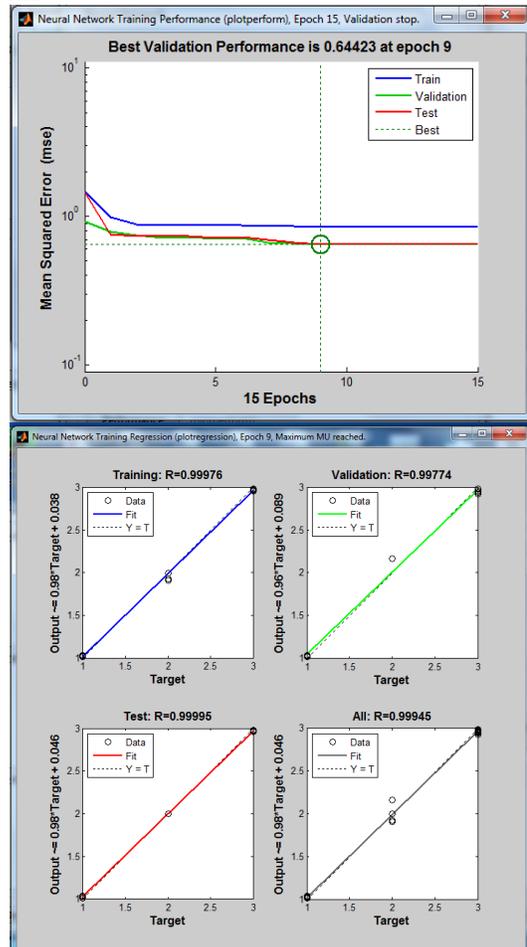


Fig. 11 (a) shows the best validation performance (b) shows regression plot of the network

Network2:

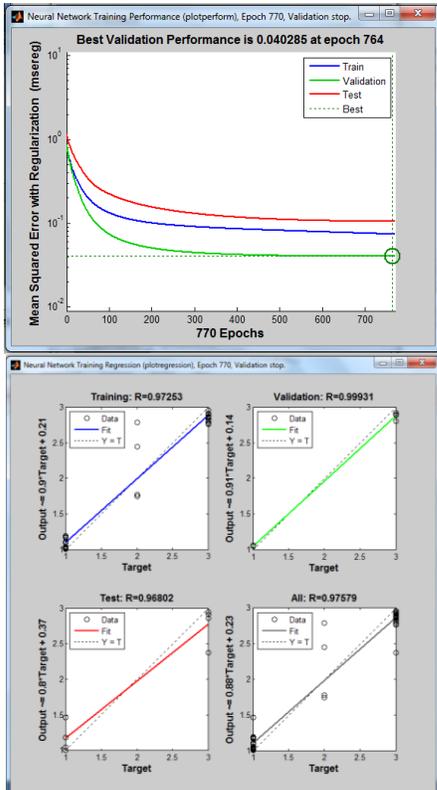


Fig. 12 (a) shows the best validation performance (b) shows regression plot of the network

Network3:

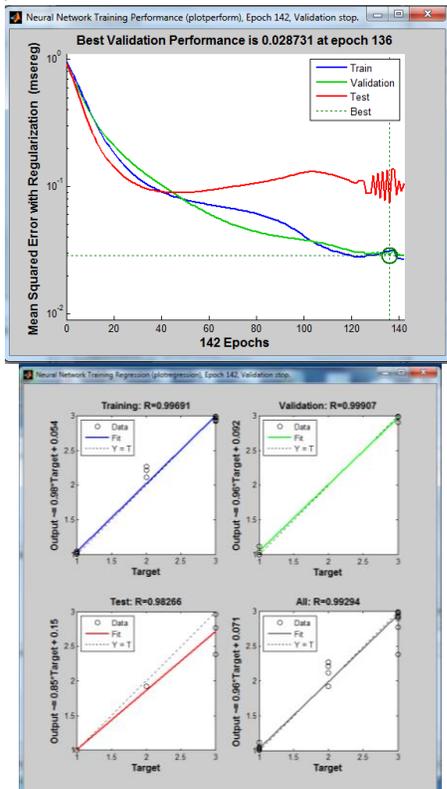


Fig. 13 (a) shows the best validation performance (b) shows regression plot of the network

Network5:

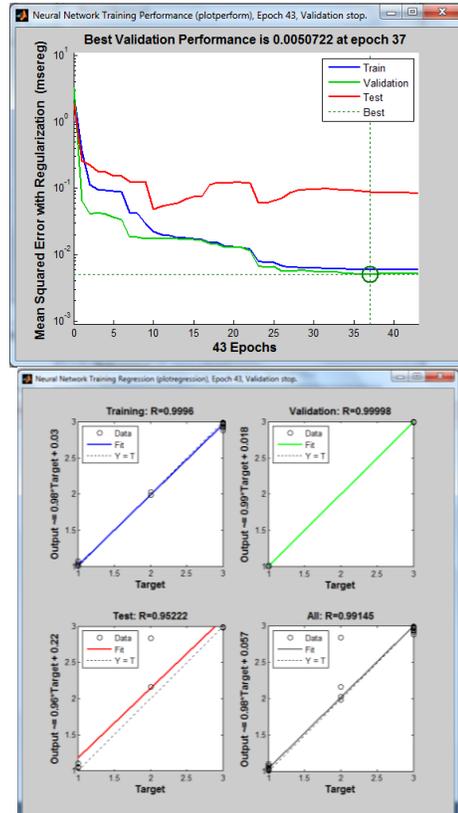


Fig. 14 (a) shows the best validation performance (b) shows regression plot of the network

Network8:

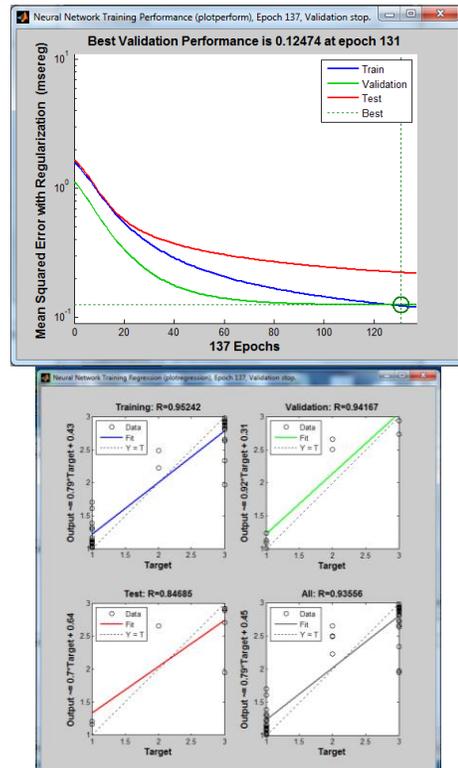


Fig. 15 (a) shows the best validation performance (b) shows regression plot of the network

IV. INTERPRETATION AND DISCUSSION

In this study we have created ten neural network model (network 1, network2, network 3network10) based on different parameter. And tried to check the performance (using MSE and MSEREG Performance Function) level of each network and also tried to find out the best ANN model from out them on the basis of Training, Validation, and testing output. For the creation of network we have used MATLAB nntool box. On the basis of Table1 the observation was that “network1,2,3,5,8” have best result, like network 1 have MSE value is 0.0021 and best validation is 0.011784 and overall regression value is 0.99841 which is near to 1, as we all know if regression value will reached to 1 that means machines learned 100%. In the same way network2 and network3,5,8 have best result. Figure 1 to 10 shows the performance graph and regression plot of the different neural network model. After that the MSEREG value has been calculated for the generalization of the result from the selected network. In this paper we have selected only 5 network model based on their performance (MSE value and regression). Table 2 shows that the MSEREG value and regression value of the selected network from this table we have tried to find out best ann model for the prediction of occupational stress level of the professional educator’s. on the basis of table2 we find out that “network1”and “network3” with training function TRAINLM, TRAINGDA and performance function MSEREG is best model because regression value of this model1 is 0.99945, 0.99294 which is very near to 1. And MSEREG value is 0.64423, 0.028731 which is very less than other network, so we can say that this model is best suitable for the prediction of occupational stress level.

V.CONCLUSION

After interpretation and discussion we can conclude that Proper analysis through artificial neural network techniques makes one attentive about their condition of occupational stress level. This model helps to recognize one’s stress level so that timely it can be cure by proper treatment and counseling. After result analysis we have found that network1 and network3 (Feed Forward Backpropagation network) with Training Function TRAINLM, TRAINGDA has given best performance. Sample size was 50. We are working on the replica of this work on multi fold model with the large set of data, combination of variables and the encouraging results are showing accuracy around 92% in ANN prediction.

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