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Determining the Influencing Factors of COVID 19 on Mental Health Using Neural Network

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Abstract

In 2020 there is outbreak of the pandemic COVID 19. Due to the pandemic most of the countries enforced full lockdown. During lockdown the mental health of the common people of all ages are affected. The study aims to investigate the factors which influence the mental health. Mental health is influenced by the various factors. In this research the artificial neural network is used to predict the factors influencing the mental health due to COVID 19 pandemic. Experimental result showed that artificial neural network not only has better accuracy up to 81.5% but also faster training process. Based on these results, the determinant factors of mental health among people are: frustration, fear, sudden change in daily life style, anxiety to perceive changes as a challenge.

Keywords: Pandemic, Covid 19, Neural Network, Mental Health

1. Introduction

The Corona Virus Disease (COVID 19) was first reported in Wuhan province and quickly spread to other parts of China and it spread to all over the World. The World Health Organization (WHO) declared COVID 19 as pandemic on 11 March, 2020. The whole world suffered due to pandemic. In India till now people are infected and unable to come up from the situations. It is transmitted to a healthy person when an infected person breathes out droplets which contain very small particles of virus. To stop the virus to spread Indian Government enforced nationwide lockdown all over India on March 23, 2020 for 21 days. Later on this lockdown was announced at differ times partially or fully in different parts of the nation by central and state government. For Indians, challenges in the medical sector increases the worries and brings psychological distress [1]. During pandemic people tend to experience fear of getting infected which results anxiety, stress and depression [2-5]. Stress can be explained as a feeling of emotional and physical tension which arises from any event that threatens our homeostasis [11]. On the other hand the fear of unknown is termed as anxiety [6]. World Health Organization has also issued public interest guidelines to address psychological issues that may arise [13]. Fear related to COVID 19 culminating in common people for committing suicide [4-8]. A study by Wang et al reported severe psychological distress (anxiety, stress and depression) during COVID 19 among Chinese nationals [12]. The present lockdown in India affected people regarding profession, economic status etc. Many people have lost their jobs and return to their native places. Many business and start-up have been shut down due to lockdown and unavailability of customers. Due to the economic crisis and an uncertain future people have faced anxiety and mental health issues. The level of stress resistance was predicted using determinant factors [5]. This research aims to predict factors influencing the mental health due to COVID 19

using Artificial Neural Network (ANN). This system was built to predict the five states of mental health condition i.e. Good Mental Health and Bad Mental Health based on values of four nodes in the input layer which represent frustration, fear, sudden change in daily life style, anxiety to perceive changes as a challenge.[9-12].

ANN has capabilities to predict the mental health among the people which is influenced due to COVID 19. The purpose of this research is to find the influencing factors which laid on four determinant factors of mental health.

1.1 Artificial Neural Network Approach:

The neural network is a computing system that imitates the information process of biological neurons [7]. The neural networks have been widely used in various fields and results are obtained [9]. The main characteristics of neural networks are they have the ability to learn complex nonlinear input-output relationships and adapt themselves to the data [3].

2. Research Methodology:

The study was conducted during lockdown in the month of April 2020 to May 2020. Questionnaires was prepared and circulated using online platforms. A total of 200 participants completed the survey. The mean ages of the participants are 32 years. The answer respondents are calculated to generate input values for the determinants factors: frustration, fear, sudden change in daily life style, anxiety to perceive changes as a challenge. The values are used as an input for ANN in next stage.

After the input data obtained the next stage was adjusting ANN configuration that would be used. To gain the best results, the input data were applied to several configurations of ANN. The architecture used in the study is shown in Figure 1. After completing the configuration of the neural network that would be used for the research, the next step was to conduct ANN training and testing. 60% of the data is used as for training, 20% of data is used for testing and 20% of the data is used for prediction. The detail of inputs to the ANN is shown in Table 1 below.

Table 1: Input factors to the ANN

Inputs	Good Mental State Factor
F1	Tolerance of Frustration
F2	Overcome against Fear
F3	Adapt to change in life style
F4	Anxiety Level

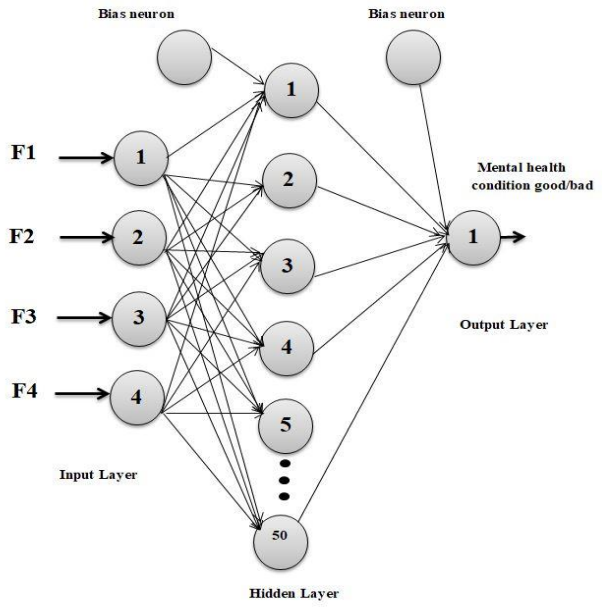

Fig.1: Feed Forward Multi-Layer Perceptron (FFMLP)

As shown in Fig-1, an Feed Forward Multi-Layer Perceptron (FFMLP) that includes a number of neurons or nodes that work in parallel to transform the input data into output categories. It consists of three layers namely input, hidden layers and output. The output generated by ANN only has two possibilities i.e good mental health condition or bad mental health condition. The research is focussed ability of neural network to predict the mental health condition.

3. Research Findings:

The MLP was designed in MATLAB using ANN toolbox which is shown in figure 2. After training and testing of the ANN the performance and regression obtained is shown in figure 3(a) and figure 3(b) respectively.

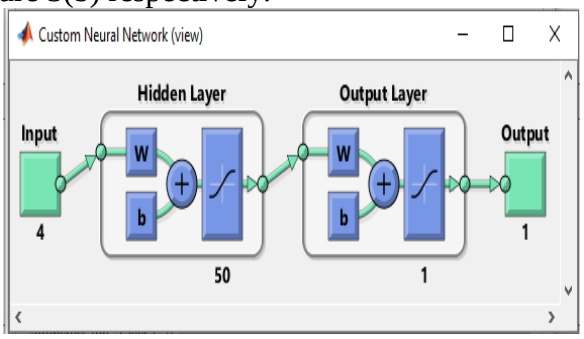

Fig.2. Simulated MLP in MTLAB

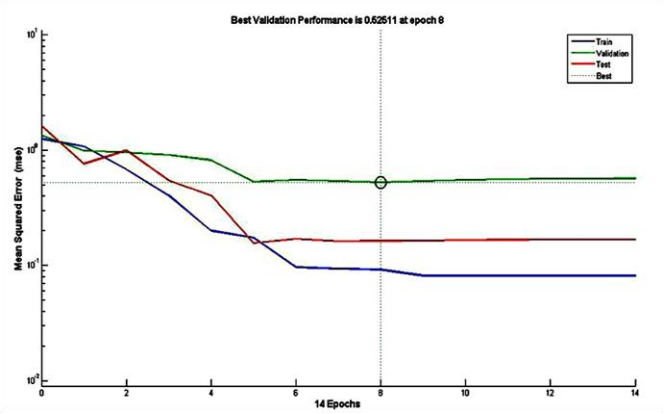

Fig. 3(a)- Performance of the MLP after training. [x-axis represent Epoche, y-axis represent Mean Square error. Colour Codes: Red-Trained, Blue-validation, Green-test dataset]

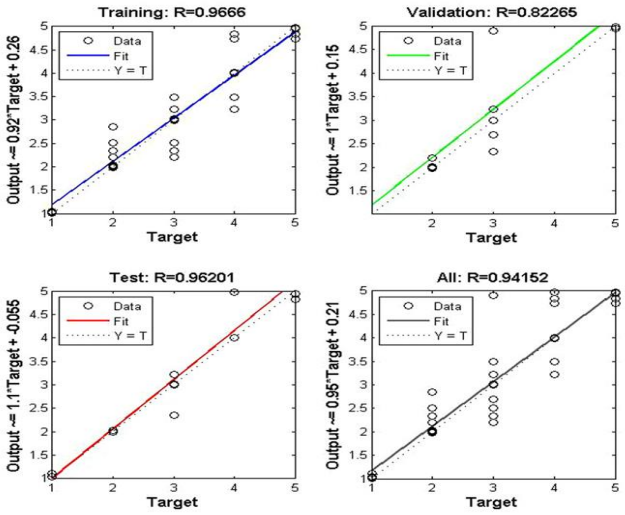

Fig.3(b). Regression result after training.

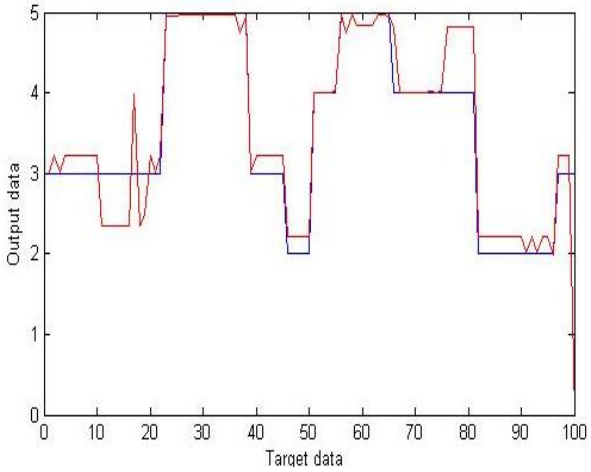

Fig.4 Target vs Output plot for both actual and predicted data. [Colour Codes: Blue- actual data, Red- predicted data]

Fig.4 shows the target and output plot of for both actual and predicted data. Here it is observed that using ANN the predicted mental health based on the mentioned influencing factors is highly accurate to the actual values after proper training and testing. The error is very less and it is shown in figure 5.

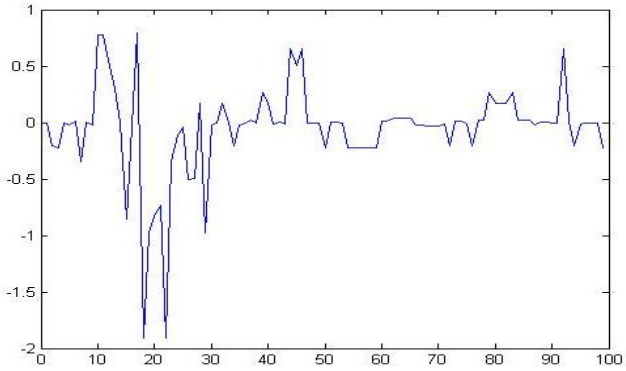

Fig. 5 Error in Prediction of Mental health.

Conclusion:

ANN is increasingly used to inform health care management decisions, ANN are used for diagnosis with better accuracy [10]. Here ANN is used to predict mental health condition of the people influenced during COVID 19. Future research can be done on implementation of ANN for prediction of social, economic and other major factors with higher accuracy. In addition it can be used for risk disaster management strategy

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