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PREDICTING MENTAL DEPRESSION

K. Jamberi[1], S. B. Mohan[2], S. Bhuvana[3], R. Ashwini[4], M. Premkumar[5] and A. Rajasekar[6]
[1]Department of Computer Science, S.A. College of Arts & Science, Chennai, India
[2]Departmnet of Electronics and Communication Engineering, S.A. Engineering College, Chennai, India
[3]Deparment of Computer Science and Engineering, Dr. MGR Educational and Research Institute, Chennai, India
[4]Department of Electronics and Communication Engineering, S.A. Engineering College, Chennai, India
[5]Department of Electronics and Communication Engineering, Panimalar Engineering College, Chennai, India
[6]Department of Artificial Intelligence and Data Science, Sri Sai Ram Institute of Technology, Chennai, India
E-Mail: drsbmohan@gmail.com

ABSTRACT

In this study, a multilevel linear regression technique based on neural network tailored association is suggested to predict human mental depression. The suggested technique uses a neural network configured for association-based multiple linear regression to forecast the mental depression dataset. The spectrum of depression is predicted using a variety of statistical techniques, including both multiple linear regression and linear regression with neural network tuning. When predicting the severity of depression, tweaked algorithms perform less well. They have been fine-tuned for significant differences in the accuracy, timing, and speed of depression predictions. To address these difficulties, a multiple linear regression solution based on neural network tailored association is suggested. The Multiple linear regression using a neural network that has been tweaked for association yields high compared to other statistical approaches, accuracy prediction is roughly 91%.

Keywords: depression dataset, neural network tuned multiple linear regression, neural network tuned association based multiple linear regression.

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INTRODUCTION

Today, people experience severe mental disorders due to their feelings, thinking, and actions. In the world, 10 % of people are affected by mental disorders such as depression, anxiety, obsessive-compulsive disorder (OCD), bipolar disorder, posttraumatic stress disorder (PTSD), and schizophrenia. Specifically, 3% of people are affected by mental depression disorder, and another 3% of people are affected by anxiety mental disorder. The remaining 4% of people are affected by other types of mental disorders. In India, 14% of people are affected by depression and anxiety mental disorders.

The medical field has huge improvements in science but still, people are affected by mental disorders. Depression mental disorder is a common disorder that affects people. Mainly depression disorder occurs through stressful life, medical problems, sad mood, and genes. Disability people are mainly affected by depression and mental disorders. Depression disorder has a lot of symptoms such as hopelessness, sadness, loss of interest, and sleep disturbances like insomnia or sleeping too much.

Severe depression disorder is a trigger to attempt suicide. Suicide is an emerging cause of death among young generation. Environmental factors, history factors, and health factors are risk factors for suicide. There are different types of algorithms used to predict depression. Prediction of depression is used to prevent people from suicide attempts. Some of the predicting algorithms are naïve bayes, deep Convolutional neural network (DCNN), random forest algorithm, support vector machine (SVM), artificial intelligence, K- nearest neighbour (KNN), long-short term memory (LSTM) and decision tree algorithms. These algorithms have some advantages and disadvantages compared to each other. The best algorithm is selected by accuracy and time. To solve the above problems, a neural network tuned association-based multiple linear regression method is introduced.

PROBLEM STATEMENT

In recent years, there has been a significant advancement in predictive algorithms designed to identify mental depression from extensive datasets. Despite these advancements, accurately predicting depression levels from mental health datasets remains a challenging task. Current methods, particularly those involving Neural Network Tuned Linear Regression and Neural Network Tuned Multiple Linear Regression, have demonstrated limitations in their predictive accuracy. These conventional methods have struggled to provide precise and reliable predictions of depression levels. The resulting low accuracy poses a serious impediment to effective mental health diagnosis and intervention. Existing algorithms, especially Neural Network Tuned Linear Regression and Neural Network Tuned Multiple Linear Regression, have exhibited inadequacies in accurately predicting depression levels. These methods often fail to capture the nuanced patterns and complex interrelationships within mental health data. The predictive accuracy of the current algorithms is far from satisfactory. Low accuracy rates hinder the development of effective interventions and support systems for individuals suffering from depression.

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CONTRIBUTIONS

To predict depression levels, different types of methods play important roles. To solve the above problem neural network tuned association-based multilevel linear regression method is proposed.

a) To determine the mental depression through the proposed method neural network tuned association based multilevel linear regression from depression and suicide dataset.
b) To find the high-accuracy prediction of mental depression through the proposed method of neural network tuned association based multilevel linear regression.
c) To prove the accuracy of depression and avoid attempting suicide after the prediction of depression through statistical methods.

LITERATURE SURVEY

In the realm of mental health research, several innovative approaches have been employed to address the pressing issue of depression. A literature survey conducted in recent years has revealed various methodologies and their outcomes in this domain. In 2018, one study [1] focused on detecting depression using neural networks, leading to the development of a better capture system. The advantages included fault tolerance and gradual corruption detection, although a drawback was identified in its hardware dependence. In 2020, another study [2] delved into depressive emotion detection through machine learning, boasting good performance and easy identification, but faced challenges in data acquisition. Similarly, digital technology was utilized in 2020 to recognize depression symptoms and mental changes due to stress [3], proving effective for monitoring but limited by online transaction issues. Analyzing the effects of depressive symptoms, a study in 2017 employed data analyzing methods with adjusted demographic characteristics [4], demonstrating enhanced effectiveness while being hindered by online transaction constraints. Machine learning was again harnessed in 2019 to predict the emergence of mental illness through signals [5], providing honed attention on specific disorders but facing challenges in data acquisition. Suicide prediction was addressed comprehensively in another 2019 study using machine learning and data mining techniques [6], achieving a remarkable 100% prediction rate but encountering data acquisition issues. Mental health identification in general was pursued in 2019 utilizing digital technology [7], showing feasibility but hampered by online transaction concerns. In 2021, postpartum depression prediction was enhanced considerably through machine learning [8], leading to early detection rates with the advantages of easy identification and wide application. Early detection of depression was also explored in 2016 using discrete Fourier transform and K-means clustering [9], improving performance but hampered by inefficiency. Predicting anxiety, depression, and stress in 2020 employed multiple models [10] identifying the best accuracy model, but at the cost of low speed and increased time requirement. In the same year, depression signs were detected through Long Short-Term Memory (LSTM) and machine learning techniques [11], achieving high accuracy despite challenges in data acquisition. Employing prediction modeling techniques, another study in 2020 achieved high performance in depression detection while saving energy but at an increased cost [12]. Addressing depression in specific demographics, a study in 2016 predicted depression in infertile women [13] through multiple regressions, reducing negative vibes but encountering output errors. Social issues related to depression were tackled using context mining in 2019 [14], resulting in high prediction rates but with occasional output errors. Lastly, examining suicide attempt predictors, a study in 2019 utilized logistic regression and machine learning [15], achieving high sensitivity and moderate specificity, with challenges in data acquisition.

INFERENCE ACQUIRED FROM LITERATURE SURVEY

There are several ways to predict mental depression, including neural network-tuned multiple linear regression and neural network-tuned linear regression. These fine-tuned algorithms do less well when predicting depression severity. The precision, timing, and speed of these fine-tuned algorithms make a significant impact on the prediction of depression. A multilevel linear regression approach based on neural network tailored association is suggested to address the aforementioned issues. The suggested approach of multilevel linear regression based on neural network tailored association provides high-accuracy prediction, good performance, high speed, and little time.

METHODOLOGY

To determine the amount of human depression, a neural network tailored association-based multilevel linear regression technique is provided in Figure-1. Three neighboring variables, such as adjsimp (adjacent simplicity), adjfatal (adjacent fatalism), and adjdep (adjacent depression), are included in the depression dataset. These data have been adjusted and pre-processed. Then, using various methods like neural network linear regression and neural network multiple linear regression, these customized data are compared. The speed, timing, and accuracy of these tailored algorithms' depression predictions are some of their drawbacks. Consequently, a multilevel linear regression approach based on neural network tailored association is presented. The suggested technique, neural network tailored association-based multilevel linear regression, uses less time and higher accuracy to analyze and forecast the range of human depression. This highly accurate forecast aids in preventing suicide attempts.

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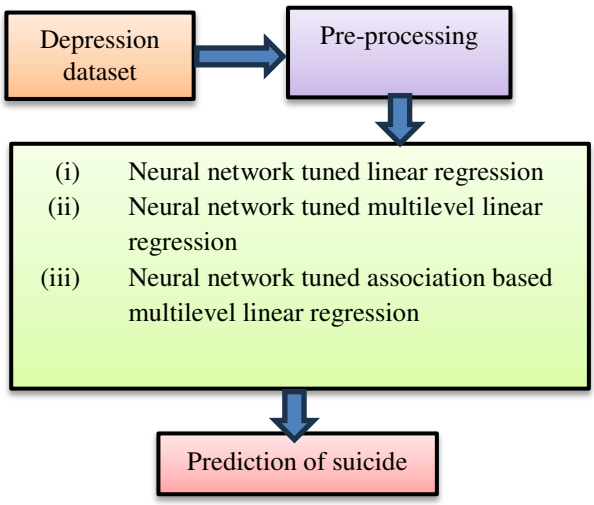

Figure-1. Block diagram of neural network tuned association-based multilevel linear regression.

a. Neural Network Tuned Linear Regression

The human brain is imitated by neural networks, which are a collection of algorithms used to recognize the link between data and patterns. Because the human brain has a large number of neurons, neural networks also contain several layers of neurons. Neural network software may identify and address issues with deep learning, machine learning, and artificial intelligence. Three layers make up a neural network: the input layer, the hidden layer, and the output layer. More neurons are found in the hidden layer. Used as a hidden layer to determine an accurate link between data. Artificial intelligence neural networks (ANNs), convolutional neural networks (CNNs), and recurrent neural networks (RNNs) are three examples of neural networks. For high accuracy, the depression dataset was adjusted in a neural network, and this neural network tuning method is challenging. Tuning entails modifying or altering a parameter's value. When neural networks select poor parameters, they learn slowly, but when they select good parameters, they learn rapidly. This is known as neural network tuned linear regression if the neural network is tweaked with just one value. Because there is just one input and one outcome in linear regression. The link between dependent and independent variables is determined using linear regression. Here, the output value is tweaked, but the input value is fixed. Then the tuned value runs with the depression dataset's constant value. There is a linear output.

b. Neural Network Tuned Multiple Linear Regression

To ascertain the link between additional dependent and independent variables, multiple linear regression is performed. The fact that multiple linear regression involves additional variables makes it a complex procedure. A neural network is adjusted using one set of values at first, followed by another set. Once more, a neural network is executed with these tweaked parameters. This neural network is called a neural network tuned multiple linear regression. Because neural networks tune multiple variables and give linear output for given data.

c. Neural Network Tuned Association Based Multiple Linear Regression

The association-based multiple linear regression method chooses good variables and compares them with beneficial variables. Association-based multiple linear regression method gives more accurate output. In a neural network, the data is tuned with a selective variable, and the one variable is constant. Then another set of variables and these tuned variables again run in a neural network. This also has more variables. Neural network tuned association based multiple linear regression method gives more accurate output for given data. This method provides a quality measurement for the output of prediction. Hence, depression is predicted through a neural network tuned association-based multiple linear regression method for high accuracy prediction.

RESULT AND DISCUSSIONS

The depression dataset is classified into different types of attributes such as adjsimp (adjacent simplicity), adjfatal (adjacent fatalism), and adjdep (adjacent depression). An adjsimp and adjfate attributes are correlated with depression parameters. An adjsimp attribute refers to the adjacent value of simplicity. Simplicity explains black and white thinking. Black and white thinking hurts physical health and mental health. This behaviour affects careers and relationships between others. White represents purity and black represents evil. An adjfatal attribute refers to the adjacent value of fatalism. Fatalism defines the subjugation of fate or destiny. Fatalism is people's faith in pre-destination things. Fatalism is classified into three types such as mythological fatalism, theological fatalism, and rational fatalism. These fatalisms correlate with depression and anxiety. Fatalism people think negatively about their lives. An adjdep attribute refers to the adjacent value of depression. The people who have simplicity, fatalism, and depression, feel like hopelessness and they think about suicide. Depressed people do not care about their lives because of stress. Therefore, they decide sometimes to attempt suicide.

The neural network tuned multiple linear regression and neural network tuned linear regression were used to forecast this depression dataset. There are various drawbacks to neural network tailored linear regression, including lower performance and sensitivity to outliers. The drawbacks of neural network tuned linear regression are solved by neural network tuned multiple linear regression. Neural network tailored multiple linear regression does have several drawbacks, such as its degree of accuracy and dependence on data. A neural network tailored association-based multiple linear regression approach is suggested as a solution to these issues. The suggested approach uses neural networks adjusted for association-based multiple linear regression and exhibits excellent levels of prediction accuracy, performance, and speed. High accuracy depression level prediction prevents suicide attempts.

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Table-1 shows the depression level and range. Table-2 shows the output parameters of neural network tuned association-based multiple linear regression. Table 3 shows the statistical parameters of neural network tuned association-based multiple linear regression.

Table-1. Depression level and range.

Depression	Depression range
Normal depression	- 0.4
Low depression	0.4 - 0.8
Medium depression	0.8 - 1
High depression	1 - 1.4
Suicide attack	1.4 & above

In Table-1, 0.1 t0 0.4 refers to the normal depression level. This is the starting stage of depression. 0.4 to 0.8 refers to the low level of depression. 0.8 to 1 refers to the medium level of depression. 1 to 1.4 refers to the high level of depression and 1.4 above refers to the suicide attack. This depression range is predicted through the proposed method of neural network tuned association-based multiple linear regression from the mental depression dataset. People who have depression levels of 1.4 and above, they deeply depressed. The deep depression level triggers people to attempt suicide. This suicide is avoided through the proposed method of neural network tuned association based multiple linear regression by early prediction of mental health.

Table-2. Output parameters of neural network tuned association-based multiple linear regression.

Parameters	Neural network tuned linear regression	Neural network tuned multiple linear regression	Neural network tuned association based multiple linear regression
Epoch	4	6	9
Performance	0.954	1.27	1.35
Gradient	2.44	2.41	1.71
Mu	0.00100	0.00100	0.00100
Validation checks	3	6	6

In Table-2, depression is predicted through neural network tuned association based multiple linear regression by using adjsimp variable, adjfatal variable, and adjdep variables from mental depression data. An adjsimp, adjfatal, and adjdep variables have some parameters such as epoch, performance, gradient, Mu, and validation checks. First, adjdep as an input variable and adjsimp as output variables are given to the neural network. This output variable is tuned as another set of data. This tuned value and input values are again evaluated through a neural network to predict the depression level. It gives the result as linear output. Hence, it is called neural network tuned linear regression and it has one input and one output. In neural network tuned multiple linear regression, two sets of data (adjsimp-adjfatal & adjfatal-adjdep) are tuned. Then tuned data is evaluated through a neural network to predict the depression level. In neural network tuned association-based multiple linear regression, first one set of data is tuned then the tuned value and another one variables are again tuned. These tuned values are evaluated through the neural network tuned association-based multiple linear regression to predict the depression level with a high accuracy level.

Multiple linear regression using neural network controlled association has strong performance (1.35), good gradient value (1.71), and high epoch (9). Due to iteration, this high epoch provides a high level of precision. The gradient relates to the pace at which the quantity level of depression changes. The default value of Mu, the control algorithm, is 0.001. The training parameter is chosen through validation tests to prevent overfitting. Six validation tests are included in the neural network tailored association-based multiple linear regression approach. The neural network tailored association-based multiple linear regression approach has high performance, gradient value, epochs, mu, and validation checks to predict the amount of depression when compared to other statistical methods.

Table-3. Statistical parameters of neural network tuned association-based multiple linear regression.

Tuned values	Neural network tuned linear regression	Neural network tuned multiple linear regression	Neural network tuned association based multiple linear regression
Bias(b)	0.4542	0.5132	0.6796
Slope(m)	0.2293	0.3754	0.4378
Regression(r)	0.6107	0.84067	0.9143

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In Table-3, bias (b) was employed to create a better curve to suit the data. For bias, slope (m) is helpful. To predict the data, regression (r) learns the correlation between the variables. The multiple linear regression approach using neural network tuned associations has a high bias value of 0.6796 and a high slope value of 0.4378. The neural network tailored association-based multiple linear regression approach offers a high regression value (0.9143) and a high accuracy value when compared to other statistical methods. Accuracy of neural network-tuned linear regression (61%), association-based multiple linear regression (84%), and multiple linear regression with neural network-tuned association (91%). High accuracy predictions are provided by the neural network tailored association-based multiple linear regression approach, which is utilized to prevent suicide attempts.

Figure-2 shows the output of neural network tuned linear regression and neural network tuned multiple linear regression. Figure-3 shows the output of neural network tuned association-based multiple linear regression.

Figure-2(a) shows the neural network-tuned linear regression to be 0.61072, and Figure-2(b) demonstrates the neural network-tuned multiple linear regression as 0.84067. Figure-2 (c) and Figure-2(d) project the validation checks for the gradient, mu, and neural network-tuned linear regression and multivariate linear regression with network tuning. These variables were utilized to select the control and training parameters by altering the algorithm and the data volume. In Figure-2(e) and 2 (f), the graphs demonstrate the best validation performance of neural network-tuned multiple linear regression and linear regression with neural network tuning regression. The error histogram of neural network-tuned linear regression is depicted in Figure-2(g) and Figure-2(h) multivariate linear regression with neural network tuning is also showcased.

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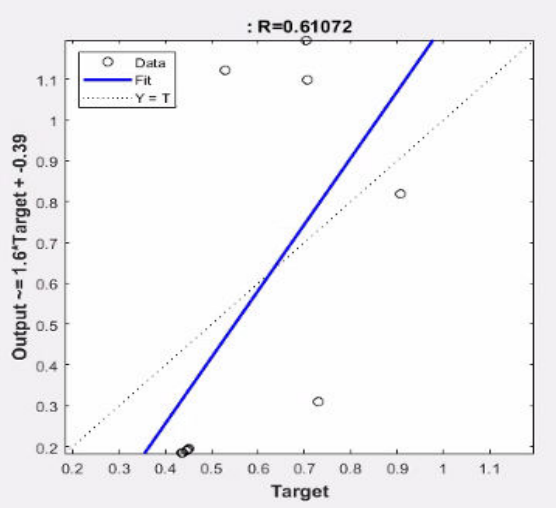
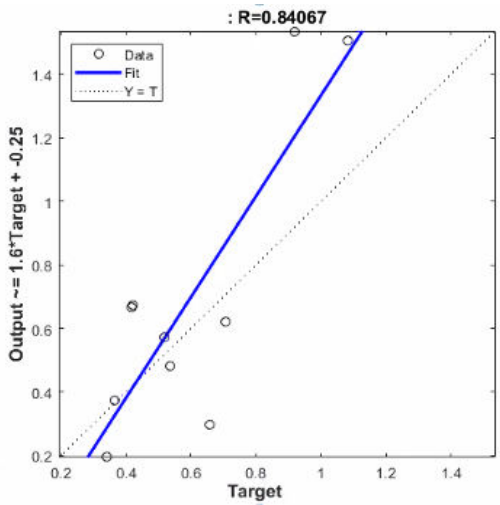
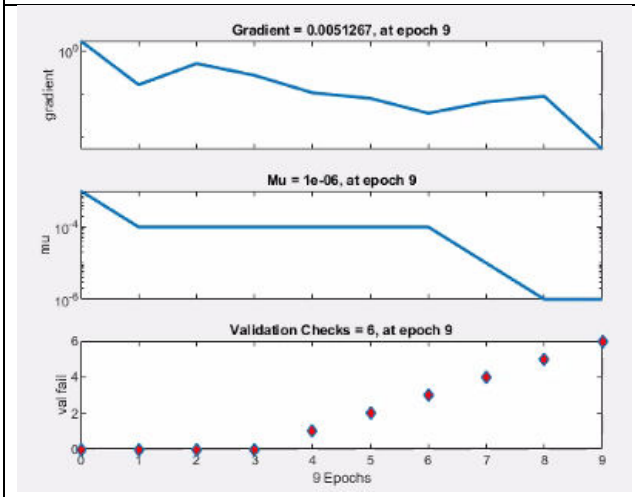
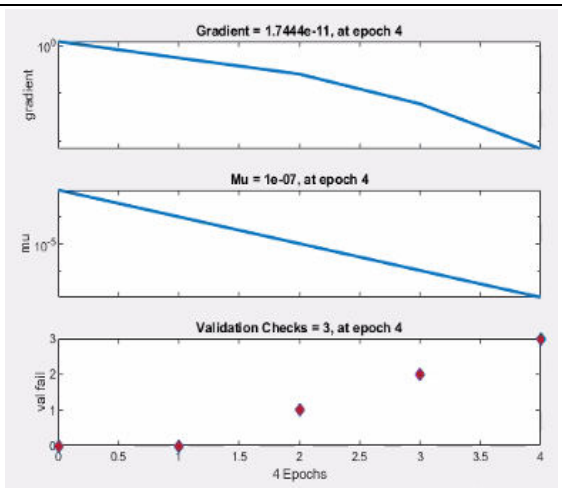
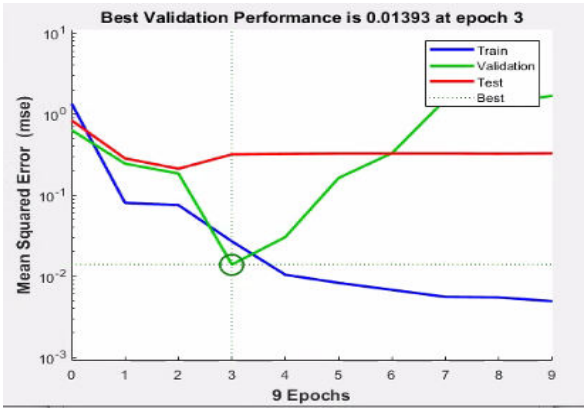
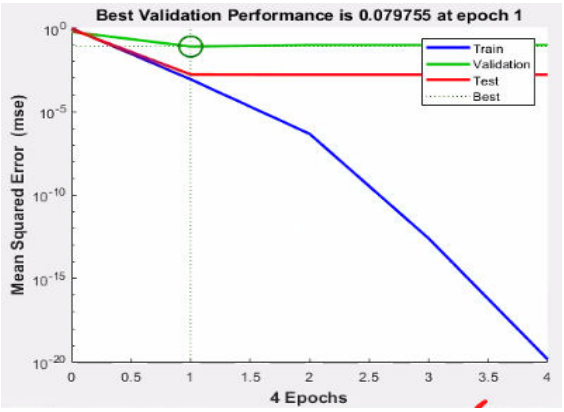
Neural network tuned linear regression	Neural network tuned multiple linear regression
	
a. Regression of neural network tuned linear regression	b. Regression of neural network tuned multiple linear regression
	
c. Gradient, mu and validation checks of neural network tuned linear regression	d. Gradient, mu and validation checks of neural network tuned linear regression
	
e. Best validation performance of neural network tuned linear regression	f. Best validation performance of neural network tuned multiple linear regression

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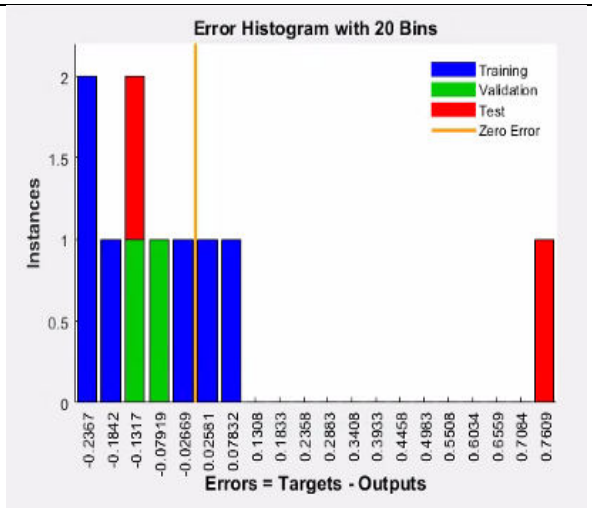
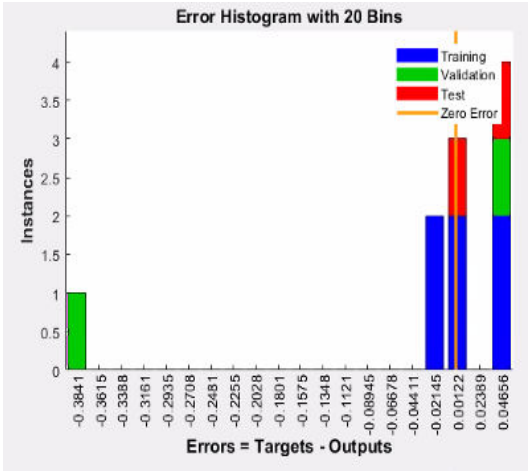
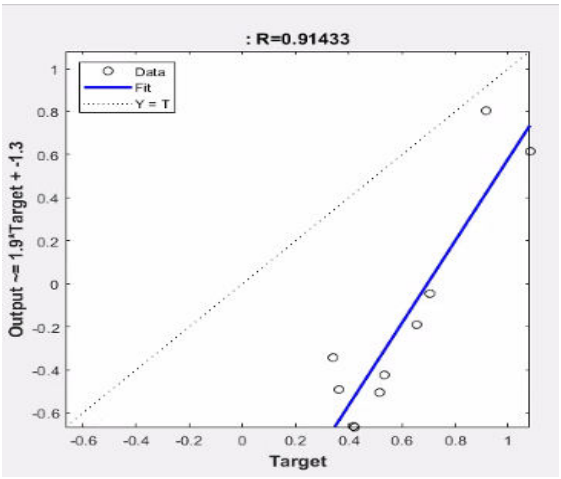


g. Error histogram of neural network tuned linear regression

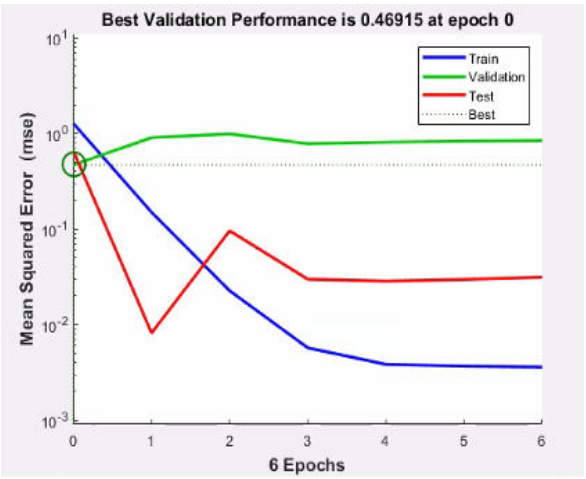


h. Error histogram of neural network tuned multiple linear regression

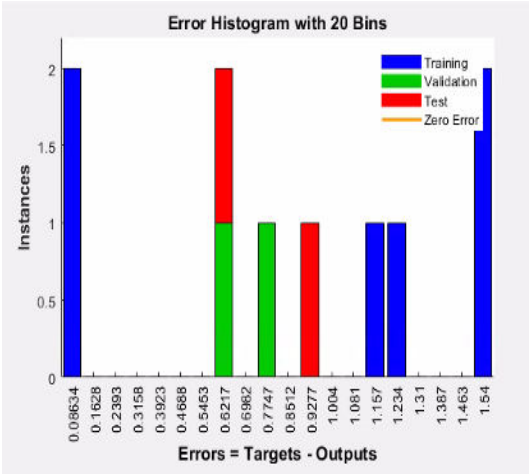
Figure-2. The output of neural network tuned linear regression and neural network tuned multiple linear regression.



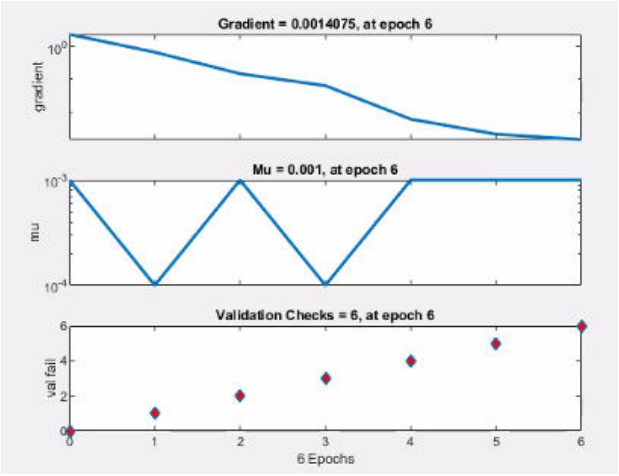
i. Regression of neural network tuned association based multiple linear regression



j. Best validation performance of neural network tuned association-based multiple linear regression



k. Error histogram of neural network tuned association-based multiple linear regression



l. Gradient, mu and validation checks of neural network tuned association based multiple linear regression

Figure-3. The output of neural network tuned association-based multiple linear regression.

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The regression of neural network tailored association-based multiple linear regression is 0.91433, as shown in Figure-3. The greatest validation performance of neural network tailored association-based multiple linear regression is shown in diagram (k). The error histogram of neural network-tuned association-based multiple linear regression is depicted in diagram (l). The gradient, mu, and validity tests of neural network tailored association-based multiple linear regression are shown in diagram (m). The suggested approach, neural network tailored association based multiple linear regression, has high regression value, highest validation performance, low error, high gradient, mu, and validation checks values when compared to other approaches. The suggested technique, neural network tailored association-based multiple linear regression, provides very accurate depression prediction, and this accuracy prediction is utilized to prevent suicidal thoughts.

CONCLUSIONS

In this study, a neural network tailored association-based multiple linear regression approach is suggested to predict mental depression from a dataset of mental depression. For the mental depression dataset, the neural network tailored association-based multiple linear regression approach produces improved results in comparison to other statistical methods. In comparison to previous approaches, the neural network tailored association-based multiple linear regression method performs satisfactorily in terms of gradient, validation checks, mu, regression, and clear plots of the depression dataset. For the mental depression dataset, the neural network tailored association-based multiple linear regression approach provides excellent accuracy (around 91%) quickly and efficiently. This forecast was used to discourage suicide attempts.

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