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Diagnosis of Major Depressive Disorder with Neural Network Models

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***Abstract* – Artificial neural network is widely used in diagnosing diseases. One of the advantages of this network can be traced to the lack of fatigue or burnout. Present paper is aimed to achieve practical and tangible approach in the field of neural networks has been developed. So that Psychiatrists with little knowledge about computers and programming by reading the content and efficiency of artificial neural networks realize and are interested in using them. In this article trying to design the models of neural network such as RBF and SVM, then compare the error of models for select the best model for diagnosis of major depressive. The SVM model with the 14.16% error is better for training the neural network.**

***Keywords* – Major Depressive, Neural Network, SVM, RBF.**

I. INTRODUCTION

Neural networks techniques have recently been applied to many medical diagnosis problems [1, 2]. Mental illness is a sub-field of medical sciences [3].

Mood disorders Divided into different types of depression, then depression and bipolar disorder are divided into two basic types [4].

Depression can generally be classified into two general categories, which in Figure 1 is shown [5].

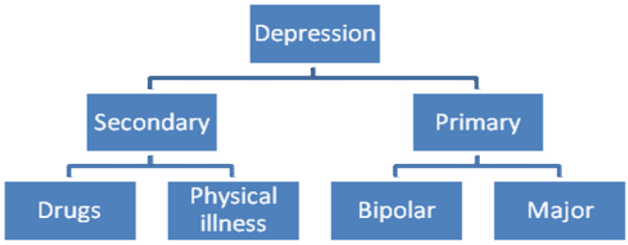

Fig.1. Classification of types of depression

Depression is a psychological disorder in which the patient's activities severely reduced and in fact, he was not motivated to do many things. Depressed person whose life is reduced and the energy and skill of mindfulness is also greatly reduced [6]. It is sometimes aggressive and sometimes disappointing. His guilt is very strong. In addition to their goals in life remain patient and reduce social activities and production [7].

We refer to the work done in the field of neural networks to detect depression:

In [8], Electroencephalography (EEG) is a measure which represents the functional activity of the brain. We show that a detailed analysis of EEG measurements provides highly discriminant features which indicate the mental state of patients with clinical depression. Our feature extraction method revolves around a novel processing structure that combines wavelet packet decomposition (WPD) and non-linear algorithms. WPD was used to select appropriate EEG frequency bands. The resulting signals were processed with the non-linear measures of approximate entropy (ApEn), sample entropy (SampEn), renyi entropy (REN) and bispectral phase entropy (Ph). The features were selected using t-test and only discriminative features were fed to various classifiers, namely probabilistic neural network (PNN), support vector machine (SVM), decision tree (DT), k-nearest neighbor algorithm (k-NN), naive bayes classification (NBC), Gaussian mixture model (GMM) and Fuzzy Sugeno Classifier (FSC). Our classification results show that, with a classification accuracy of 99.5%, the PNN classifier performed better than the rest of classifiers in discriminating between normal and depression EEG signals. Hence, the proposed decision support system can be used to diagnose, and monitor the treatment of patients suffering from depression.

In [9], the author study performance of different classification techniques for classifying depression patients from normal subjects. For this aim, power spectrum of three frequency bands (alpha, beta and theta) and the whole bands of EEG are used as features. Authors have shown that Support Vector Machine (SVM) classifier using Genetic algorithm for feature selection can achieve accuracy of 88.6% on classifying depression patients.

In [10], Major depressive disorder (MDD) is a major public health concern. Despite tremendous advances, the pathogenic mechanisms associated with MDD are still unclear. Moreover, a significant number of MDD subjects do not respond to the currently available medication. MicroRNAs (miRNAs) are a class of small noncoding RNAs that control gene expression by modulating translation, messenger RNA (mRNA) degradation, or stability of mRNA targets. The role of miRNAs in disease pathophysiology is emerging rapidly. Recent studies demonstrating the involvement of miRNAs in several aspects of neural plasticity, neurogenesis, and stress response, and more direct studies in human postmortem brain provide strong evidence that miRNAs can not only play a critical role in MDD pathogenesis, but can also open up new avenues for the development of therapeutic targets. Circulating miRNAs are now being considered as possible biomarkers in disease pathogenesis and in monitoring therapeutic responses because of the presence and/or release of miRNAs in blood cells as well as in other

peripheral tissues. In this review, these aspects are discussed in a comprehensive and critical manner.

In [11], predict the number of depression patients using BP (*Back-Propagation*) neural networks, so the government will put more attentions to mental diseases and widely raise public awareness about mental health issues.

In [12], presents a study on computer-aided detection of depression from MRI scans. These systems have not yet been identified, categorized and compared in the literature. The paper covers fully automated to semi-automated detection systems. It also presents performance comparison for the considered systems.

II. Artificial Neural Network

An artificial neural network is an interconnected group of nodes, akin to the vast network of neurons in a brain. Here, each circular node represents an artificial neuron and an arrow represents a connection from the output of one neuron to the input of another [13, 14].

III. RBF Model

One of the neural networks used for estimation of the issues, the RBF neural network. These previously there Perceptron network to the network, has a strategic advantage [15].Unlike the MLP networks with multiple successive layers, the RBF network is composed of three layers. Input layer, where the input signal is injected into the network Cladding or floor RBF is that RBF functions and output layer that outputs the class of RBF linear combination of all makes. RBF network requires more neurons and network training time is shorter and the result will be more desirable to receive additional entries [16].The structure of this network is similar to the structure of the MLP network. Gaussian functions in RBF layer is used in most cases. Functions with two parameters and the variance of the Gaussian center or the extent of the Gaussian are identified. Building a RBF network in Figure 2 is shown [17].

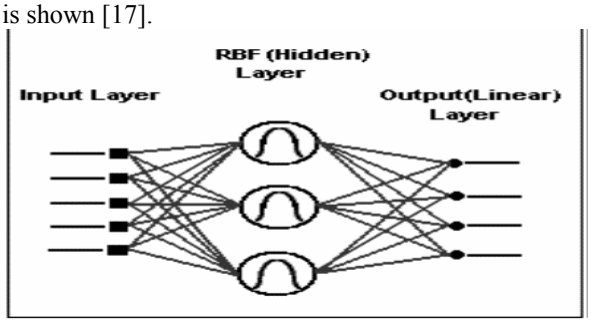

Fig.2. rbf model

IV. SVM Model

Algorithm for SVM, the pattern recognition algorithms to classify [18]. Algorithm SVM, where you need to identify patterns or specific categories Objects classes can be used [19]. Continuing to use this algorithm to the case notes are:

System risk analysis, control plane without a pilot, the aircraft deviated track, route simulation systems, automated vehicle guidance systems, quality inspection, welding room tests Figure 3 schematically SVM function shows [20].

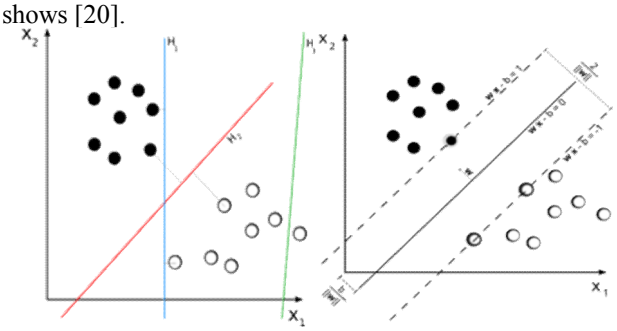

Fig.3. svm model

V. Structure of Proposed Method

After a review of records and interviews with psychiatrists Relevant questionnaire[21,22] and Articles [23] Parameters were found to be depressed in this paper, 12 parameters that are: Depressed mood, loss of pleasure, loss of energy, feelings of guilt, suicidal ideation, worthlessness, insomnia, psychic anxiety, somatic anxiety, lack of decision making power, lack of hope for the future, dissatisfaction appears. Then begin to implement it in two RBF, SVM results presented in Tables (1), (2) the order of the RBF and SVM models can be seen.

5.1 Simulation results of neural network models with RBF

Figure (4) shows how the training phases of this model. For 40 to 90 this ring will be trained. And for each of its education-related error is calculated. Also can show the error of RBF model in Table 1.

Figure (5) chart Performance the RBF model in MATLAB environment. The mean square error compared to the same period as the Epoch shows. Training Chart Red Green Blue Test and Evaluation and Early stopping point is called the point shown by the amount of the assessment error is minimized.

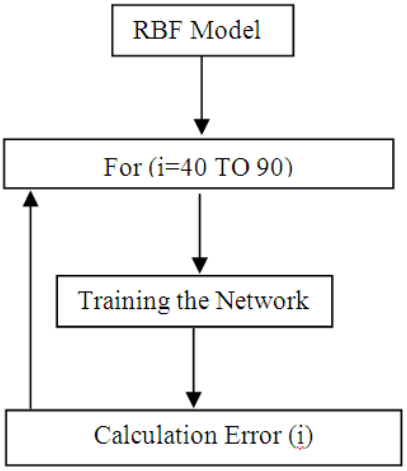

Fig.4. Training the RBF model

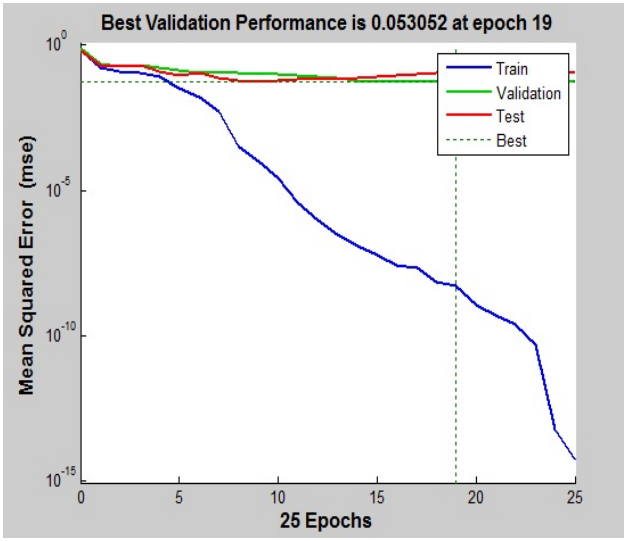

Fig.5. Performance graph of RBF model

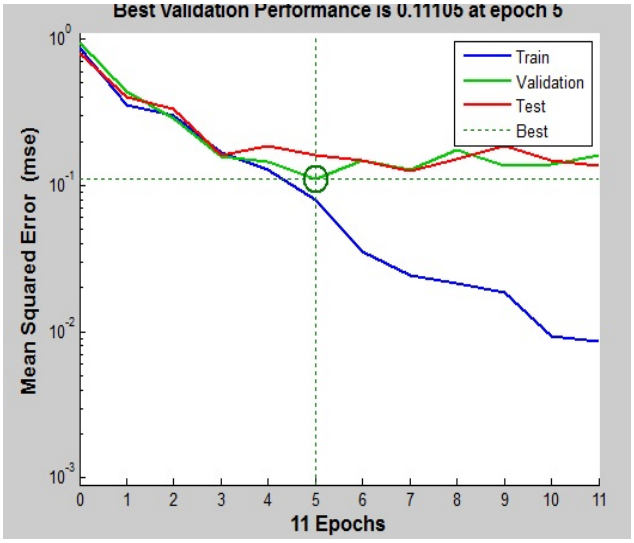

Fig.7. Performance graph of svm model

Table 1: RBF NETwork Error

Network Error	Percent of Education
0.18	40
0.16	50
0.13	60
0.09	70
0.13	80
0.24	90

Table 2.SVM Network Error

Network Error	Percent of Education
0.13	40
0.11	50
0.13	60
0.11	70
0.14	80
0.23	90

5.2 Simulation results of neural network models with SVM

Figure (6) shows how the training phases of this model. For 40 to 90 this ring will be trained. And for each of its education-related error is calculated. Also can show the error of SVM model in Table 2.

Figure (7) chart Performance the SVM model in MATLAB environment. The mean square error compared to the same period as the Epoch shows. Training Chart Red Green Blue Test and Evaluation and Early stopping point is called the point shown by the amount of the assessment error is minimized.

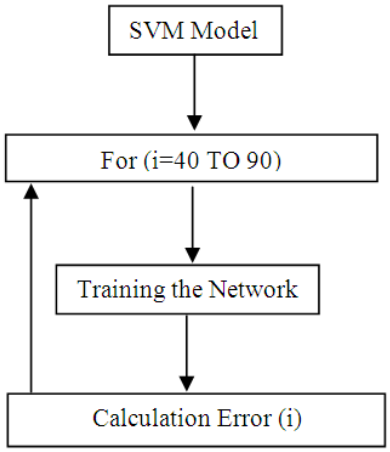

Fig.6. Training the SVM model

VI. COMPARE

After comparing both RBF and SVM models, and also according to Table 3, it can be stated that, using the SVM for training have the better detection for major depressive disorder RBF with 15.5% error, with the SVM model has the 14.16% error in this disorder.

Table 3: Compare Error of Models

Error Network	Model
14.16	SVM
15.5	RBF

VII. CONCLUSION

As previously mentioned in the context of neural networks have many applications, especially in the medical diagnosis. And according to this article, Operative diagnosis of major depressive disorder was obtained with 12 parameters and SVM and RBF models is carried out that the results can be seen, we can say that the mean percentage error of RBF model is equal to 15.5% and error of SVM model is equal to 14.16.% . So, SVM model has an error percentage of less than and has the better diagnosis of major depression.

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