AN AUTOMATIC PATIENT SEVERITY INDICATION SYSTEM USING PATTERN CLASSIFICATION WITH ADALINE NEURAL NETWORK

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ABSTRACT

Pattern classification and pattern association are the two powerful tools in neural network, these networks has a capability to use the features of the brain and compute some of its strengths for the competitions. Adaline, is found to use bi-polar activations for its input signal and target output. When adaline is to be used for pattern classification, after training, a threshold function is applied to the input to obtain the activation and can solve the problem with linear separability technique. In this paper, has simulated one of the methods of pattern classification carried out using Adaline network. The object of the paper is to estimate the length of the stay of a patient in a hospital by monitoring the symptoms of a patient's diseases. The factor "Number of days to stay" has a direct relationship to the severity of illness of the patient. Here, all the proposed algorithms has implemented in Matlab 2011a. Matlab uses statistical data technique, called abalone data, of symptoms of the patient for the purpose of training and testing. The main advantage of this system is to provide the statistical data of patient in the view of finance required for further stay, no of days require to stay and patient recovery condition etc.

Keywords: Adaline, Attributes, Automatic, Classification, Pattern, Matlab, Neural, Network, Matlab, Separability, Severity, System, Training, And Threshold.

I. INTRODUCTION

In this paper, has adopted Adaline neural network, developed by Widrownd Hoff, which uses supervised learning techniques. This network is used to solve linear separable problems. Adaline is found to use bi-polar activations for its input signals and target output. The weights and the bias of the adaline are adjustable. The learning rule used can be called as Delta rule, Least Mean Square or Widrow-Hoff rule. The derivation of this rule with single output unit, several output units. Since the activation function is an identity function, the activation of the unit is its net input. When Adaline is to be used for pattern classification, then, after training, a threshold function is applied to the net input to obtain the activation. The Adaline also resembles a single layer network, which receives input from several neurons and it also receives input from the unit which is always '+1', called bias. The bias weights also trained in the same manner as the other weights. The link between the input and output neurons possess weighted interconnections. These weights get changed as the training progresses. In training algorithm,

initially the initial weights of adaline network have to be set to small random values and not to zero as like in Hebbo networks or perceptron networks. This is because of this may influence the error factor to be considered. When the initial weights are assumed, the activation for the input unit are set. The net input are calculated based on training input pattern and the weights. By applying the Delta learning rule the weights updation is being carried out. The training process is continued until the error, which is the difference between the target and the net input becomes minimum. The process of modifying the weights in the connections between network layers with the objective of achieving the expected output is called training a network. The internal process that takes place when a network is trained is called learning; these are 3 types namely Supervised Training, Unsupervised Training and Reinforcement Training. Here in this paper Supervised Training is adopted to Adaline network. The supervised training is the process of providing the network with a series of sample inputs (abalone data) and comparing the output with the expected responses. The training continues until the network is able to provide the expected response. In a neural net, for a sequence of training input vectors there may exist target output vectors. The weights may be adjusted according to learning algorithm. This process is called supervised training. This supervised training is adopted in pattern association as well. If a neural network is trained to associate a set of input vectors with a corresponding set of vectors, then it is called associative memory net. If the output is the same as the input, then it forms auto-associative memory, if the output is different from the input then it is hetro-associative.

II. ALGORITHAM DEVELOPMENT

The major objective of the paper is categorized into three sections. 1. To achieve an improved pattern classification using Adaline. 2. To reduce the training time for liners separable data so as to achieve quicker response and 3. To train the network with minimum number of failures. The adopted Adaline neural network has been implemented in this paper for pattern classification, with a collection of information containing the abalone data of symptoms of the patient admitted to the hospital. The network is trained by the method of unsupervised learning and is fed with eight attributes consisting of symptoms of the patient. The output consists of three classes, minimum, medium and maximum, which are classified depending upon the severity of the illness of the patient. This in turn can be used to estimate the length of the stay of the patient in order to reduce the hospital expenses. The network is tested by considering different amount of data to get a good degree of accuracy. In this paper the symptoms of the patient has taken for a single network, there are 8 input variables and one output variable. These variables are 1. Body functionality 2. Complications 3. Diseases of blood 4. Diabetes 5. Hyper tension. 6. Obesity. 7. Smoker/Drinker and 8. Anatomical surgical groups. The output variable is length of stay and is subdivided in three categories as 1. Minimum (1- 3 days). 2. Medium (3 – 7 days) and 3. Maximum (7 – 15 days). Here in this paper Adaline has trained individually which learn how to classify and predict the severity of illness for particular diagnoses so that quality and cost issues can be addresses fairly. Training information is purely based on the length of stay in the hospital which has a direct relationship to the severity of the illness. The neural network uses variables of 8 types like 1. Diagnoses. 2. Complications. 3. Comorbidity. 4. Body systems involved. 5. Procedure codes and their relationships. 6. General Health indicators. 7 Patient demographics and 8. Admission category.

III. TRAINNG OR LEARNING OF ADALINE

Adaline has a large number of applications but it is restricted to a linear problem space. The input patterns in the Adaline's training set must be linearly separable, otherwise, the Adaline will not categorized all of the training patterns correctly even when it reaches the low point of the error surface paraboloid. However, the Adaline gives much guarantee to reach its minimum error state since there is no obstacles along the error surface to inter5fere with training process. This training has taken repeatedly presenting sets of data composed of input pattern and their desired outputs. Learning occurs as the Adaline minimize the number of errors it makes when sorting the patterns into their correct categories. Once trained, the Adaline can categorize new inputs according to the experience it gained. Here in this paper the data contains 300 patterns gathered by the observing the symptoms of the patient admitted into hospital. This data has each unique pattern, is a set of 8 attributes in the range of 0.0 to 1.0. Each unique attributes represents a particular symptoms suffered or faced by the patient. Here the three classes are represented with 0, 1 and 2, whereas "0" denotes the minimum stay of patients in hospital, "1" denotes the medium number of days for the patient to stay and "2" denotes the maximum number of days of stay. The give data sets are in the analog form and are need to convert to digital form. Scaling has the advantages of mapping the desired range of variables.

Analog To Digital Conversion

The total 8 numerical attributes are in analog form scaled in the range between0 to 0.9 for converting into binary/ digital form. The 8 attributes has assigned discrete values of "-1" to less than 0.5 and value of binary "1" to attributes greater than or equal to "0.5".

IV. EXPERIMENT SIMULATION AND RESULTS

S. No	PATIENT ATTRIBUTE	DATA SET
1	No of Instances	300
2	No of attributes	8
3	Classes	0 – Minimum length of stay (1 – 3 days)
		1 – Medium length of stay (3 – 7 days)
		2 – Maximum length of stay (7 – 15 days)

Table.1: Information about patient attributes and data sets used for assigned to Adaline.

S. No	ATTRIBUTES	RANGE
1	Body System Involved	0 – 0.9
2	Complications	0 – 0.9
3	Diseases of blood	0 – 0.9
4	Diabetes	0 – 0.9
5	Hyper Tension	0 – 0.9
6	Obesity	0 – 0.9
7	Smoker/ Drinker	0 – 0.9
8	Anatomical Surgical Groups	0 – 0.9

Table.2: Description of the Attributes and their ranges assigned to Adaline.

Here in this paper the learning rate (α) has chosen as Training is 60% and testing 40% and Number of Epochs are taken as 250. Accuracy for α was 0.0005 is maximum, hence it is chosen for training. The variation in the accuracy for different learning rates has mentioned in Table.3.

S. No	LEARNING RATE	ACCURACY IN %
1	0.1	65
2	0.05	62.5
3	0.02	65.5
4	0.01	69.5
5	0.005	72.5
6	0.001	77
7	0.0005	78.5

Table.3: Learning Rate Vs Accuracy.

Range.	Attribute1	Attribute2	Attribute3	Attribute4	Attribute5	Attribute6	Attribute7	Attribute8
0	0.35	0.265	0.09	0.2155	0.099	0.0485	0.075	0.77
1	0.05	0.57	0.61	0.1735	0.4975	0.6405	0.845	0.619
0	0.43	0.429	0.135	0.277	0.2565	0.1415	0.51	0.29
2	0.67	0.95	0.65	0.615	0.85	0.775	0.34	0.65
1	0.3	0.515	0.514	024	0.310	0.675	0.705	0.1
2	0.56	0.85	0.75	0.71	0.835	0.65	0.87	0.15
0	0.43	0.365	0.125	0.416	0.2155	0.214	0.55	0.61
1	0.968	0.35	0.12	0.515	0.224	0.108	0.1565	0.9
2	0.56	0.95	0.85	0.67	0.805	0.75	0.614	0.9
1	0.87	0.2	0.73	0.77	0.0496	0.41	0.621	0.39

Table.4: Patients abalone sample data.

Training: 10 %		**Testing: 90%**
Training	Accuracy : 69% No of vectors : 50	Seconds taken to complete the task 6.31

Training: 20 %		**Testing: 80%**
Training	Accuracy : 72.25% No of vectors : 100	Seconds taken to complete the task 12.64

Training: 30 %		**Testing: 70%**
Training	Accuracy : 78% No of vectors : 145	Seconds taken to complete the task 18.81

Training: 40 %		**Testing: 60%**
Training	Accuracy : 78.5% No of vectors : 175	Seconds taken to complete the task 26.51

Training: 50 %		**Testing: 50%**
Training	Accuracy : 79% No of vectors : 180	Seconds taken to complete the task 34.45

Training: 70 %		**Testing: 30%**
Training	Accuracy : 84% No of vectors : 230	Seconds taken to complete the task 41

Training: 90 %		**Testing: 10%**
Training	Accuracy : 89% No of vectors : 250	Seconds taken to complete the task 56.39

Training: 99 %		**Testing: 1%**
Training	Accuracy : 100% No of vectors : 285	Seconds taken to complete the task 60.11

Table.5: Accuracy and Training Information.

V. CONCLUSIONS

The Adaline neural network has implemented using Matlab for pattern classification with an abalone data of symptoms of the patient admitted into the hospital. This network was able to classify all the patterns with desired accuracy. This trained network learn how to classify and predict the severity of illness for particular diagnoses so that quality and cost issues can be addressed fairly. In this paper the neural network trained with Adaline is used to predict the severity of illness and use of hospital resources. Expenses will be reduced by fewer unnecessary test and procedures, lowering length of stay and procedural charges. This new hospital information and patient prediction system would improve the quality of care, reduce the death rate and would save millions of rupees.

VI. ACKNOWLEDGEMENT

We thank to our beloved Guide Prof. M. Purnachanra Rao, who gave us such an opportunity to work on NEURAL NETWORK, ARTIFICIAL INTELGENCE and MATLAB SOFTWARE and his assistance on our presentation.

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