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An Application of Artificial Neural Network (ANN) Facilitate Candidate for Carrier Opportunities & Guidance

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Abstract - **This article describes design for an Artificial Neural Network (ANN) based decision support system. The system supports beneficiaries to select suitable stream (Science, Arts, and Commerce) after 10th standard. It is very important decision in everybody's life, when we decide our stream. An example set of 9 input parameters and 3 outputs are illustrated in this paper. As the ordinary fuzzy set does not capture uncertainty particularly dealing with vagueness and ambiguity in complex system, type-2 fuzzy sets are used. The discussion includes introduction to ANN and type-2 fuzzy set along with application.**

Keywords: **ANN, type-2 fuzzy system, Artificial Intelligence, Java Neural Network Simulator**

I. Introduction

In today's competitive world, it is very important to select appropriate career in order to achieve success by utilizing ones' capabilities and intelligence. To decide a stream is significant decision in every ones life, and we have to take this decision in limited time period. If some system is there which helps you to decide the stream then you can take fair decision. Artificial Intelligence (AI) based systems work as tools that not only enhance human decision making but also compensate inherent weaknesses in human decision making process. The decision support system is Artificial Neural Network (ANN) because it learns from feedback or experience. ANN based system uses normalized data that is very unfriendly with user. The stream selection process deals with linguistic parameters whose values are very difficult to mold in crisp values. For these reasons, with ANN system, the type-2 fuzzy system is proposed.

II. Artificial Neural Network (Ann)

A neural network (NN), in the case of artificial neurons called artificial neural network (ANN) or simulated neural network (SNN), is an interconnected group of neural or artificial neurons that uses a mathematical or computational model for information processing based on a connectionist approach to computation.

An artificial neural network involves a network of simple processing elements (artificial neurons) which can exhibit complex global behavior, determined by the connections between the processing elements and element parameters. Artificial neurons were first proposed in 1943 by Warren McCulloch, a neurophysiologist, and Walter Pitts, a logician, who first collaborated at the University of Chicago[1].

In more practical terms neural networks [2] are non-linear statistical data modeling or decision making tools. They can be used to model complex relationships between inputs and outputs or to find patterns in data.

The ANN is an artificial intelligence technique that mimics the human brain's biological neural network in the problem solving processes. As humans solve a new problem based on the past experience, a neural network takes previously solved examples, looks for patterns in these examples, learns these patterns and develops the ability to correctly classify new patterns. In addition, the neural network has the ability to resemble human characteristics in problem solving that is difficult to simulate using the logical, analytical techniques of expert system and standard software technologies.

The different types of neural network [3] based on their incremental complexity are:

1. Feedforward
2. Recurrent
3. Stochastic
4. Modular network

This neural network is formed in three layers, called the input layer, hidden layer, and output layer. The lines between the nodes indicate the flow of information from one node to the next. The nodes of the input layer are passive, meaning

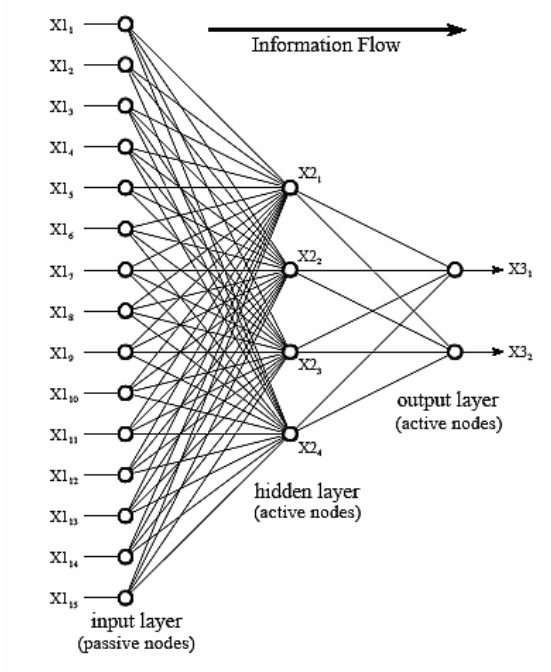

Fig.1Multi layer neural network

they do not modify the data. They receive a single value on their input, and duplicate the value to their multiple outputs. In comparison, the nodes of the hidden and output layer are active. This means they modify the data as shown in Figure1.

Each value from the input layer is duplicated and sent to all of the hidden nodes. This is called a fully interconnected structure. As shown in Figure 1, the values entering a hidden node are multiplied by weights, a set of predetermined numbers stored in the program. The weighted inputs are then added to produce a single number. This is shown in the diagram by the symbol, ∑. Before leaving the node, this number is passed through a nonlinear mathematical function called a sigmoid. This is an "s" shaped curve that limits the node's output. The output of this node is threshold to provide a positive or negative indication of the target's presence or absence in the input data. This architecture is very simple and much generalized. The ability of the neural network to provide useful data manipulation lies in the proper selection of the weights [3].

III. Type-2 Fuzzy System

The ANN systems lack explicit explanation and reasoning facility, as knowledge is stored in the connections. Input values to ANN must be crisp and normalized unlike in real practice. Here the values of the parameters coming form users are vague and in the form of linguistic variable.

Type-2 fuzzy sets and systems generalize (type-1) fuzzy sets and systems so that more uncertainty can be handled. From the very beginning of fuzzy sets, criticism was made about the fact that the membership function of a type-1 fuzzy set has no uncertainty associated with it, something that seems to contradict the word fuzzy, since that word has the connotation of lots of uncertainty. So, what does one do when there is uncertainty about the value of the membership function? The answer to this question was provided in 1975 by the inventor of fuzzy sets, Prof. Lotfi A. Zadeh [4], when he proposed more sophisticated kinds of fuzzy sets, the first of which he called a type-2 fuzzy set. A type-2 fuzzy set lets us incorporate uncertainty about the membership function into fuzzy set theory, and is a way to address the above criticism of type-1 fuzzy sets head-on. And, if there is no uncertainty, then a type-2 fuzzy set reduces to a type-1 fuzzy set, which is analogous to probability reducing to determinism when unpredictability vanishes.

Type-2 fuzzy sets let us model and minimize the effects of uncertainties in rule base fuzzy logic system [6].

Mendal argues that many kinds of uncertainties can be present in a FLS and that type-1 fuzzy sets are inadequate to handle them, i.e., to directly model them and to minimize their effects, whereas type-2 fuzzy sets are adequate to handle them [7] Fig. 2 is a structure of type-2 Inference Fuzzy System.

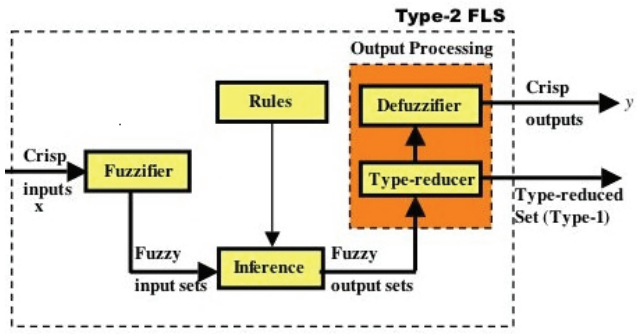

Fig. 2 Type-2 Inference Fuzzy System Structure

A. The Crisp Set versus the Fuzzy Set

- The crisp set is defined in such a way as to dichotomize the individuals in some given universe of discourse into two groups: members and nonmembers [5].

  However, many classification concepts do not exhibit this characteristic.

For example, the set of tall people, expensive cars, or sunny days.

- A fuzzy set can be defined mathematically by assigning to each possible individual in the universe of discourse a value representing its grade of membership in the fuzzy set.

For example: a fuzzy set representing our concept of sunny might assign a degree of membership of 1 to a cloud cover of 0%, 0.8 to a cloud cover of 20%, 0.4 to a cloud cover of 30%, and 0 to a cloud cover of 75%.

To improve understanding of perceptions in more human friendly way, a fuzzy system need some measure of dispersion to capture more about linguistic uncertainties than just a single Membership Function (MF). T1 FS can deal with a single MF.A T2 FS provides these measures of dispersion.

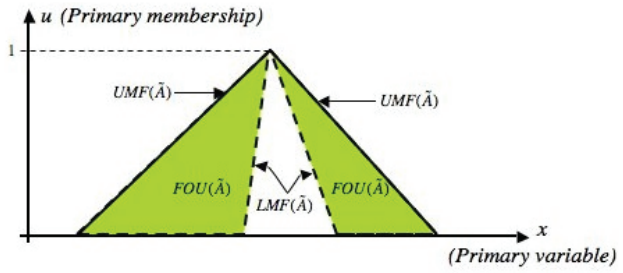

Fig. 3 Blurring of a type-1 membership function

The FOU represents the blurring of a type-1 membership function, and is completely described by its two bounding functions (Figure 3) [8], a lower membership function (LMF) and an upper membership function (UMF), both of which are type-1 fuzzy sets! Consequently, it is possible to use type-1 fuzzy set mathematics to characterize and work with interval type-2 fuzzy sets.

B. An Application of ANN

The proposed decision support system helps students while there are selecting their stream (Science, Arts and Commerce). The system has nine neurons in input layer and three neurons in output layer. A decision support system to select a stream has the following different parameters which affect the decision making.

- Interest in Management
- Performance in Theater/Painting/Poet/Music
- Interest in Sports
- Interest in Mathematics
- Interest in Science subjects
- Students Logic
- How much time spends on study?
- The result of 10th standard
- Financial condition

Figure 4 is a user screen through which user can enter their data. Each parameter has options. First parameter Interest in Management has four options – High, Normal, Average and Less. Each one has some value associated with them between 0 and 1. First of all user has to enter their data into the user input screen. Depending on that value it will find out the solution as shown in figure 5.

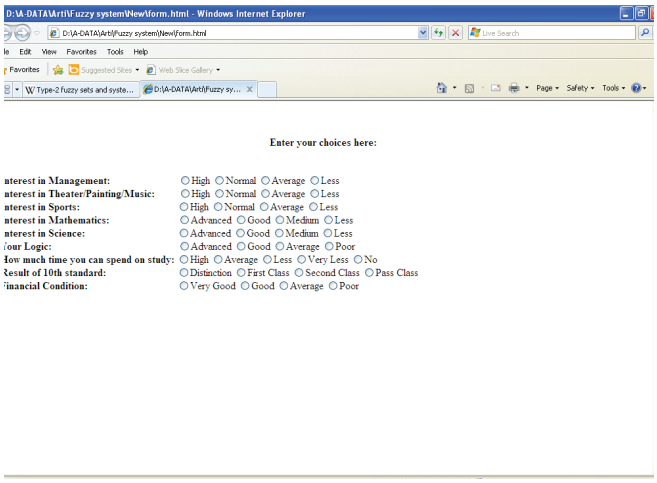

Fig.4 User Input Screen

Here in this example, as shown in figure 5, there is one input layer with nine neurons, 2 hidden layers with six neurons each and one output layer with 3 neurons. The number of neurons in hidden layer should be less than the number of neurons in input layer and it should be greater than the number of neurons in output layer.

The heuristic used to determine number of hidden layer neuron is as follows:

$$N_{Hidden} = ½ (N_{Input} + N_{Output})$$

Neural networks can learn from experience, so first we train the network by using training pattern data sets [9]. After the network is trained by training set, the system can be used to extend decision support to the users.

IV. Method of Learning/Training

If the classification problem is separable, we still need a way to set the weights and the threshold, such that the threshold unit correctly solves the classification problem. This can be done in an iterative manner by presenting examples with known classifications, one after another. This process is called learning or training, because it resembles the process we go through when learning something. Simulation of learning by a computer involves making small changes in the weights and the threshold each time a new example is presented in such a way that the classification is improved. The training can be implemented by various different algorithms. Feed-forward neural networks can also be used for regression problems, which require continuous outputs, as opposed to binary outputs (0 and 1). By replacing the step function with a continuous function, the neural network outputs a real number. Often a 'sigmoid' function—a soft version of the threshold function—is used .The sigmoid function can also be used for classification problems by interpreting an output below 0.5 as class 0 and an output above 0.5as class 1; often it also makes sense to interpret the output as the probability of class 1.

V. Back-Propagation

The previously mentioned back-propagation learning algorithm works for feed-forward networks with continuous output. Training starts by setting all the weights in the network to small random numbers. Now, for each input example the network gives an output, which starts randomly. We measure the squared difference between this output and the desired output—the correct class or value. The sum of all these numbers over all training examples is called the total error of the network. If this number was zero, the network would be perfect, and the smaller the error, the better the network. By choosing the weights that minimize the total error, one can obtain the neural network that best solves the problem at hand.

Among the many interesting properties of a neural network is the ability of the network to learn from its environment and to improve its performance through learning. A neural network learns about its environment through an iterative process of adjustments applied to its synaptic weights and thresholds.

We define learning in the context of neural networks as follows:

Learning is a process by which the free parameters of a neural network are adapted through a continuing process of stimulation by the environment in which the network is embedded.

The type of learning is determined by the manner in which the parameter changes take place.

After the training session the neural network is able to generate the output. The network receives input values from input layer and output suggestion regarding the stream to be selected is through output layer.

In output layer there are 3 neurons and on of them has value 1 and other 2 has value 0. The output pattern is like 1 0 0. The suggested output is with value 1. Here in this example the system suggests the Commerce stream. In figure 5, first neuron in output layer is for Commerce stream, second neuron is for Arts stream and third neuron is for Science stream.

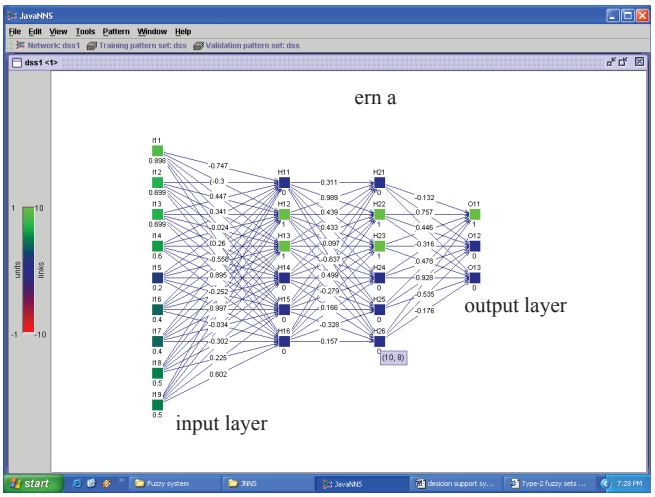

Fig.5 Network structure with input pattern and suggested output

This network is designed using Java Neural Network Simulator (JavaNNS) [10]. Java Neural Network Simulator for neural networks is developed at the Wilhelm-Schickard-Institute for Computer Science in TÜbingen University, Germany. It is based on the Stuttgart Neural Network Simulator (SNSS) 4.2 kernel. The simulator is used to implement the design. The simulator software used provides options for creating neurons in different layers, initialization, generation of pattern files and learning from the pattern sets. JavaNNS provides control and log panel, and generates Error graph if it is required.

VI. Conclusion

Neural networks have been proposed as useful tools in decision making in a variety of fields and applications, like forecasting, medicine etc. Neural networks will never replace human experts but they can help in screening and can be used by experts to double check their decisions. This artificial neural network will help students to make decision while there are deciding their stream. There are many areas where such a decision support system can help in setting priorities and making effective and productive decisions. In conclusion, when the ANN was trained and tested after optimizing the input parameters, the overall predictive accuracy obtained was very high.

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