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Adaptive Neural Fuzzy Inference System for Employability Assessment

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Abstract: Employability is potential of a person for gaining and maintains employment. Employability is measure through the education, personal development and understanding power. Employability is not the similar as ahead a graduate job, moderately it implies something almost the capacity of the graduate to function in an employment and be capable to move between jobs, therefore remaining employable through their life. This paper introduced a new adaptive neural fuzzy inference system for assessment of employability with the help of some neuro fuzzy rules. The purpose and scope of this research is to examine the level of employability. The concern research use both fuzzy inference systems and artificial neural network which is known as neuro fuzzy technique for solve the problem of employability assessment. This paper use three employability skills as input and find a crisp value as output which indicates the glassy of employee. It uses twenty seven neuro fuzzy rules, with the help of Sugeno type inference in Mat-lab and finds single value output. The proposed system is named as Adaptive Neural Fuzzy Inference System for Employability Assessment (ANFISEA).

Keywords: Neural Network, Fuzzy Logic, Employability, Sugeno type inference, Education, Understanding Power, Personal Development

1. INTRODUCTION

The problem of finding membership functions and fitting rules is frequently a demanding process of endeavor and error. This leads to the idea of applying knowledge algorithms to the fuzzy systems. The neural networks which have efficient learning algorithms had been obtainable as an alternative to computerize or to maintain the development of tuning fuzzy systems. Progressively, its application extent for all the areas of the knowledge in the vein of data classification, data analysis, imperfections detection and maintain to decision-making. JSR Jang proposed an adaptive network based fuzzy inference system [4]. The architecture and knowledge procedure underlying ANFIS is offered, which is a fuzzy inference system employed in the framework of adaptive networks. By by means of a hybrid knowledge procedure, the proposed ANFIS can build an input-output plotting based on both human knowledge and specified input-output data pairs. CF Juang proposed an online self-constructing neural fuzzy inference network and its applications [7]. It proposed a self-constructing neural fuzzy inference network (SONFIN) through online knowledge ability. The SONFIN is naturally a modified Takagi Sugeno Kang type fuzzy rule based model holding neural network knowledge ability. NK Kasabov, and Q Song proposed a dynamic progressing neural fuzzy inference system and its application for time series prediction [9]. It introduces an innovative type of fuzzy inference systems which indicated as dynamic evolving neural fuzzy inference system (DENFIS) for adaptive online and offline knowledge and their application for dynamic time series forecast. CT Lin and CS Lee proposed a neural network based fuzzy logic control and decision system [10]. This model associate the notion of fuzzy logic controller and neural network configuration in the form of feed forward multilayer net and knowledge abilities into an incorporated neural network based fuzzy logic control and decision system. O Avatefipour et al. designed a New Robust Self Tuning Fuzzy Backstopping Methodology [11]. It is focused on suggested Proportional Integral (PI) like fuzzy adaptive backstopping fuzzy algorithm constructed on Proportional Derivative (PD) fuzzy rule base through the adaptation laws consequent in the lyapunov sense. GO Tirian et al. proposed an adaptive control system for continuous steel casting based on neural networks and fuzzy logic [12]. It defines a neural network based approach for crack extrapolation aimed at improving the steel casting process presentation by decreasing the number of crack produced by failure cases. A neural system to approximation crack detection possibility has been designed, implemented, tested and incorporated into an adaptive control system. R Kumari et al. applied fuzzy control system for scheduling CPU [41], Job Shop scheduling [42], two way ducting system [40] and air conditioning system [43].

2. EMPLOYABILITY

Employability is defined as a set of accomplishments which consider skills, understandings and personal attributes. These achievements are make graduates further likely to gain employment and be prosperous in their selected occupations. Employability skills are generic or non-technical skills, such as communication, team work, self-management, planning and organizing, positive attitude, learning, numeracy, information technology and problem solving, which subsidize to your ability to be a successful and effective participant in the workplace. They are occasionally referred to as key, core, life, essential, or soft skills. Many employability skills and technical skills are exchangeable between jobs. Employability plays a significant role in the implementation of the Teaching Strategies and College Learning. It is part of worthy learning exercise. Students who involve in emerging their employability are likely to be reflective, independent and responsible learners. Teaching, innovative learning and assessment approaches which encourage students'

understanding and help them to participate in deep learning will also improve their employability. Concerning employers in the education knowledge can help students appreciate the significance of their course and acquire how to apply knowledge and theory in practical ways in the workplace. R Kumari et al. proposed an expert system for employability [45] and a fuzzified employability assessment system [44].

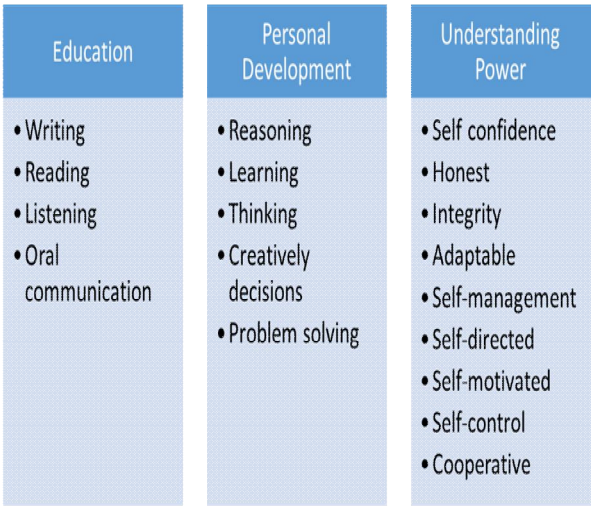

Figure 1. Classification of Employability Skills

3. FUZZY LOGIC CONTROL SYSTEM

Fuzzy systems recommend a mathematic calculus to interpret the subjective human awareness of the real processes. This is a way to control the practical awareness with some level of improbability. The Fuzzy logic techniques were firstly recommended by A L Zadeh in 1956 [1] [2] [3]. Aim of these techniques were scheming a system in which employers are permitted to form sets of rules through linguistic variables and membership functions, after that, the system renovates these rules into their mathematical complements.

4. NEURO FUZZY LOGIC CONTROL SYSTEM

Fuzzy logic and artificial neural networks [5][6] both are analogous tools for crafting systems that deal with expectation and classification of tasks. The idea of different terminologies for neuro-fuzzy systems introduced in the literature was neuro-fuzzy systems [8]. The term neuro-fuzzy system is usually a shortening of adaptive fuzzy systems industrialized by manipulating the similarities among fuzzy systems and neural networks methods. The two techniques of fuzzy logic and neural networks have combined in several different ways. In general, there are three combinations of these techniques. One is neural-fuzzy systems, another one is fuzzy neural networks and third one is fuzzy-neural hybrid systems. Neuro-fuzzy architecture Fuzzy Adaptive Learning Control Network (FALCON) proposed by CT Lin and CS Lee [30]. Architecture Adaptive Network based Fuzzy Inference System (ANFIS) proposed by R. R. Jang [31]. Architecture Neuronal Fuzzy Controller (NEFCON) proposed by D. Nauck and Kruse [32]. Architecture Fuzzy Net (FUN) proposed by S. Sulzberger, N. Tschichold and S. Vestli [33]. Architecture Fuzzy Inference and Neural Network in Fuzzy Inference Software (FINEST) proposed by O Tano and Arnould [34]. Architecture of Self Constructing Neural Fuzzy Inference Network (SONFIN) proposed by Juang and Lin [35]. Architecture Dynamic/Evolving Fuzzy Neural Network (EFuNN and dmEFuNN) proposed by Kasabov and Song [36]. Architecture Generalized Approximate Reasoning based Intelligence Control (GARIC) proposed by H. Berenji [29]. Architecture Fuzzy Neural Network (NFN) proposed by Figueiredo and Gomide [37].

4.1 Neural Fuzzy System

The neural network is used to regulate the functions and representing the fuzzy sets which are operated as fuzzy rules. The neural network deviation its weight in the training for the expectation of diminishing the mean square error amid the tangible output of the networks and the targets. L. Wang, J. Mendel, Y. Shi and M. Mizumoto proposed some illustrations of this approach [19, 20, 21]. Neural fuzzy systems are used in controller systems.

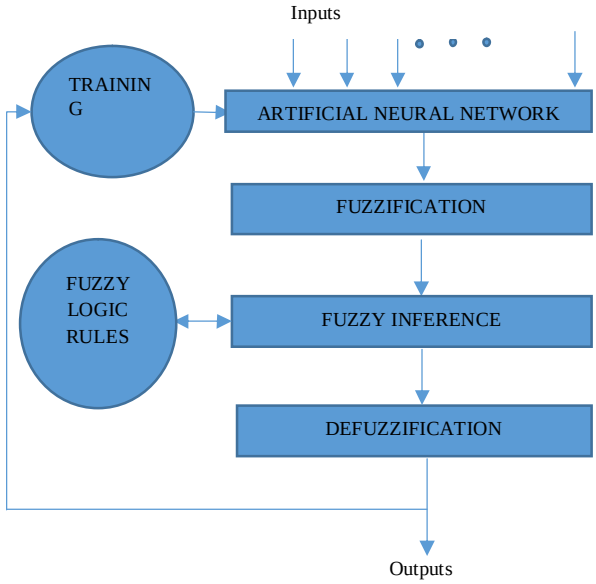

Figure 2. Neural Fuzzy System

4.2 Fuzzy Neural Network

A fuzzy neural network introduced memory connections for classification and weight connections for selection, so that it solves concurrently two foremost problems in pattern recognition that is pattern classification and feature selection. Fuzzy neural systems are used in pattern recognition applications. Lin and Lee presented a neural network in 1996 which composed of fuzzy neurons [16].

4.3 Fuzzy Neural Hybrid System

A fuzzy neural hybrid system is prepared individually from both fuzzy logic and neural network techniques to bring out solicitations such as control systems and pattern recognition. The lead objective of the fuzzy neural hybrid system can be proficient by having each technique do its task by incorporating and approving one another. This kind of inclusion is application oriented and appropriate for control and pattern recognition applications both. The worthy example of hybrid neuro fuzzy are GARIC, ARIC, ANFIS the NNDFR model [22, 23, 18, 38, 17].

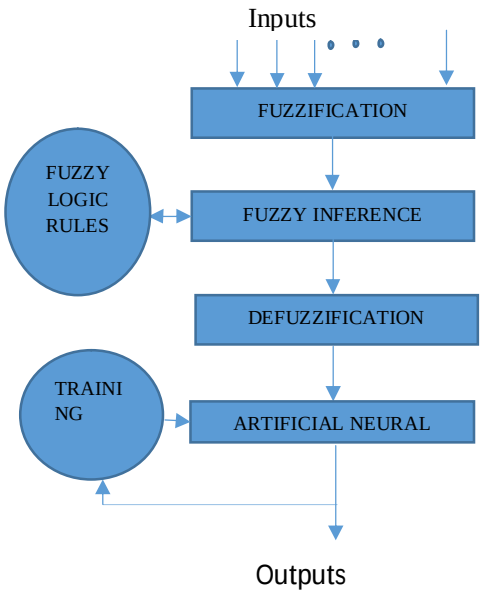

Figure 3. Fuzzy Neural System

5. ANFIS STRUCTURE

The adaptive neuro fuzzy inference system (ANFIS) is a commercial approach which is combined the two techniques such as a neural network and a fuzzy logic to generate a complete shell [18] Fundamentally the system of ANFIS applies the method of the artificial neural network learning rules to conclude and adjust the fuzzy inference systems parameters and structure. Many important features of ANFIS can support the system to achieve a task intensely; these features are considered as fast and accurate learning, easy to implement, excellent explanation facilities, strong generalization abilities, through fuzzy rules. It is easy to integrate both linguistic and numeric acquaintance for problem solving [18, 38, 39, 13, 14, 15]. This system is measured as an adaptive fuzzy inference system through the competency of learning fuzzy rules from data and as a connectionist manner provided with linguistic significance. A hybrid neuro-fuzzy inference expert system had developed by Jang that works in Takagi-Sugeno type fuzzy inference system [24, 25, 26, 27, 28]. ANFIS method is used as a teaching technique for Sugeno-type fuzzy systems. System constraints are identified by the support of ANFIS. When ANFIS is applying, generally the number and type of fuzzy system membership functions are well defined by user. ANFIS technique is a hybrid technique, which consists two parts, one is gradient technique which is applied to calculation of input membership function parameters, and another one is least square technique which is applied to calculation of output function parameters.

6. FUZZIFIED EXPERT SYSTEM FOR EMPLOYABILITY ASSESSMENT

In the previous research work initiates a new expert system for assessment of employability with the help of some fuzzy rules. These rules are ultimately used for observe the optimal valuation for employability. This employability compacts with various fuzzy rules and these rules are constructed on employability skills. It computes the Employability Skills for several employees with the help of Mamdani type inference. It used linguistic variables as input and output for calculate a crisp value for employability skills.

7. ADAPTIVE NEURAL FUZZY INFERENCE SYSTEM FOR EMPLOYABILITY ASSESSMENT

This paper introduced an innovative adaptive neural fuzzy inference system for employability with the help of some neuro fuzzy rules. These neuro fuzzy rules are ultimately used for examine the best valuation for employability. This employability deals with some neuro fuzzy rules and these rules are based on three employability skills named as education, Personal Development and Understanding Power. This work is proposed to compute the Employability Level for any employee with the help of Takagi Sugeno type inference.

This concern research use suitable linguistic variables as input and output for calculate a crisp value for employability. Education (E), Personal Development (PD) and Understanding Power (UP) measured as Low, Medium and High and Employability skills (ES) measured as Very Low, Low, Medium, High and Very High. The recommended skills is a gathering of linguistic neuro fuzzy rules which designate the relationship between distinct input variables (E, PD and UP) and output (ES).

Table 1. Membership function and range of input variables

Education	Personal Development	Understanding Power	Range
Low	Low	Low	0-4
Medium	Medium	Medium	2-8
High	High	High	6-10

Table 2. Membership function and range of output variable

Employability	Range
Very Low	0-2
Low	1-4
Medium	3-6
High	5-8
Very High	7-10

Table 1 encloses the membership functions and range of input variables named as education, employability and understanding power. Table 2 encloses membership function and range of output variable named as employability. Table 3 encloses the twenty seven rules which are built on IF THEN statement such as

IF E is high and PD is high and UP is high THEN ES is high

These rules are used for calculate the crisp value using centroid defuzzification technique of Sugeno type inference in Matlab that signifies the employability level of each and every employee.

Figure 4 shows the membership function of input variable education, figure 5 shows input variable personal development, figure 6 shows input variable understanding power, figure 7 shows output variable employability, figure 8

shows ANFIS structure and figure 9 outlines rules of employability.

Table 3. Set of proposed rules

Rule Number	Education	Personal Development	Understanding Power	Employability
1	Low	Low	Low	Very Low
2	Low	Low	Medium	Very Low
3	Low	Low	High	Low
4	Low	Medium	Low	Very Low
5	Low	Medium	Medium	Medium
6	Low	Medium	High	Medium
7	Low	High	Low	Low
8	Low	High	Medium	Medium
9	Low	High	High	Medium
10	Medium	Low	Low	Very Low
11	Medium	Low	Medium	Low
12	Medium	Low	High	Medium
13	Medium	Medium	Low	Medium
14	Medium	Medium	Medium	Medium
15	Medium	Medium	High	High
16	Medium	High	Low	Medium
17	Medium	High	Medium	High
18	Medium	High	High	Very High
19	High	Low	Low	Low
20	High	Low	Medium	Medium
21	High	Low	High	Medium
22	High	Medium	Low	High
23	High	Medium	Medium	High
24	High	Medium	High	Very High
25	High	High	Low	High
26	High	High	Medium	Very High
27	High	High	High	Very High

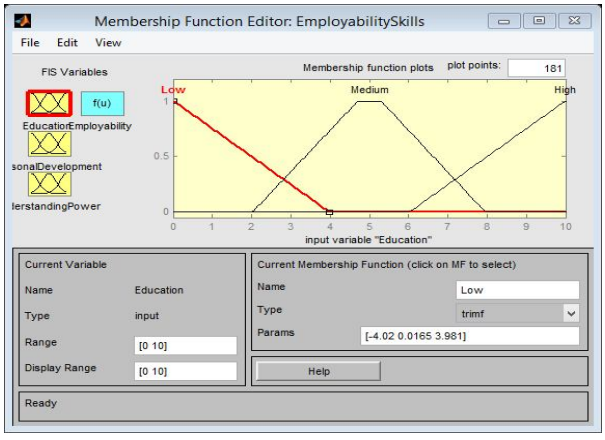

Figure 4. Input Variable "Education"

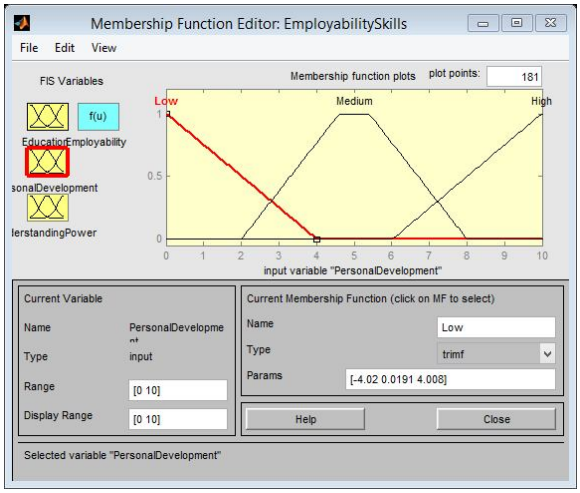

Figure 5. Input Variable "Personal Development"

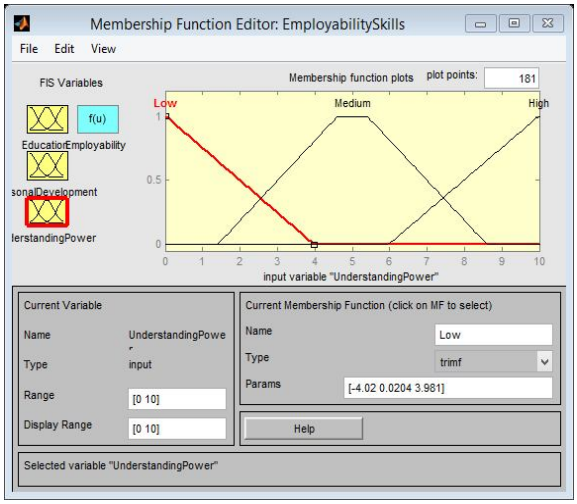

Figure 6. Input Variable "Understanding Power"

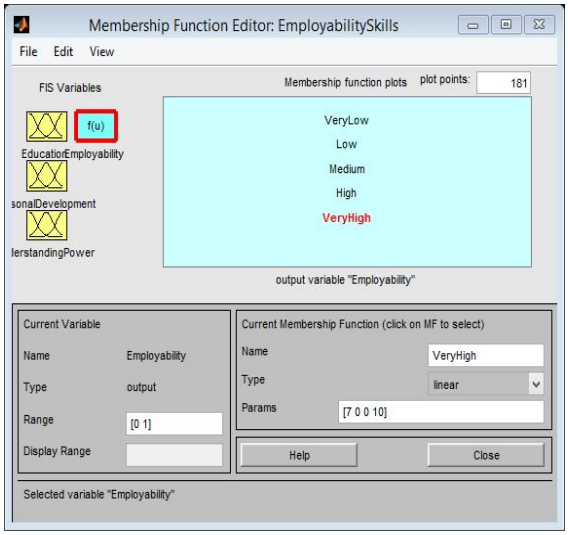

Figure 7. Output Variable "Employability"

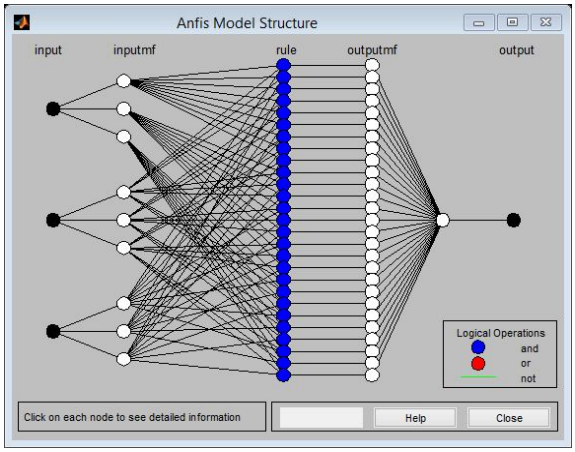

Figure 8. ANFIS Structure for Employability

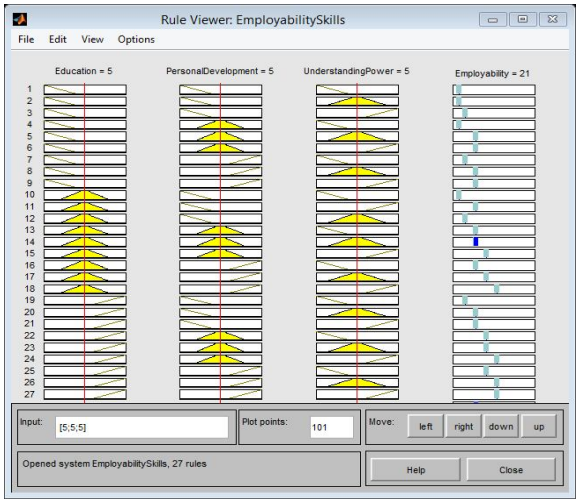

Figure 9. Rules for Employability Skills

8. CONCULSION

This paper estimated an adaptive neural fuzzy inference system for employability assessment. The concern research finds the level or capability of any employee with the help of three employability skills named as education, personal development and understanding power. The proposed system is beneficial for organization to compute employability level for individual in a simple manner. With the help of proposed system employer can simply filter best appropriate candidates based on their education, personal development and understanding power. This system operates above three inputs based on neuro fuzzy rules and computes employability.

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