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ARTICLE

NEW ACADEMIC PREDICTION SYSTEM BASED ON COMPACT SOFT COMPUTING

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ABSTRACT

Background: *The prediction of data is a science. Data is studied in this paper under the compact soft computing. The compact soft computing involves the fuzzy logic, fuzzy set, neural network and genetic algorithm. This paper delivers a system for predicting and evaluating the academic performance of the student. Hence the optimized data interpretation system is proposed in this paper.* ***Method:*** *This academic prediction system is based on compact soft computing.* ***Results:*** *A new academic prediction system is proposed in this paper which is based on the data analysis via compact soft computing.* ***Conclusions:*** *The fuzzy logic, fuzzy set, neural network and genetic algorithm are used as the compact computation tool in this paper. This is proved as the errorless interpretation.*

KEY WORDS
Compact Soft Computing, Fuzzy, Neural Network, Genetic Algorithm

INTRODUCTION

The objective of the data analysis is to transform the data into useful and usable form. This is a transformation from fact to information. No data able to speak about themselves. Thus its interpretation is required. May be many information involved in single information or single information be a source of several information. These all hypothetical remarks studies in data analysis. Chow et al [1] studied the data under the probability distribution over the tree in 1968. This presented an approximation of the data and error estimation. Nakhaeizadeh [2] developed a data management system for banking in 1998. The data of banks inter-relate and co-relate by this data management system. The economical application of database first time came in the existence.

Nauck et al [3] established the neuro-fuzzy data base system in 1997. The fundamental rules were defined in this foundation. In 1988, Lauritzen et al [4] proposed the concept of local computation over the expert systems by probability. The graphical structures of the data and its application has presented in this concept. The previous Neruo-fuzzy concept used again for this, but this was presented as the survey of all such types of data system based results. In 1992, a noteworthy idea came in the existence as the Intelligent System. This system is invented by Pearl [5]. This is basically a reasoning based data base mechanism. In the same year, another mechanism came in the existence as learning system by examples. Wang et al [6] developed this theory through the fuzzy rule generator. The learning by example is the key idea behind this system.

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Kruse [7] put the theory on data and its interpretation by the uncertainty and vagueness concept. The knowledge management system was launched as the mapping between uncertainty and vagueness in the year 1991 for the generation of the new database system. Three years later, they proposed another data management system based on fuzzy systems. Hackerman et al [8] generalized the data base which is recalled later as Bayesian Network. The combination of knowledge and statistical data is proposed first time as the learning management system in 1995. In 1999, Hoopner et al [9] presented the data analysis by the cluster algorithm. The cluster and fuzzy presented simultaneously in this survey.

The possibilistic model is developed as the second model. The data and network were the two sets for establishing the map. The hyper tree decomposition model was the second last model in the series. This model was based on multivariate possibility distribution. The last model was the source of information. By the parallel combination this was structured.

In 1999, Gentch [10] proposed some tools for data mining. In the same year, Dubois et al [11] merged the fuzzy information. Fayyad et al [12] edited a note on modern data management system in 1996. Anderson et al [13] proposed an expert system based on HUGIN. In 1989, they generalized the data over the Bayesian Distribution Process (BDP).

Next section deals with pre-requisites on soft computing techniques.

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MATERIALS AND METHODS

The Analysis of Fuzzy Models: Fuzzy set, Neural Network and Genetic Algorithm are the base of this paper. Its composition for data mining of student's academic performance is the objective of this paper.

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The sequence is remaining as per the mentioned, first Fuzzy Set, then Neural Network and Genetic Algorithm in the last. It is defined in below:

Fuzzy Set: Let X be a space of points, with a generic element of X denoted by x. Thus, $X = \{x\}$.

A fuzzy set A in X is characterized by a membership function $f_A(x)$ which associates with each point in X a real number in the interval [0, 1] with the value of $f_A(x)$ at x representing the grade of membership of x in A.

Fuzzy Logic: According to Zadeh [31], Fuzzy Logic is a logical system for forming the system by approximate reasoning.

Fuzzy is method of redefining the class according to the membership. The class and the membership is decided by the social and understanding behavior. The classical set never behaves as variable but the fuzzy set always holds the same always by the logic. In general, the crisp value, e.g. 2 means only 2 again in the classical set theory but 2 means 2, 2.1, 2.2, 2.3, 2.4, 2.7, …2.9, …2.11…2.99 and so on…in fuzzy theory.

Neural Network: It is inspired by the mechanism of human brain. The layers are the elements of any NN. It is also referred as Artificial NN, by the reason of it is not natural brain but an artificial.

Basically the followings are the main steps of ANN:

1. Input Layer
2. Middle Layer
3. Output Layer

By the structure it can be demonstrated as follows:

The Activation Function: Let the input variables be x_i and its corresponding weight be w_i, then the weighted sum is called activation function and it is represented by,

$$A(\overline{x}_i, \overline{w}_i) = \sum_{i=0}^{n} x_i w_i .$$

The Sigmoidal Function: An activation function is called a Sigmoidal Function if it is represented as,

$$O(\overline{x}_i, \overline{w}_i) = \frac{1}{1 + e^{A(\overline{x}_i, \overline{w}_i)}}$$

The Error Function: The sum of all the layers of output is called an error function if it represented as,

Genetic Algorithm: Fitness proportionate selection, recombination/crossover and mutation are the three fundamental characteristics of GA.

$$E(\overline{x}_i, \overline{w}_i, d) = (O(\overline{x}_i, \overline{w}_i) - d)^2$$

Definition: Let a function $f : X \to R \geq 0$ be given, then the optimization problem is represented by,

$Optimize(x) = \arg(\max(f(x)),$ Where $f(x)$ is the fitness function.

Definition (Proportionate Selection): The rate of probability is represented by,

$$. \; p(x, t+1) = p(x, t)\frac{f(x)}{f(t)}$$

Definition (Proportionate Selection Function): The response function for the proportionate function is represented by,

$$R(t) = \frac{V(t)}{\bar{f}(t)},$$
$$V(t) = \sum_{x} p(x,t)(f(x) - \bar{f}(t))^2$$
$$R(t) = \bar{f}(t+1) - \bar{f}(t)$$
$$\bar{f}(t) = \sum_{x} p(x,t) f(x)$$

Definition (Recombination): Robbin's distribution $\pi(x,t)$ is given by,

$$\pi(x,t) = \prod_{i=1}^{n} p_i(x_i, t).$$

The generalization of the genetic algorithm as per the dynamic data analysis is presented in the below section:

Generalized Genetic Algorithm: It is the process for generating the best variable for the next operation. The data of student's academic performance is studied as the application of GA.

Let the random variables are: $x_1, x_2, x_3, \ldots x_n$.

The corresponding weights are: $w_1, w_2, w_3, \ldots w_n$.

The summation of the weights is:

$$\sum_{i=1}^{n} w_i = w_1 + w_2 + w_3 + \ldots + w_n,$$

or,

$$\sum = w_1 + w_2 + w_3 + \ldots + w_n.$$

Hence, the Activation Function is: $f(\sum)$.

Next is the fitness function, which is required for executing the process.
Let S be a total number of samples, G be the global error, t_i be the time at i position. Hence the fitness function will be;

$$f = \frac{1}{G} = \frac{1}{\sum_{i=1}^{s} (t_i)^2}.$$

The crossover function is defined in the next section.

Let X_i, X_{i+1}^t be the pair before crossover, X_i^{t+1}, X_{i+1}^{t+1} be the pair after crossover, C_i be the random number of uniform distribution in [0, 1], then,

$$X_i^{t+1} = c_i . X_i^t + (1 - c_i) . X_{i+1}^t$$
$$X_{i+1}^{t+1} = (1 - c_i) . X_i^t + c_i . X_{i+1}^t .$$

The algorithm is given in the next section.

1. The given data.
2. The Set of Random Numbers.
3. The coding by real numbers by; $L = i \times s + s \times j,$

Where,

i be the Input random number, s be the sample random number and j be the out random number.

4. $\min(f)$.
5. New Population Generation by;

$$X_i^{t+1} = c_i . X_i^t + (1 - c_i) . X_{i+1}^t$$
$$X_{i+1}^{t+1} = (1 - c_i) . X_i^t + c_i . X_{i+1}^t .$$

Next section lies with the proposed system.

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RESULTS

Data Set:

$$L = \begin{bmatrix} l_{11} & . & . & . & l_{1n} \\ . & . & . & . & . \\ . & . & . & . & . \\ . & . & . & . & . \\ l_{m1} & . & . & . & l_{mn} \end{bmatrix}_{m \times n}$$

Fuzzy Set:

$$A = \begin{bmatrix} \mu_{11}/x_{11} & . & . & . & \mu_{1n}/x_{1n} \\ . & . & . & . & . \\ . & . & . & . & . \\ . & . & . & . & . \\ \mu_{m1}/x_{m1} & . & . & . & \mu_{mn}/x_{mn} \end{bmatrix}_{m \times n}$$

The Real Number Coding: $L = i \times s + s \times j,$

Where,
i be the Input random number, s be the sample random number and j be the out random number.

Optimization:

$$\min f = \frac{1}{L} = \frac{1}{\sum_{i=1}^{s} (e_i)^2}.$$

New Population Generation:

$$X_i^{t+1} = c_i . X_i^t + (1 - c_i) . X_{i+1}^t$$
$$X_{i+1}^{t+1} = (1 - c_i) . X_i^t + c_i . X_{i+1}^t .$$

Predicted Data:

$$(\pi(x, t), L) = \left(\prod_{i=1}^{n} p_i(x_i, t), A \right)$$

.

CONCLUSION

The data is not just a fact but more than the fact. The past, present and future data can be mapped with each other. The probability on the data is applied not only for studying the certainty and uncertainty of data but to define the data as the real value. The prediction of the data is important because repetition could be avoided. It is all an optimization. The data then its classification by fuzzy then its weight consideration and then the best fit data or the origin of the data or the generator of the data or the mean data or the inference data or the central valued data or an only data, which could be presented or leaded as the universe of the data. Thus compact model fulfils the desired goal.

CONFLICT OF INTEREST

None.

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FINANCIAL DISCLOSURE
This is an unfunded research.

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