International Journal of Mathematical Archive-3(2), 2012, Page: 762-766
Available online through www.ijma.info ISSN 2229 – 5046

ANALYSIS AND PERFORMANCE PREDICTION OF STUDENTS USING FUZZY RELATIONS

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(Received on: 11-02-12; Accepted on: 29-02-12)

ABSTRACT

Education today is based on information collection and information – giving. In this state, it is difficult to analyse the end purpose of education itself. Levels of grasping absorbing and then expressing vary according to individuals. In spite of our good teaching, the students fail due to so many reasons. The output by the students depends on the student's capacity and the knowledge obtained by them. Hence, by using fuzzy relations, it is possible to confirm the possible marks obtained by the students in the final examination.

An attempts has been made by using the approach formulated by adlassnig and Kolarz [1] and Adlassnig[2] in the design of CADIAG-2, the problem of finding the possible marks obtained by a student in the final exam using his capacity or intelligence and the knowledge obtained is derived.

The model proposes two types of relations to exist between capacity and knowledge obtained.
(1) Existence relation
(2) Assurance relation

The first relation gives information about how much a student has basic intelligence or capacity. It corresponds to the question.

"what is the level of a particular student's IQ in certain topics?"

The second relation assures the presence of intelligence and the knowledge obtained by the students in certain topics, so that he is sure of getting good marks. It corresponds to the question "What is the level of intelligence and the knowledge obtained in certain topics?"

ANALYSIS:

The distinction between assurance and existence is important and is useful because a student may be quite intelligent but may not have obtained the knowledge about one subject. On the other hand, a student with less IQ but with the knowledge obtained might get good marks.

Let C denote the crisp universal set of all capacities, K be the crisp universal set of all knowledge obtained by the students and S be the crisp universal set of all students.

Let us define a fuzzy relation

R_c on the set S X C

In which membership grades R_c (s,c) (where s $\in$ s, c $\in$ c) indicates degree to which the capacity c is present in student S. For instance, it c represents the capacity level in calculus and the test marks is roughly 3.6 to 5.1, then a test result of 5.1 for a student S could lead to a membership grade R_c (s, c)=0.5

Let us further define a fuzzy relation R_e on the universal set where R_e (c, k) (c $\in$ C, k $\in$ K) indicates the existence of capacity with the knowledge K let R_a also be a fuzzy relation in the same universal set(C,K) where R_a (c,k) corresponds to the degree to which the capacity together with the knowledge assures the maximum marks.

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We assign membership grades of 1, 0.9, 0.6, 0.3, 0 in fuzzy sets R_e and R_a for the linguistic terms very high, high, medium, low, very low respectively. We use a concentration operation to model the linguistic modifier very such that A_{very} (x) = A^2 (X).

Assume that the following documentation exists concerning the relations of capacities C_1, C_2, C_3 to the knowledge obtained K_1, K_2, K_3

- Capacity C_1 is very high in calculus and the knowledge obtained in calculus K_1 is low.
- Capacity C_1 is high and K_2 the knowledge obtained in Algebra is very high.
- Capacity C_2 is very low in Algebra and K_2 is high.
- Capacity C_3 in Differential equations is medium and K_3 the obtained is very high.
- Capacity C_3 is very low and K_1 is low.

All missing relational pairs of capacities and the knowledge obtained are assumed to be unspecified and are given a membership grade of 0.5. We construct the following matrices of relations $R_e, R_a \in (C, K)$.

$$R_e = \begin{bmatrix} 1 & 0.56 & 0.3 \\ 0.6 & 0.8 & 0.57 \\ 0.7 & 0.6 & 0.9 \end{bmatrix}$$

$$R_a = \begin{bmatrix} 0.9 & 0.5 & 0 \\ 0.7 & 0.9 & 0.6 \\ 0.25 & 0.4 & 1 \end{bmatrix}$$

We assure that we are given a fuzzy relation R_c specifying the degree of capacities C_1, C_2, C_3 for three students S_1, S_2, S_3 as follows

$$R_c = \begin{bmatrix} 0.4 & 0.3 & 0.25 \\ 1 & 0.15 & 0.5 \\ 0.8 & 0.6 & 0.75 \end{bmatrix}$$

using the relations R_e, R_a & R_c we can now calculate four different indication relations defined on the set S XC of students and capacities.

The first existence indication R, is defined as $R_1 = R_c o R_e$

(ie)

$$R_1 = \begin{bmatrix} 0.4 & 0.4 & 0.3 \\ 1 & 0.75 & 0.57 \\ 0.8 & 0.6 & 0.75 \end{bmatrix}$$

The assurance indication relation R_2 is given by

$$R_2 = R_c o R_a$$

This result is

$$R_2 = \begin{bmatrix} 0.4 & 0.4 & 0.3 \\ 0.9 & 0.75 & 0.6 \\ 0.8 & 0.6 & 0.75 \end{bmatrix}$$

The non- existence indication R_3 is given by

$R_3 = R_c o(1 - R_e)$ And specified here by

$$R_3 = \begin{bmatrix} 0.4 & 0.4 & 0.4 \\ 0.4 & 0.44 & 0.7 \\ 0.4 & 0.44 & 0.7 \end{bmatrix}$$

Finally,
the non- capacity indication R_4 is given by

$R_4 = (1 - R_c) o R_e$ And equals

$$R_4 = \begin{bmatrix} 0.7 & 0.7 & 0.75 \\ 0.5 & 0.5 & 0.5 \\ 0.4 & 0.4 & 0.4 \end{bmatrix}$$

From these four indication relations, we may draw different types of conclusions. If R_2 (S, K) =1, we may make confirmed analysis of a students knowledge. If R_3 (S, K) =1 or if R_4 (S, K) =1 may made an excluded capacity K in student S. In our example, we may exclude the capacity or knowledge K_2 for the student S_2 . Finally we may include in our set of hypotheses for any student S and knowledge K the inequality.

0.5 < max [R_1 (S, K), R_2 (S, K)] is satisfied. In our example K_1, K_2, K_3 are suitable knowledge hypotheses for students S_1, S_2, S_3 This system incorporates relations not only between knowledge and capacity but also between the knowledge themselves and capacities themselves and between combinations of knowledge and capacities.

CLUSTER ANALYSIS:

Another alternative approach to modeling the student performance analysis utilizes fuzzy cluster analysis. This type of technique is used by Fordon and Bezdek (1979) and Esogbue and Elder (1979, 1980, 1983). Models that use cluster analysis usually performs a clustering algorithm on the set students by examine the similarity of the existence and assurance of capacity patterns exhibited by each. The level of capacity present can be designated with degrees of membership in fuzzy sets representing each capacity category. Often the similarity measure is computed between the capacities of the student in question and the capacities of a student possessing the prototypical capacity pattern for each possible student. The student to be analyzed is then clustered to varying degrees with the prototypical students whose capacities are most similar. The most likely diagnostic candidates are those knowledge clusters in which the student's degree of membership is the greatest.

We describe a simplified adaptation of the method employed by Esogbue and Elder [1979, 1980, 1983] to illustrate this technique.

Let us assume that we are given a student x who displays the capacities c_1, c_2, c_3 & c_4 at the levels given by the fuzzy set
$A_x = .1/s_1 + .7/s_2 + .4/s_3 + .6/s_4$ Where $A_x(s_i) \in [0,1]$ denotes the grade of membership in the fuzzy set characterizing student x and defined on the set

c = { c_1, c_2, c_3, c_4 }

Which indicates the level of the capacity c_i for the student.

We must determine an analysis for this student among 3 possible knowledge obtained in 3 areas as k_1, k_2 & k_3 Each of these knowledge's is described by a matrix giving the upper and lower bounds of the normal range of level of each of the four capacities that can be expected in a student with the knowledge. The knowledge k_1, k_2 & k_3 are described in this way by the matrices

$$B_1 = \begin{matrix} \text{lower} \\ \text{Upper} \end{matrix} \begin{bmatrix} 0 & .6 & .5 & 0 \\ 2 & 1 & -7 & 0 \end{bmatrix}$$

$$B_2 = \begin{matrix} \text{lower} \\ \text{upper} \end{matrix} \begin{bmatrix} 0 & .9 & .3 & .2 \\ 0 & 1 & 1 & .4 \end{bmatrix}$$

$$B_3 = \begin{matrix} \text{Lower} \\ \text{upper} \end{matrix} \begin{bmatrix} 0 & 0 & .7 & 0 \\ .3 & 0 & .9 & 0 \end{bmatrix}$$

For each j= 1, 2, 3 matrix B_j defines fuzzy sets defines fuzzy sets $B_{jl}(c_i)$ & $B_{ju}(c_i)$ denote respectively the lower and upper bound of capacity ci for knowledge k_j. The relation W of these weight of relevance is given by

$$\begin{matrix} & k_1 & k_2 & k_3 \\ c_1 & .4 . & 8 & 1 \\ c_2 & .5 & .6 & .3 \\ c_3 & .7 & .1 & .9 \\ c_4 & .9 & .6 & .3 \end{matrix}$$

Where w (c_i, k_i) denote the weight of capacity for the knowledge obtained in subject k_j. In order to discuss the student's condition performance, we use a clustering technique to determine to which performance cluster (as specified by matrices B_1, B_2 & B_3). The student is most similar. The clustering is performed by computing a similarity measure between the student's capacities and those typical of each knowledge k_j.

To compute this similarity we use a distance measure based on the Minkaoski distance that is appropriately modified. It is given by the formula

$$D_p(k_j, x) = \left[\sum_{i \in I_l} \left| W(c_i, k_j)(B_{jl}(c_i) - (A_x(c_i)) \right|^p + \sum_{i \in I_u} \left| W(c_i, k_j)(B_{ju}(c_i) - A_x(c_c)) \right|^p \right]^{1/p}$$

where $I_l = \{ i \in N_m | A_x(c_i) < B_{ji}(c_i) \}$,

$$I_u = \{ i \in N_m | A_x(c_i) > B_{ju}(c_i) \},$$

And m denotes the total number of symptoms. Choosing, for example the Euclidean distance we use (1) with p = 2 to calculate the similarity between the student x and knowledge's k_1, k_2, k_3 in our example as follows:-

$$D_2(k_1, x) = \left[|(.7)(.5 - .4)|^2 + |(.9)(0 - .6)|^2 \right]^{1/2} = .54;$$

$$D_2(k_{2,} x) = \left[|(.6)(.9 - .7)|^2 + |(.8)(0 - .1)|^2 + |(.6)(.4 - .6)|^2 \right]^{1/2} = .19$$

$$D_3(k_3, x) = \left[|(.9)(.7 - 4)|^2 + |(.3)(0 - .7)|^2 + |(.3)(0 - 0.6)|^2 \right]^{1/2} = 0.39$$

the most likely knowledgeable candidate is the one for which the similarity measure attains the minimum values. In this case, the students capacities are most similar to those typical of knowledge k_2 .

CONCLUSION:

Thus it can be inferred that students can be identified to score a higher percentage by (1) the cardiac method through the (2) cluster analysis method groups of achievers can be clustered in order to train them for excellence

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