Decision Making of Conducting Remedial Classes for Weak Students through Fuzzy Ingredients

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Abstract- Making decisions are one of the most fundamental activities of human beings. In an atmosphere of uncertainty the decision maker has to select the best course out of several alternative courses of action that may be available to him. In earlier days, decisions were made mainly on personal judgement. Now-a-days judgement is combined with several quantitative techniques and the best action is arrived at in a given situation. In this paper we find the solution for the problem that Bharathidasan Constituent College (W), Orathanadu, Thanjavur district,Tamil Nadu, South India need to conduct remedial classes for the weak students in their College. Finally we conclude that the decision maker (The Principal) enable to take an optimal decision through Fuzzy ingredients.

Index Terms- Decision situation, Fuzzy actions, Fuzzy states, Fuzzy information

I. INTRODUCTION

In order to deal with vagueness of human thought, Zadeh(1965) first introduced the fuzzy set theory. A fuzzy set is an extension of a crisp set. Classical statistical decision method involves the notion that the uncertainty in the future states of nature can be characterized as probability events. When we want to make a decision among various alternatives our choice is predicated on information about the future which is normally discretized into various "states of nature". The problem with the statistical scheme, the events are vague and ambiguous. The statistical method can be further extended to include the possibility that the states of nature are fuzzy and the decision makers alternatives are also fuzzy.

II. PRELIMINARIES

Here some basic definition of membership function, orthogonal fuzzy set are reviewed.

. **Definition 2.1:-** Let $X = \{ x_1,x_2,x_3,\ldots,x_r\}$ is a universe of discourse. We define fuzzy events, M on this information, such as "good", "moderate", and "poor" information. Then the fuzzy event will have membership function $\mu_M(x_k)$, $k = 1,2,.....r$

Definition 2.2:- The collection of all the fuzzy events describing fuzzy information is defined as an orthogonal fuzzy information system.

i.e. $\varphi = \{M_1,M_2,....,M_g\}$.

The sum of the membership values for each fuzzy event, M_i for every data point in the information universe x_k equals unity.

$$\text{i.e.} \sum_{t=1}^{g} \mu_{Mt}(x_k) = 1 \qquad \text{for all } x_k \in X \qquad (1)$$

Remedial classes can be a positive environment for students suffering from low-self esteem, as they encourage students to ask as many questions as necessary to understand a subject, rather than feeling pressured to learn everything immediately.

Weak Students

Here we consider 'weak' students as those who had a 3rd class, had failed more than 40 or 50 percent of their subjects in a given year.

III. DECISION MAKING UNDER FUZZY STATES AND FUZZY ACTIONS

In any organization, the main function of the executive is to make decisions. The organisation is faced with several type of decision problems. The decision maker has to face such endless problems. In each of decision-making problems there are certain common elements which are called ingredients of decision problems. Here we consider the statistical decision problem ingredients with fuzzy states and fuzzy actions as follows:

1. Alternative courses of fuzzy actions: The process of decision-making involves the selection of a single act from among some set of alternative acts. The decision maker can choose best action out of several actions. The possible fuzzy actions among m alternatives are given by $A_1,A_2,A_3,\ldots A_m$.

2. Uncertainity: In all decision problems "uncertainty" is found to be a common element. When there are many possible outcomes of an event (also called fuzzy states of nature) one cannot predict with certainity and it is only the probability. Here the possible fuzzy states of nature is given by F_s, s=1,2,….n and the orthogonal condition on the fuzzy state is given by

$$\text{i.e. } \sum_{s=1}^{n} \mu_{Fs}(s_i) = 1 \quad i = 1,2,\ldots n \qquad (2)$$

3. Utility value: In order to evaluate each possible course of action the result of each event with each course of action have a payoff value. While the fuzzy alternative have a utility value. We assign a **utility value u_{js}** for a given fuzzy alternative A_j and the future states of nature F_s.A number of consequences for various fuzzy states of nature will be mxn in number.

4. Decision criteria: The decision maker must determine how to select the best course of action. In most statistical decision problems the decision payoff (EP) is used as a decision criteria. In Fuzzy decision making problem the expected utility is used as a decision criteria. The utility value is a non-dimensional unit and it should be determined by the decision maker. The values are usually arranged in matrix form shown in Table 1.

The expected utility of fuzzy alternative A_j is given by

$$E(u_j) = \sum_{s=1}^{n} u_{js} P(F_s) \quad i = 1,2,\ldots n \qquad (3)$$

where

$$P(F_s) = \sum_{s=1}^{n} \mu_{Fs}(s_i) P(s_i) \qquad (4)$$

Table I: Utility values for fuzzy states & fuzzy alternatives

u_{js}	F_1	F_2	……	F_n
A_1	u_{11}	u_{12}	……	u_{1n}
A_2	u_{21}	u_{22}		u_{2n}
.				
A_m	u_{m1}	u_{m2}	……	u_{mn}

The membership values for each orthogonal fuzzy set on the fuzzy information system is given by

$$\sum_{t} \mu_{Mt}(x_i) = 1 \qquad (5)$$

In order to make an optimal decision some criterion and additional information are necessary. With the utility matrix the decision maker may be able to reach the optimal solution of a problem. The most common decision criteria is the maximum expected utility among all fuzzy alternatives.

$$\text{i.e. } E(u^*) = \max_j E(u_j) \qquad (6)$$

Which leads to the selection of fuzzy alternative A_k if $u^* = E(u_k)$

IV. APPLICATIONS AND RESULTS

Suppose that the Bharathidasan university has allotted fund to conduct remedial classes for weak students in BDUCC(W), Orathanadu, Thanjavur district, Tamil Nadu, South India. A sample analysis of examination results of 2500 students was made. Considering all the departments it was found that only the students of the following three departments have weak students.The records of 400 students performance are given below.

Scores / No.of Students	Below 40	Between 40&50	Above 50	Total
B.A.,(English)	90	20	10	120
B.Sc.,(Mathematics)	30	30	70	130
B.Com.,(Commerce)	25	30	95	150
Total	145	80	175	400

After verifying the above record, the decision maker has to take an optimal decision using fuzzy ingredients.

i.e. the decision maker has to select one of the three departments for conducting remedial classes.

Solution

The three courses of fuzzy alternatives (actions) are

A_1- Students belonging to the department of English
A_2- Students belonging to the department of Mathematics
A_3- Students belonging to the department of Commerce

The three possible fuzzy states of nature are

F_1-Below average marks
F_2- Average marks
F_3-Above Average marks

The prior probabilities for each of these fuzzy states are

$P(s_1) = 0.3$
$P(s_2) = 0.4$
$P(s_3) = 0.3$

Consider each department as x_1-Tamil; x_2-English; x_3-Mathematics; x_4-History; x_5-Economics; x_6-Physics; x_7-Chemistry; x_8-Social Work; x_9-Computer Science; x_{10}-Commerce.The utilities of x_2,x_3 &x_{10} are

assessed by the decision maker in non-dimensional units are given in table 2. Hence, the utility values for this situation is given by

Table II: Utilities for fuzzy states and alternatives

u_{js}	F_1	F_2	F_3
A_1	10	8	9
A_2	7	3	-7
A_3	4	-3	8

Consider a fuzzy information system,

$M = \{M_1, M_2, M_3\}$

Where M_1- Marks is less than 40
M_2- Marks between 40&50
M_3-Marks is more than 50

The membership value for each orthogonal fuzzy state is given in Table 3. The fuzzy set in the below table satisfy the orthogonality condition, for the sum of each column equals 1,

$$\text{i.e. } \sum_{s} \mu_{Fs}(s_i) = 1$$

Table 3: Orthogonal fuzzy sets for fuzzy states

μ_{Fs}	S_1	S_2	S_3
F_1	1	0.5	0
F_2	0	0.5	1
F_3	0	0	0

Calculate the prior probabilities for fuzzy states using eqn.,(5)

i.e$P(F_1) = (1)(0.3) + (0.5)(0.4) + (0)(0.3) = 0.5$

Similarly $P(F_2) = 0.5$ and $P(F_3) = 0$

Therefore, the expected utility using equation (4) is given by

$$E(u_j) = \begin{pmatrix} 9.0 \\ 5.0 \\ 0.5 \end{pmatrix}$$

The optimum expected utility of the fuzzy alternatives (actions) using equation (6) is $E(u^*) = 9.0$

So alternative A_1, is the optimum choice. Hence on the basis of prior information only (prior probabilities) the decision maker take an optimal decision.

IV. CONCLUSION

This paper concludes that the decision maker decides to conduct remedial classes for the weak students belonging to the department of English, BDUCC(W), Orathanadu, Thanjavur district, Tamil Nadu, South India using fuzzy ingredients. By conducting this kind of remedial class the weak students will definetly got the clear idea about their subject.

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