FUZZY LOGIC - DECISION MAKING

https://www.tutorialspoint.com/fuzzy_logic/fuzzy_logic_decision_making.htm

It is an activity which includes the steps to be taken for choosing a suitable alternative from those that are needed for realizing a certain goal.

Steps for Decision Making

Let us now discuss the steps involved in the decision making process –

- **Determining the Set of Alternatives** – In this step, the alternatives from which the decision has to be taken must be determined.

- **Evaluating Alternative** – Here, the alternatives must be evaluated so that the decision can be taken about one of the alternatives.

- **Comparison between Alternatives** – In this step, a comparison between the evaluated alternatives is done.

Types of Decision

Making We will now understand the different types of decision making.

Individual Decision Making

In this type of decision making, only a single person is responsible for taking decisions. The decision making model in this kind can be characterized as –

- Set of possible actions

- Set of goals $G_i \, (i \, \in \, X_n)$;

- Set of Constraints $C_j \, (j \, \in \, X_m)$

The goals and constraints stated above are expressed in terms of fuzzy sets.

Now consider a set A. Then, the goal and constraints for this set are given by –

$$G_i \, (a) \, = \text{composition}[G_i \, (a)] = G_i^1 \, (G_i \, (a)) \text{ with } G_i^1$$

$$C_j \, (a) \, = \text{composition}[C_j \, (a)] = C_j^1 \, (C_j \, (a)) \text{ with } C_j^1 \quad \text{for } a \, \in \, A$$

The fuzzy decision in the above case is given by –

$$F_D = min[i \in X_n^{in} f G_i \, (a) \, , j \in X_m^{in} f C_j \, (a)]$$

Multi-person Decision Making

Decision making in this case includes several persons so that the expert knowledge from various persons is utilized to make decisions.

Calculation for this can be given as follows –

Number of persons preferring x_i **to** x_j = $N\left(x_i,\ x_j\right)$

Total number of decision makers = n

Then, $SC\left(x_i,\ x_j\right) = \frac{N(x_i,\ x_j)}{n}$

Multi-objective Decision Making

Multi-objective decision making occurs when there are several objectives to be realized. There are following two issues in this type of decision making –

- To acquire proper information related to the satisfaction of the objectives by various alternatives.

- To weigh the relative importance of each objective.

Mathematically we can define a universe of n alternatives as –

$$A = [a_1,\ a_2,\ \ldots,\ a_i,\ \ldots,\ a_n]$$

And the set of "m" objectives as $O = [o_1,\ o_2,\ \ldots,\ o_i,\ \ldots,\ o_n]$

Multi-attribute Decision Making

Multi-attribute decision making takes place when the evaluation of alternatives can be carried out based on several attributes of the object. The attributes can be numerical data, linguistic data and qualitative data.

Mathematically, the multi-attribute evaluation is carried out on the basis of linear equation as follows –

$$Y = A_1X_1 + A_2X_2 + \ldots + A_iX_i + \ldots + A_rX_r$$