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An Application of Fuzzy Logic for Expert Selection

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Abstract

Decision making is one of the most fundamental activities of human beings. Every one faces various situation and selection among varieties of alternatives available to us. Most of the times we need to select the most appropriate one. This is nothing but the process of decision making. Decision making is the study of how decisions are made and how decisions are actually made better or more successful. Selection is the process that an organization used to choose the most suitable one for the requirements. Effective selection is depends on effective matching. The situation of selection of expert is surrounded by many uncertain conditions going in and around the organization. Process involves many uncertain conditions in between. The study proposes the use of fuzzy logic and fuzzy decision making for the selection of best suitable person without extra workload. Allocation of suitable human resource for the new project is accomplished using fuzzy decision making method.

Keywords

Fuzzy Logic, Fuzzy inference system, Ant Colony Optimization, Selection process, Fuzzy Selection, Fuzzy Decision Making.

1. Introduction

Selection is the process that an organization used to determine which expert is more suitable for the requirements. It is worth undertaking rigorous job analysis as the consequences of selection mistakes can be very costly to the organization [1]. Selecting expert whose skill sets are mismatched can lead to increase cost for the organization and lowering of the morale in the existing workforce. Under such situation organization suffers from all the way. Expert may fail to offer the flexibility and commitment that many organizations seek. Managers and supervisors will have to spend extra time on future arrangements. Expert selection is the process of putting right men on the right job. It is a procedure of matching projects needs with the skills and qualification of the expert.

Effective selection can be done only when there is effective matching. By selecting right expert at right job the organization will get quality performance of employees. Moreover organization will face less absenteeism and employee turnover problem. By selecting right person at the right job organization will save time and money. Selection will include choosing the best expert with best suitable and required abilities, skills and knowledge.

The situation of selection of expert is surrounded by many uncertain conditions going in and around the organization. Especially the problem is very simple and can be accomplished by assigning the job to the required expert having proficiency in that particular domain. But actually the situation is not so straightforward always. The process involves many uncertain conditions coming in between. May be that expert is not available due to pre occupied schedule or some unavoidable circumstances. Recruiting or outsourcing the particular task or a person is not favourable for the organization in the long run as well as underestimating the available expert pool of the organization. Under such circumstances the expert who may not be very good but good in the required skill set and is available can assign to the job and hence optimum utilization of the available expert pool.

The study proposes the use of Fuzzy logic and fuzzy decision making process for expert selection. The fuzzy individual decision making process gives the alternatives of available expert with moderate work load and decision maker can use this information for effective human resource selection. The application of fuzzy decision making reduces the workload for decision maker. This study is more helpful for management people and decision maker as the optimum selection without increasing workload that indirectly helps to improve employee satisfaction level to boost the activity of employee retention.

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2. Decision Making

Decision making is a continuous process in our day to day life. Whether you are a normal person or a famous entrepreneur decision making is a routine work. The success in life as well as in business is majorly depends on our correct decision. Problem solving is nothing but making a good decision and implementing it. A good decision maker always make a note of decision made, risk available and impact of the decision for his/her future reference. A good decision maker is a good leader. There are various methods and techniques are available to improve our decision making skill as well as the quality of decisions.
People often find it hard to make decisions inevitably we all have to make decisions all the time, some are more important than others.
In simple words we can say Decision Making is the act of choosing between two or more courses of action.

The stages of decision making mainly involve:

- Naming the available alternatives.
- Defining a time constraint.
- Collecting related information.
- Calculating the risk.
- Determining the priorities
- Weighing up the pros and cons of each course of action.
- Concluding to final decision

It must always be remembered that there may not always be a 'correct' decision among the available choices. There may have been a better choice that had not been considered, or the right information may not have been available at the time.
Top managers especially working for a big company mostly involve in the process of decision making. When the information is huge and quick selection is needed, one finds it very difficult to make accurate decision. Decision making process is largely depends on the information available. Only a small portion of the knowledge/information for a typical problem might be regarded as certain or deterministic [2].

In this paper we are using Fuzzy Individual Decision Making method suggested by Bellman and Zadeh [1970].The relevant goal and constraints are expresses in terms of fuzzy sets, and a design is determined by an appropriate aggregation of these fuzzy sets.

3. Selection Process

Selection is the process of choosing the best option among the various alternatives present at that situation. Selection process is mainly studied under the subject Human Resource. Selection in day to day life is depends on our personal likings i.e. we choose the thing which we like the most according to its character, colour shape, fragrance, taste etc. But in organizations and in practical life these options of selections are not suitable. Here we need to make decision wisely.
In our proposed study we need to choose the best expert and with moderate workload. We are going to accomplish it by first finding the experts who math to the skill set criteria and finding out their workload. Selection is very simple i.e. the highly expert with available condition or having a moderate workload is the first choice. If such alternative is not found then the various options are taken under considerations the expert whose skill sets are matched to the requirement as well as who are having a moderate or low workload. This will only give the various options available after all allotment are totally depends on decision maker.

4. Fuzzy Logic

Fuzzy Logic was initiated in 1965 by Lotfi A. Zadeh, professor for computer science at the University of California in Berkeley. Fuzzy Logic depends on the fuzzy set; a fuzzy set is a class of objects with a continuum of grades of membership [3]. Fuzzy set provides a mathematical way to represent vagueness and fuzziness in humanistic systems [2]. Before the proposal of fuzzy logic and fuzzy set theory people were working on conventional logic which is called Binary logic or Boolean logic. This conventional logic was dependent on only two values 0 or 1 i.e. true or false, in simple language Black or white. Fuzzy logic comes with something new which already present but was neglected due to limitations in conventional logic, it says that there may be many gray shades in between the black and white colour. Fuzzy logic is having the capacity to deal with the uncertain situation which is applicable to the real life problems. This is the attempt of giving human like touch way of thinking and implementing it in the computer programs. The main contribution of Fuzzy Logic is a methodology for computing with words [4].

So many changes occur in the last century and the concept of uncertainty was one of the important

changes happens in the field of science. In conventional science there was no space for uncertainty, it said it should be avoided. But proposal of fuzzy logic break down the traditional view and a new alternate view comes to an existence that presence of uncertainty and it is unavoidable. This is the birth of new thinking, a modern view of certainty which is considered and important to science. It is unavoidable and has a great utility.

In our study we are using fuzzy logic rather than the conventional logic because of so many uncertain situations may arise related to experts and their workloads.

5. Proposed Study

Organization's success depends on employee's job satisfaction and job satisfaction depends on the type of work done. Job satisfaction is simply how people feel about their jobs and different aspects of their jobs [6]. This is one of the major concerns of our study i.e. best skill set with balanced work load. The process in reality starts after project verification. If it passes through this preliminary stage then it is considered as a new project arrival and proceeds to the next stage which leads to the stage of requirement verification. This requirement verification stage includes listing of all required resources. Consider if it is a very big organization and with huge human resource under such situation computerisation of selection process to certain extent is helpful. Computer systems development professionals are forced to deal with a staggering amount of change, generated at an unbelievable speed and increasing in complexity with every passing day [7]. Latest database technologies like data warehousing and data mining are very much helpful in handling huge database. Data warehouse is the huge storage of organization's huge database and data mining is the extraction of hidden predictive information from large database a powerful technology with great potential to help companies focus on the most important information in their data warehouse [8].

The real work of our study begins from this stage i.e. the third stage. The outcome of the second stage is enlisting all the eligible resources men, machine, money etc. At this level we are advocating the usage of fuzzy logic for effective selection. Apart from various resources our major concern is selection of proper human resource i.e. selection of the highly skilled expert along with less work load. Main purpose of the study is to balance the work load and skill set.

Figure 1: various stages of the process

We are explaining the study with one example of a small scale software industry having six software programmer expert in various software like Java, .NET, C++ and Oracle. The company develops the projects using these application software and languages. All programmers are well known about these languages and software but expert in selected one.

Our next step includes making the list of experts according to their core competency. We have grade all the six programmers (experts) on 10 point scale i.e. 10 to 9 point highly expert, 8 to 7 Moderate expert and then less expert (Chart 1). Next step is to make the chart of work load against total number of project actually running in the industry. In this example there are total six projects running at a time.

Consider the chart 2 which shows the corresponding workload of every programmer.

Now our concentration is to match the matrix of highly expert (HE) -moderate expert (ME) to Available- Busy.

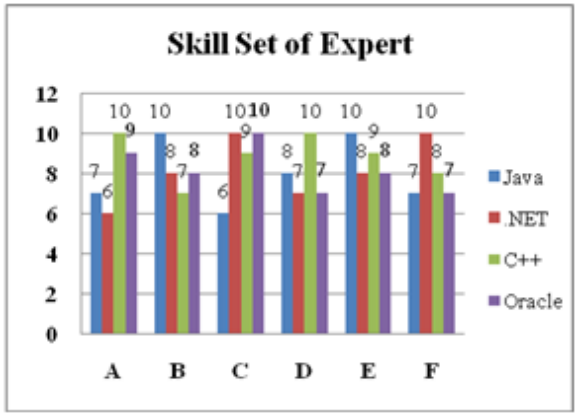

Chart 1: Skill set of experts on 10 point scale

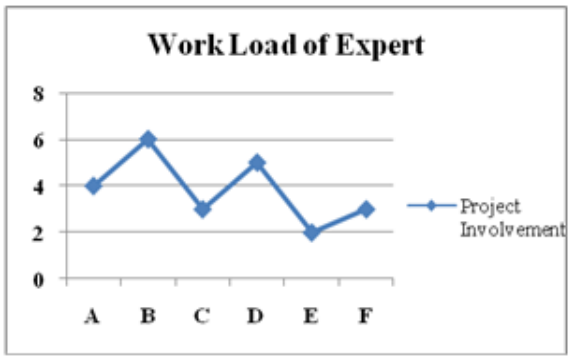

Chart 2: Work load of experts

6. Fuzzy Decisions

According to the skill sets and the availability of experts we will have the following linguistic variables:

Availability of Experts

- Extremely busy (EB)
- Very busy (VB)
- Busy (B)
- Slightly busy (SB)
- Available (A)

Skill Set

- Highly Expert (HE)
- Moderate Expert (ME)
- Less Expert (LE)

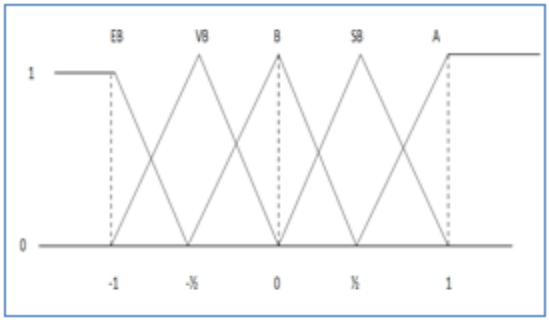

Figure 2: Possible fuzzy quantization of the range [-1, 1] by triangular-shaped fuzzy numbers

We will follow the individual decision making model suggested by Bellman and Zadeh. This model is characterized by the following components:

1. A set A of possible action.

   $A = \{\text{allocation: } a_1, a_2 \ldots an\}$

2. A set of goals G_i ($i \epsilon N_n$) each of which is expressed in terms of a fuzzy sets defined on A

   $G_i = \{\text{highly expert}\}$

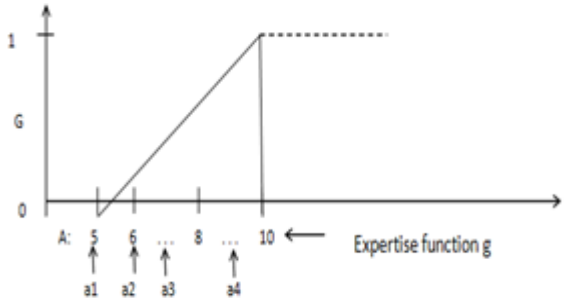

Figure 3 : Expertise function

1. A set of constraint C_j ($j \epsilon N_m$) each of which is also expressed by a fuzzy set defined on A
   $C_j = \{\text{available}\}$

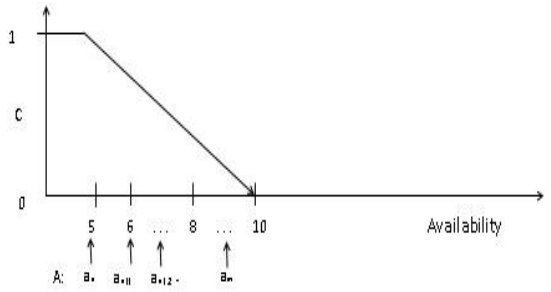

Figure 4 : Availability function

Aim of the study is to find available highly expert and suggest to the decision maker. This study will give the various options and will definitely help and reduce the valuable time of decision maker and will increase the job satisfaction level of employees. We are living in the era of knowledge management system where tremendous data is stored daily and is retrieving whenever we need it without wasting time. In such condition the best hardware technology along with compatible software is needed. Here the concept of our study is explained using example of few project and experts but same can be extended for huge organization. Even if the data is tremendous the searching and updating must be fast which the extended study of our work.

7. Conclusion and Future Work

Selection of the right person was always a prime concern of any industry. We have described our study using the example of a software industry but this can be implemented to any kind of industry. The application of fuzzy logic in various sectors is increasing day by day because of its ability of decision making nearer to human being. Consideration of work load at the time of project allotment boost the feeling of job satisfaction. Retaining present employee is very important for any industry and for that job satisfaction is very important. Justifiable work for all level definitely creates a positive environment within the industry. The study just gives the possible selection to the decision maker; from the various possibilities decision maker will chose the best. This study proposes the use of fuzzy logic for time saving and effort reducing of decision maker by making available the various options on his/her finger tip.
Optimum selection can be accomplished using Ant Colony Optimization Technique., the application of this algorithm will improve the process of selection.

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