Chapter 10

A Study and Estimation of Different Distance Measures in Generalized Fuzzy TOPSIS to Improve Ranking Order: An Application of Fuzzy TOPSIS on Banking Business

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ABSTRACT

Multi criteria decision making (MCDM) is used to solve multiple conflicting criteria. There are different methods available in MCDM out of which TOPSIS is a well-known method to solve precise and imprecise information. In this chapter, triangular fuzzy TOPSIS is considered which has different steps like normalization, weight, finding of positive ideal solution (PIS) and negative ideal solution (NIS), distance between PIS and NIS, calculating relative closeness coefficient (RCC) value and ranking the alternatives. Out of these different steps a distance method is studied. The distance measures are basically used to find the distance between the target alternative and the best and the least alternatives. The most commonly used distance method is Euclidean distance. Many other distance methods are available such as Manhattan, Bit-vector, Hamming, Chebyshev distance, etc. To obtain the appropriate distance, these methods are evaluated. The proposed approach is applied in banking domain to find the suitable user for multi criteria reporting (MCR).

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1. INTRODUCTION

Multi Criteria Decision Making (MCDM) is one of the fastest growing areas of decision making with multiple conflicting criteria (conditions). It ranks the users (alternatives) according to different criteria and finds the best alternative (Xiaojun, 2015). A MCDM technique analyzes weights of all the criteria with one another, ranks it through its processes and finds the best alternative (Beatrice & Francesco, 2015). Hence this characteristic of MCDM technique is applied to find different levels of user preference for MCR. The recent developments and advancements in computer have simplified the computations associated with MCDM techniques.

The popularly applied MCDM methods are Analytic Hierarchy Process (AHP) (Pedro, 2013), Elimination and Expressing Reality (ELECTRE) (Arshadi, 1987), Grey Relational Analysis (GRA) (Ashton, 1998), Technique for Order Preference by Similarity to an Ideal Solution (TOPSIS) (Yong, 2006), (Shih & Lee, 2007), Preference Ranking Organization Method for Enrichment Evaluation (PROMTHEE) (Patrick & Serge, 2011) and so on. TOPSIS is one of the most popularly applied MCDM techniques which works based on the principle of distance between Positive Ideal Solution (PIS) and Negative Ideal Solution (NIS) (Zadeh, 1965). The logic which is applied to TOPSIS resembles with human rationale choice (Shih & Lee, 2007) and it solves simple and complex problems with conflicting criteria (Hwang & Yoon, 1981; Yong, 2006). It is considered as one of the best technique to address “total rank reversal” which is widely experienced problem in MCDM technique.

Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) is one of the known classical Multiple Criteria Decision Making (MCDM) method was first developed by (Hwang & Yoon, 1999). It is based upon the concept that the chosen alternative should have the shortest distance from the Positive Ideal Solution (PIS), i.e., the solution that maximizes the benefit criteria and minimizes the cost criteria; and the farthest from the Negative Ideal Solution (NIS), i.e., the solution that maximizes the cost criteria and minimizes the benefit criteria.

A MCDM technique consists of different kinds of steps. For example, in TOPSIS the best alternative is ranked using six processes. These processes are normalized in the decision matrix, multiply weight with the matrix, determine the positive and negative ideal solution, obtain the distances of the existing alternatives from the positive and negative ideal solutions, calculate the relative closeness to the ideal alternatives and finally rank the alternatives.

Among these processes, the distance plays a vital role in finding the better alternative and the least alternative. It measures the distance between positive ideal and negative ideal solution. TOPSIS identifies the better alternative based on the concept that the chosen alternatives should have the two types of distance such as shortest geometric distance from the positive ideal solution and longest geometric distance from the negative ideal solution. Hence, a study on distance measure analysis is required to find the alternative method for distance measures.

From the literature it has been found that, generally three kinds of distance methods are applied in MCDM techniques. These techniques are Manhattan vertex method, Chebyschev vertex method and Euclidean vertex method. In this research, these three distance methods are applied in TOPSIS and ranking order is evaluated using MCDM evaluation parameters. From this evaluation better distance method is identified. In order to apply these distance methods, a case study is conducted on banking business. In this case study, a suitable user is identified to customize the multi criteria reporting for banking business. Today banks have different kinds of information. These information have to be delivered to a banking user as customized report according to their requirement and preference. It is called as Multi