Multiple Attribute Group Decision Analysis for Intuitionistic Triangular and Trapezoidal Fuzzy Numbers

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ABSTRACT

Solving Multiple Attribute Group Decision Making (MAGDM) problems has become one of the most important researches in recent days. In situations where the information or the data is of the form of an Intuitionistic Triangular Fuzzy Number (ITrFN) or Intuitionistic Trapezoidal Fuzzy Number (ITzFN), a new distance function is defined for ranking the alternatives in the decision making process. After processing the decision information through a sequence of arithmetic aggregation operators, namely, the Intuitionistic Triangular Fuzzy Weighted Arithmetic Averaging (ITrFWAA), Intuitionistic Triangular Fuzzy Ordered Weighted Averaging (ITrFOWA) operator and the Intuitionistic Triangular Fuzzy Hybrid Aggregation (ITrFHA) operator, the proposed distance function is utilized to rank the best alternative. A model is proposed to solve MAGDM problems using the developed distance formula defined for ITrFNs. Numerical illustration is provided and comparisons are made with some of the existing MAGDM models and ranking procedures.

KEYWORDS

Group Decision Analysis, Intuitionistic Triangular Fuzzy Hybrid Aggregation (ITrFHA) Operator, Intuitionistic Trapezoidal Fuzzy Number (ITzFN), Intuitionistic Triangular Fuzzy Number, MAGDM

INTRODUCTION

Multi-Attribute Group Decision Making (MAGDM) problems are of importance in most kinds of fields such as engineering, economics and management. It is obvious that much knowledge in the real world is fuzzy rather than precise. Imprecision comes from a variety of sources such as unquantifiable information (Li & Nan, 2011). In many situations decision makers have imprecise/vague information about alternatives with respect to attributes. One of the methods which describe imprecise cases is the fuzzy set (FS) introduced by Zadeh, (1965). It is well known that the conventional decision making analysis using different techniques and tools has been found to be inadequate to handle uncertainty of fuzzy data. To overcome this problem, the concept of fuzzy approach has been used in the evaluation of decision making systems. Multi attribute group decision making (MAGDM) problems are widespread in real life decision making situations. A MAGDM problem is to find a desirable solution from a finite number of feasible alternatives assessed on multiple attributes, both quantitative and qualitative. In order to choose a desirable solution, the decision maker often provides his/her preference information which takes the form of numerical values, such as exact values, interval number values and fuzzy numbers. However, under many conditions, numerical values are inadequate or insufficient to model real-life decision problems. Indeed, human judgments including preference information may be stated in intuitionistic fuzzy information, especially in intuitionistic triangular fuzzy information.
Hence, MAGDM problems under an intuitionistic fuzzy or intuitionistic triangular fuzzy environment is an interesting area of study for researchers in the recent days.

In real life, a person may consider that an object belongs to a set, to a certain degree, and also it is possible that he is not sure about it. In other words, the person has hesitation about the membership degree. In classical fuzzy set theory there is no means to incorporate this hesitation regarding the degree of suitability to which each alternative satisfies the decision maker’s requirement. To include the unknown degree in the membership function of fuzzy sets, Atanassov, (1986; 1989; 1994) introduced the concept of intuitionistic fuzzy sets (IFSs), which is the generalization of the concept of fuzzy sets (Atanassov, 1989). Out of several higher-order fuzzy sets, IFSs, first introduced by Atanassov, (1986) has been found to be compatible to deal with vagueness. The concept of IFS can be viewed as an alternative approach to define a fuzzy set in cases where the available information is not sufficient for the definition of an imprecise concept by means of a conventional fuzzy set. In fuzzy sets only the degree of acceptance is considered, but IFS is characterized by a membership function and a non-membership function, so that the sum of both values is less than one (Atanassov, 1986).

Presently IFSs are being studied and used in different fields of science. Among the works done in IFSs, Atanassov (1986, 1989, 1994), Atanassov & Gargov, (1989), Szmidt & Kacprzyk, (2000; 2002; 2003), Gerstenkorn & Manko, (1991) can be mentioned. With best of our knowledge, Burillo et al., (1994) proposed the definition of intuitionistic fuzzy number (IFN) and studied the perturbations of IFN and the first properties of the correlation between these numbers.

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