A STUDY ON GENERALIZATIONS OF SOFT SETS

ABSTRACT

Submitted by

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ABSTRACT

Most of the problems in economics, environment, science and engineering are deals with uncertainty and decision making. The uncertainty arises in the form of ambiguity and lack of information about the data. Decision making is the problem of choosing the optimal choice which suits the physical nature of the problem. In these situations a tool such as soft set, which deals with uncertainty and rich in handling the parameters will analyze the problem effectively and gives a much better solutions.

The main objective of this research is to study the generalizations of soft sets and their application in decision making problems. This research agenda includes investigation on a similarity measure and a Mean Potentiality Approach (MPA) of Intuitionistic Fuzzy Soft Sets (IFSSs), discussions on decision making in medical diagnosis problems. This novelty research helps to find the performances of Generalized Fuzzy Soft Rough (GFSR) matrices, on fuzzy soft sets and Fuzzy Parameterized Soft Fuzzy (FPSF) matrices, on soft fuzzy sets which facilitate to the problems in decision making. Further, the ultimate aim is to present theoretical aspects of Ordered Intuitionistic Fuzzy Soft (OIFS) sets and union-soft sets, and that enhance the flexibility of its applications.

This research provides a platform for such kinds of soft sets and helps to conclude the decision in real life applications. The effectiveness of these methods is demonstrated with a numerical example. Hence, the decisions which are based on the different kinds of soft sets, are more reliable, dependable, and are also more consistent.

Chapter 1 depicts the origin and history of soft set concepts. It clearly expounds the operations in both soft set and fuzzy soft set theory. Also, it provides with the objectives and summary of the research work.

Chapter 2 emphasizes on the similarity measures between two IFSSs. A new similarity measure and a weighted similarity measure on IFSSs are proposed and some of their basic properties are discussed. Using this proposed similarity measure, a relation $(\approx^{\alpha})$ between two IFSSs are defined and it has been found that the defined relation is not an equivalence relation. Further, the optimality criteria for the decision making problem using the proposed method are stated and performance analysis of the method is discussed through a measure of performance and measure of error. The effectiveness of the proposed method is demonstrated with a numerical example based on performance analysis. Moreover, medical diagnosis problems have been exhibited through a hypothetical case study by using this proposed similarity measure.

Finally, the proposed method is applied to ten different medical data sets from UCI Machine Learning Repository datasets and its similarity measures are calculated. The corresponding performance measures, like, accuracy, sensitivity, specificity, ROC curves, AUC values, and F-measures are obtained and it is compared with the existing methods. This shows that the proposed method exhibits more accuracy, sensitivity and enhanced F-measures than the existing methods.

Chapter 3 deals with the concept of Mean Potentiality Approach for a balanced solution of an IFSS based decision making problem, using level soft sets. The importance of this approach is to obtain the appropriate level to get the level soft of an IFSS. Further it deals with optimality criteria for a balanced solution of an IFSS based decision making problems and the definition of the measure of performance of IFSS is introduced. The concept

of mean potentiality approach was defined and an algorithm based on this approach to get a balanced solution of an IFSS based decision making problems are developed. Moreover, a parameter reduction procedure has been used to reduce the choice parameter set with the help of the balanced algorithm of mean potentiality approach. The proposed method is compared with the well known existing methods of IFSSs, and the effectiveness of the proposed method has been demonstrated through medical diagnosis problem.

Chapter 4 discusses the Generalized Fuzzy Soft Rough (GFSR) matrices and their operations which are more essential to make theoretical studies in the fuzzy soft rough sets. Further, based on the analysis of generalized fuzzy soft rough matrices, several algebraic properties and famous De Morgan's inclusions and De Morgan's laws are established. Using the notions of generalized fuzzy soft rough matrices, a novel method for choosing an optimum choice in a multi criteria decision making problem is developed. The proposed method is compared with the well known existing methods of fuzzy soft matrices, and the effectiveness of the proposed method has been demonstrated through numerical example.

In chapter 5, Fuzzy Parameterized Soft Fuzzy (FPSF) sets are introduced and some of their basic properties are studied. Further, the notion of FPSF matrix is introduced, by using FPSF aggregation operator, which can be applied for decision making problems. Finally, by using FPSF matrix, a FPSF decision making algorithm is developed and implemented through numerical example.

Chapter 6 provides some new basic operations and results of Ordered Intuitionistic Fuzzy Soft (OIFS) sets, such as equality, complement, subset, union, intersection, OR, and AND operators along with several examples. Further, based on the analysis of several operations on OIFS sets, numerous algebraic properties and famous De Morgan's inclusions and De Morgan's

laws are established. Finally, using the notions of OIFS sets, an algorithm is developed and implemented in a numerical example.

The theoretical aspects of union-soft sets by extending the notions of equivalence relations, partition, composition of relations, and function to the framework of union-soft sets are introduced in chapter 7. Further the Cartesian product, the relation between union-soft sets, induced relations from the universal set and the attribute set with examples are discussed.

Chapter 8 summarize the work that has been done to analyse the generalizations of soft sets and their application in decision making problems. It addresses certain future research directions in executing the realistic uncertainty problems such as problems in social system, economic system, pattern recognition, feature extraction, image processing, game theory, coding theory, etc. This research is also desirable to be further progressed on to the next level of soft sets.