

Chapter 13

Comparative Analysis of Hybrid Soft Set Methods

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ABSTRACT

The whole mathematical scenario has changed with the advent of the Rough Set Theory, a powerful tool to deal with uncertainty and incompleteness of knowledge in information system. With the advancement of research, the Soft Set Theory has emerged as an advanced mathematical tool to deal with data associated with uncertainty. The present chapter endeavors to forge a connection between soft set and rough set and maps a new model rough soft set to address the challenges of vagueness and impreciseness. Although the research contribution of M. Irfan Ali, Dan Meng, et al. and Feng Feng et al. had given distinct definition of rough soft set and soft rough set, the analysis explaining the genesis of these sets is not appropriate. This chapter is a new attempt to construct the relationship between a rough set, soft set, and fuzzy set to form a hybrid soft set giving a concrete comprehensive definition of rough soft set in border perspective.

INTRODUCTION

The introduction and application of theories like probability theory, fuzzy set theory (L.A.Zadeh,1965,1975), Rough set theory (Z.pawlak,1982,1991) as the mathematical tools have strengthened the efficacy of knowledge to deal with uncertainties. However some difficulties crop up when we apply them to solve complicated problems in economics, engineering and environmental sciences. In order to overcome

the difficulties in certain extent Molodtsov (D. Molodtsov,1999) introduced the concept of soft set which is considered as new mathematical tool to address uncertainties. Recently research on soft set theory and its application in various field is going on. Several operators of set theory have been introduced, as a result notion of soft groups including algebraic structures of soft sets, notion of soft topological spaces are emerged. Molodtsov in his paper has demonstrated that soft set theory has potential applications in different

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fields including the smoothness of functions, game theory, operation research, perron integration, probability theory and measurement theory. This paper seeks to explore the basic concepts of fuzzy set, rough set and soft set . Further it introduces the new concept rough soft set, the hybrid model combining rough set with soft set. Rough soft set can be used for many practical application based on rough set or soft set. Based on Pawlak approximation space, the approximation of a soft set is proposed to obtain a hybrid model called rough soft set. Alternatively, a soft set instead of an equivalence relation can be used to granulate the universe. Granulation involves decomposition of whole into parts, organisation involves integration of parts in to whole and causation involves the association of causes and effects.

The paper makes an honest attempt to define fuzzy set, rough set and soft set and then their combinations. The intention of fuzzy set theory introduced by L.A.Zadeh (1965) is to generalize the classical notion of a set and notion of graded membership which represents fuzziness . Zadeh writes “the notion of a fuzzy set provides a convenient point of departure for the construction of a conceptual framework which parallels in many respects and framework used in the case of ordinary sets, but is more general then the later and potentially, may prove to have much wider scope of applicability, particularly in the field of pattern classification and information processing. Essentially, such a framework provides a natural way of dealing with problems in which the sources of imprecision is the absence of sharply defined criteria of class membership rather than the presence of random variables.”

LITERARY BACKGROUND

In the present context the theory of fuzzy set is advancing fast in geometrical progression. But difficulty arises to set the membership in each

particular case. The nature of the membership function is extremely individual. The fuzzy set operations with membership functions sometimes do not appear natural. To avoid these difficulties, a mathematical tool, called as soft set theory, is developed to deal with uncertainties. In 1999, soft set theory was derived by D.Molodtsov as:

Let U be an initial universe and let E be the set of parameters. A pair (F,E) is called a soft set over U when F is a mapping from E into the set of subsets of U .

Thus a soft set is a parameterized family of subsets of set U .

In 2003 an article “soft set theory” was published by P.K.Maji and others [P.K.Majhi,R. Biswas and A.R.Roy,2003] which strengthened the soft set analysis [P.K.Majhi,R. Biswas and A.R.Roy,2002]. Then the researchers made the research on soft set, soft groups, fuzzy soft set, fuzzy soft group and the combination of soft set, fuzzy set and rough set.

Z.Pawlak introduced Rough set theory a mathematical tool, to deal with uncertainty, vague and imprecise problems. The idea of the rough set consists of the approximation of a set by a pair of sets, called the lower and the upper approximation of their set. The rough set approach is based on knowledge to become agent of some reality and its ability to discern some phenomena, process, object etc.

According to Pawlak , knowledge is based on the ability to classify the objects, and by objects we mean anything.

A knowledge representation system (or an information system) is a pair (U, A) where U is a non empty, finite universe of discourse and A is a set of attributes; each attribute $a \in A$, is a function $a : U \rightarrow V_a$ is the set of values of an attributes a .

In this knowledge century a lot of developments have made combining these three theories by the eminent researchers. It yields soft groups, soft rings, soft topology, vague soft sets, fuzzy

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