

REVIEW OF LITERATURE

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In 1999, Russian researcher Molodtsov initiated a novel concept of soft set theory, which is completely a new approach for modeling vagueness and uncertainties. Soft set theory has a rich potential for application in solving practical problems in Economics, Social Science, Medical Science etc. Applications of soft set theory in real life problems are now catching momentum. Molodtsov successfully applied soft set theory into several directions, such as Smoothness of Functions, Game Theory, Operations Research, Riemann Integration, Perron Integration, Theory of Probability, Theory of Measurement and so on.

Maji et al. (2002) gave first practical application of soft sets in decision making problems. Pei and Miao (2005) investigated the relationships between soft sets and information systems. Maji-Biswas-Roy (2003) presented the operations of soft sets and constructed a uni-intdecision making method by using these new operations and developed soft set theory. Then to make easy compaction with the operations of soft sets, they presented the soft matrix theory and set up the soft maximin decision making method (2010). These decision making methods can be successfully applied to many problems that contain uncertainties.

Many researchers have contributed towards the algebraic structure of the soft set theory. The application of the soft set theory in algebraic structures was introduced by Aktas and Cagman (2007). They established the basic notions of soft groups as a generalization of the idea of fuzzy groups. Feng et al. (2008) worked on soft semirings, soft ideals and idealistic soft semirings.

Shabir and Naz (2011) introduced the notion of soft topological spaces which are defined over an initial universe with a fixed set of parameters. They studied some basic concepts of soft topological spaces and also some related concepts such as soft interior, soft closure, soft subspace and soft separation axioms.

Sai and Srinivasa Kumar (2013) introduced soft semi-open sets and some related concepts by following Cagman's theory of soft topology and introduced a soft semitopology on a soft set.

Peyghan, Samadi, Tayebi (2012) introduced the concept of soft connectedness and studied their properties.

In 2012, Banu Pazar Varol, Halis Aygun introduced Hausdorff axiom in soft topological spaces.

Zorlutuna et al. (2011) introduced the concept of soft compactness and studied their basic properties.

The concept of soft sets enhanced the application potential of the different generalizations of crisp sets due to the additional advantage of parameterization tools. Various generalizations of closed and open sets in topological spaces and fuzzy topological spaces are of recent developments. Juthika (2003) introduced semiopen and semiclosed soft sets and studied various properties and notions related to these structures.

Topological studies of fuzzy soft sets were started by Tanay and Kandemir in [2011]. They gave the notion of fuzzy soft topology for the first time by defining it as a collection of fuzzy soft subsets of an arbitrary fuzzy soft set. They also introduced some basic definitions in this new space.

Neog et al. (2012) studied some properties related to Fuzzy soft topological spaces and some theorems have been established in their work.

Separation axioms and connectedness are introduced by Mahanta and Das (2012) and studied their basic properties.

Ismail Osmanoglu and Deniz Tokat (2013) introduced the concept of Fuzzy soft compactness and studied their basic properties.

Mahanta (2014) introduced semiopen and semiclosed Fuzzy soft sets in Fuzzy soft Topological spaces and studied various properties of these sets along with some characterizations.

Soft sets, Soft Topological spaces, Fuzzy Soft sets and Fuzzy Soft Topological spaces has become an important area of research in different disciplines such as Engineering, Medical Science, Social Science, Physics, Statistics, Graph Theory, Signal Processing, Pattern Recognition, Computer Networks, Expert Systems, Decision Making and so on.

The following are some of the articles published on soft sets, Fuzzy soft sets, soft topological spaces and Fuzzy soft topological spaces:

1. “Soft set theory – first results”

Molodtsov, D. (1999) [41]

The soft set theory offers a general mathematical tool for dealing objects. The basic notions of the theory of soft sets are introduced, the first results of the theory are presented and some problems of the future are discussed.

2. “From soft sets to information systems”

Daowu Pei and Duoqian Miao (2005) [18]

This paper discusses the relationship between soft sets and information systems. It is showed that soft sets are a class of special information systems. After soft sets are extended to several classes of general cases, the more general results also show that partition – type soft sets and information systems have the same formal structures and that fuzzy soft sets and fuzzy information systems are equivalent.

3. “Distance and similarity measures for soft sets”

Athar Kharal (2010) [4]

In this paper, new similarity measures for soft sets using set theoretic operations are proposed. An application of the proposed measures of similarity in the area of automated financial analysis is also presented.

4. **“Matrices in soft set theory and their applications in decision making problems”**

Tanushree Mitra Basu, Nirmal Kumar Mahapatra and Shyamal Kumar Mondal (2012) [61]

The purpose of this paper is to define different types of matrices in soft set theory. We have introduced here some new operations on these matrices and discussed here all these definitions and operations by appropriate examples. Moreover a new efficient solution procedure has been developed to solve soft set based real life decision making problems which may contain more than one decision maker.

5. **“An application of soft sets in a decision making problem”**

Maji, P.K., Biswas, R. and Roy, A.R. (2002) [38]

In this paper, the theories of soft sets are applied to solve a decision making problem.

6. **“On some structures of soft topology”**

Bashir Ahmad and Sabir Hussain (2012) [10]

In this paper, soft exterior is defined and its basic properties are studied. Several important results relating soft interior, soft exterior, soft closure and soft boundary in soft topological spaces are established.

7. **“On soft semiopen sets and soft semitopology”**

Sai, B.V.S.T. and Srinivasa Kumar, V. (2013) [55]

In this paper, some interesting properties of soft semiopen sets are studied. Soft semitopology on the collection of all soft semiopen sets over a fixed universe set is introduced.

8. **“On soft connectedness”**

Peyghan, E., Samadi, B. Tayebi, A. (2012) [49]

In this paper, some concepts such as soft connectedness, soft locally connectedness are introduced. Some results related to these concepts and soft product spaces are established.

9. **“The countabilities of soft topological spaces”**

Weijian Rong (2012) [65]

In this paper, some new concepts in soft topological spaces such as soft first-countable spaces, soft second-countable spaces and soft separable spaces are introduced and some basic properties of these concepts are explored.

10. **“On soft generalized closed sets in soft topological spaces”**

Saziye Yuksel, Naime Tozlu, Zehra Guzel Ergul (2013) [56]

In this paper, a representation of soft sets and soft topological spaces is given. It is shown that behavior relative to soft subspaces of soft generalized closed sets is investigated. A soft generalized closed set in a soft compact (soft Lindelof, soft countably compact) space is also soft compact. It is also shown that a soft compact set in a soft regular space is soft generalized closed and disjoint soft g-closed sets in a soft normal space generally cannot be separated by soft open sets. Finally, some properties of soft generalized open sets are investigated.

11. **“Soft Generalized Closed sets in Soft Topological spaces”**

Kannan(2012) [32]

In this paper, it is shown that the Soft Generalized closed sets in soft topological spaces which are defined over an initial universe with a fixed set of parameters. A sufficient condition for a soft g-closed set to be a soft closed set is also introduced. Moreover, the union and intersection of two soft g-closed sets are discussed. Finally, the new soft separation axiom, namely soft $T_{1/2}$ -space is introduced and its basic properties are investigated.

12. **“Algebraic Hyperstructures of soft sets Associated with Ternary semi Hypergroups”**

Kostaq Hila, Krisanthi Naka (2013) [34]

In this paper, soft ternary semihypergroups are introduced by using soft set theory. The notions of soft ternary semihypergroups, soft ternary subsemihypergroups, soft left

(right, lateral) hyperideals, soft hyperideals, soft quasi-hyperideals and soft bi-hyperideals are introduced and several related properties are investigated.

13. **“On soft topological spaces”**

Muhammad Shabir, Munazza Naz (2011) [42]

In this paper, it is shown that a soft topological space gives a parameterized family of topological spaces. Furthermore, with the help of an example it is established that the converse does not hold. The soft subspaces of a soft topological space are defined and inherent concepts as well as the characterization of soft open and soft closed sets in soft subspaces are investigated. Finally, soft T_i -spaces and notions of soft normal and soft regular spaces are discussed. A sufficient condition for a soft topological space to be a soft T_1 – space is also presented.

14. **“Some local properties of soft semi-open sets”**

Bin Chen (2013) [12]

In this paper some local properties by soft semi-open sets, namely, soft semi-neighborhoods of the soft point, soft semi-first-countable spaces and soft semi-pu-continuous at the soft point are introduced. Furthermore, soft semi-connectedness is defined and it is proved that a soft topological space is soft semiconnected if and only if both soft semi-open and soft semi-closed sets.

15. **“Soft gsg-closed sets in soft topological spaces”**

Seenivasan, V. and Kalaiselvi, S. (2013) [57]

In this paper a new class of soft set called soft generalized semi generalized closed sets in soft topological spaces are introduced and some basic properties are discussed.

16. **“On semi*-connected and semi*-compact spaces”**

Robert, A. and Pious Missier, S. (2012) [52]

In this paper the concepts of semi*-connected spaces, semi*-compact spaces and semi*-Lindelof spaces are introduced and studied.

17. “On soft topological space via semiopen and semiclosed soft sets”

Mahanta, J. and Das, P.K. (2012) [35]

This paper introduces semiopen and semiclosed soft sets in soft topological spaces. The notions of interior and closure are generalized using these sets. A detail study is carried out on properties of semiopen, semiclosed soft sets, semi interior and semi closure of a soft set in a soft topological space. Various forms of soft functions, like semicontinuous, irresolute, semiopen soft functions are introduced and characterized. Further soft semicompactness, soft semiconnectedness and soft semiseparation axioms are introduced and studied.

18. “Fuzzy Soft Topological Spaces”

Tridiv Jyoti Neog, Dusmanta Kumar Sut, Hazarika, G. C. (2012) [63]

In this paper, some properties related to fuzzy soft topological spaces have been established. The concepts on fuzzy soft point, fuzzy soft neighborhood, fuzzy soft closure, fuzzy soft interior and fuzzy soft subspace topology are introduced and studied.

19. “Fuzzy Soft Topology”

Banu Pazar Varol and Halis Aygun(2012) [8]

In this paper, they introduced the topological structure of fuzzy soft sets and fuzzy soft continuity of fuzzy soft mappings. Also they show that a fuzzy soft topological space gives a parameterized family of fuzzy topological spaces. Furthermore, with the help of an example it is shown that the constant mapping is not continuous in general. Then the notions of fuzzy soft closure and interior are introduced and their basic properties are investigated. Finally, the initial fuzzy soft topology and some properties of projection mappings are studied.

20. “Results on fuzzy soft topological spaces”

Mahanta, J. and Das, P. K. (2012) [37]

In this paper, Separation axioms and connectedness are introduced and investigated for fuzzy soft topological spaces.

21. “Compact Fuzzy Soft Space”

Ismail Osmanoglu, Deniz Tokat (2013) [23]

In this paper, they introduced the concept of compactness on fuzzy soft topological spaces and give some important definitions and theorems.

22. “Fuzzy Soft normed space and Fuzzy Soft linear operator”

KhamenehA.Z., Kilic,man.A., SallehA.R. (2013) [33]

In this paper, the concept of fuzzy soft norm over fuzzy soft spaces has been considered and some properties of fuzzy soft normed spaces are studied. They also study the fuzzy soft topology over a crisp set by using the fuzzy soft subsets of it and the relationship between fuzzy soft topology and general topology is investigated.

23. “Soft Topology on Function Spaces”

Taha Yasin Ozturka and Sadi Bayramova (2014) [59]

In this paper, they introduced the concept of the point wise topology of soft topological spaces and the properties of soft mappings spaces. Finally, they investigate the relationships between some soft mappings spaces.

24. “Fuzzy soft topological spaces”

Tugbahan Simsekler, Saziye Yuksel (2013) [62]

In this paper, they introduced and studied Fuzzy soft topology, fuzzy soft open set, fuzzy soft closed set, fuzzy soft interior and fuzzy soft closure point, fuzzy soft and fuzzy soft Q-neighborhood.

25. “On Fuzzy Soft Continuous Mapping”

Banashree Bora (2012) [6]

In this paper, they studied the notions related to fuzzy soft mapping. The definitions of fuzzy soft image and fuzzy soft inverse image put forward by Kharal and Ahmad have been reintroduced and the concepts of fuzzy soft bijective mapping, fuzzy soft identity mapping and fuzzy soft continuous mapping have been put forward and some propositions along with examples have been given.

26. **“On Some Structural Properties of Fuzzy Soft Topological Spaces”**

Pradip Kumar Gain, Prakash Mukherjee, Ramkrishna Prasad Chakraborty and Madhumangal Pal (2013) [51]

In this paper, some structural properties of fuzzy soft topological spaces. Fuzzy soft closure and fuzzy soft interior of a fuzzy soft set are studied and investigated. Fuzzy soft exterior and fuzzy soft boundary of a fuzzy soft set are introduced and some properties related to these structures are established.

27. **“Remarks on soft ω -closed sets in soft topological spaces”**

Nirmala Rebecca Paul (2013) [46]

In this paper, the concept of soft ω -closed sets in soft topological spaces introduces and establishes the relation between other existing generalized closed sets in soft topological spaces. It derives the basic properties of soft ω -closed sets. As an application it proves that a soft ω -closed set in a soft compact space is soft compact.

28. **“On Soft Preopen Sets in Soft Topological Spaces”**

Gnanambal Ilango and Mrudula Ravindran (2013) [21]

In this paper, they introducing a soft topology via soft preopen sets. Also they state and prove the condition for collection of soft preopen sets to be a soft topology.