Chapter 9

Sequences, Nets, and Filters of Fuzzy Soft Multi Sets in Fuzzy Soft Multi Topological Spaces

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ABSTRACT

In this chapter, the authors introduce a new sequence of fuzzy soft multi sets in fuzzy soft multi topological spaces and their basic properties are studied. The concepts of subsequence, convergence sequence and cluster fuzzy soft multi sets of fuzzy soft multi sets are proposed. Actually Cluster analysis or clustering is the task of grouping a set of objects in such a way that objects in the same group (called a cluster) are more similar to each other than to those in other groups (clusters). It is a main task of exploratory data mining and a common technique for statistical data analysis used in many fields including machine learning, pattern recognition, image analysis, information retrieval and bioinformatics. Here the authors define the notions of net and filter and establish the correspondence between net convergence and filter convergence in fuzzy soft multi topological spaces.

1. INTRODUCTION

Theory of fuzzy sets, soft sets and soft multi sets are powerful mathematical tools for modeling various types of vagueness and uncertainty. In 1999, Molodtsov initiated soft set theory as a completely generic mathematical tool for modeling vague concepts. Later on Maji and other presented some new definitions on soft sets such as subset, union, intersection and complements of soft sets and discussed in details the application of soft set in decision making problem. Based on the analysis of several operations on soft sets introduced by Molodstov, Ali and other presented some new algebraic operations for soft sets and proved that certain De Morgan’s law holds in soft set theory with respect to these new definitions. Combining soft sets with fuzzy sets, Maji and other defined fuzzy soft sets. Later Roy and...
Others constructed the fundamental theory on fuzzy soft topological spaces. Alkhazaleh and others as a generalization of Molodtsov’s soft set presented the definition of a soft multi set and its basic operations such as complement, union, and intersection etc., thereafter Mukherjee and others introduced the concept of soft multi topological spaces and studied compactness and connectedness on soft multi topological spaces. In 2012, Alkhazaleh and Salleh introduced the concept of fuzzy soft multi set theory and studied the application of these sets and recently, Mukherjee and Das studied the concepts of fuzzy soft multi topological spaces in details.

The aim of this chapter is to introduce a new sequence of fuzzy soft multi sets in fuzzy soft multi topological spaces and their basic properties are studied. The concepts of subsequence and convergence sequence of fuzzy soft multi sets are proposed. The authors also introduce the concepts of cluster fuzzy soft multi sets of sequences and their basic properties are investigated. Cluster analysis or clustering is the task of grouping a set of objects in such a way that objects in the same group (called a cluster) are more similar (in some sense or another) to each other than to those in other groups (clusters). It is a main task of exploratory data mining, and a common technique for statistical data analysis, used in many fields, including machine learning, pattern recognition, image analysis, information retrieval, and bioinformatics. In this chapter, the authors defined the notions of net and filter in the fuzzy soft multi topological spaces and studied their basic properties. Also, the authors introduce the concepts of filter base and ultra fuzzy soft multi filter and their basic properties are also to be investigated. Finally the authors obtain some results on convergence; in particular the authors establish the correspondence between net convergence and filter convergence in the fuzzy soft multi topological spaces.

2. PRELIMINARIES

2.1 FUZZY SET THEORY

Zadeh (1965) introduced the concept of fuzzy sets as a new mathematical tool for modeling uncertainty and it made its own place in decision making problems. The word fuzzy means “vagueness”. Fuzzy sets have been introduced by Zadeh (1965) as an extension of the classical characteristic function notation of set. Let \( A \) be a crisp set defined over the universe \( X \). Then for any element \( x \) in \( X \), either \( x \) is a member of \( A \) or not. In fuzzy set theory, this property is generalized. Zadeh extended the range of the membership function to the closed interval \([0, 1]\) from two element set \([0, 1]\).

**Definition** (Zadeh,1965): If \( X \) is a collection of objects then a fuzzy set \( A \) in \( X \) is a set of ordered pairs:

\[
A = \{(x, \mu_A(x)) / x \in X\}
\]

where \( \mu_A(x) \) is called the membership function of \( x \) in \( A \) which maps \( X \) to the membership space \([0,1]\). i.e., \( \mu_A: X \rightarrow [0,1] \).

The words like “young”, “tall”, “good” or “high” are fuzzy concepts. There is no single quantitative value which defines the term “young”, “good” or “high”.

Let \( A \) and \( B \) be fuzzy sets on a universal set \( X \), with the grade of membership of \( x \) in \( A \) and \( B \) denoted by \( \mu_A \) and \( \mu_B \) respectively. Zadeh (1965) defined the following relations and operations.

- \( A = B \iff \mu_A(x) = \mu_B(x) \) for all \( x \) in \( X \);
- \( A \subseteq B \iff \mu_A(x) \leq \mu_B(x) \) for all \( x \) in \( X \);
- \( \mu_A(x) = 1 - \mu_A(x) \) for all \( x \) in \( X \); \( A' \) is the complement of \( A \).
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