

## Similarity Measure of Interval Valued Intuitionistic Fuzzy Soft Sets of Root Type in Decision Making

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### Abstract

In this paper we introduce two topological operators on interval valued intuitionistic fuzzy soft set of root type and establish some theoretical properties of these operators. We define Hamming distance between interval valued intuitionistic fuzzy soft sets of root type and establish that it is a metric. Further we define a similarity measure based on interval valued intuitionistic fuzzy soft set of root type and also develop a new decision making method based on this similarity measure between interval valued intuitionistic fuzzy soft sets of root type using Hamming distance. Finally, we provide a numerical example to illustrate the working of this algorithm.

Keywords: Interval valued intuitionistic fuzzy soft set of root type, Operators, Hamming distance, Similarity measure, Decision making technique

### 1. Introduction

The theory of intuitionistic fuzzy sets was introduced by Atanassov (1983) and the concept of interval valued fuzzy set was introduced by Gorzalczany (1987). The concept of interval valued intuitionistic fuzzy set was developed by Atanassov and Gorgov (1989). Palaniappan et al. (2006) introduced some operations on intuitionistic fuzzy sets of root type. Soft set theory was first introduced by Molodtsov (1999). Motivated by these theories, the theory of fuzzy soft set Maji et al. (2001a) and the theory of intuitionistic fuzzy soft set Maji et al. (2001b) have been developed. Yang et al. (2009) developed the concept of interval valued fuzzy soft sets by combining the interval valued fuzzy set and soft set models. Anita Shanthi and Vadivel Naidu (2015) combined the concepts of interval valued intuitionistic fuzzy set, fuzzy soft set and intuitionistic fuzzy set of root type and introduced the notion of interval valued intuitionistic fuzzy soft set of root type (IVIFSSRT).

Atanassov (1986) was the first one to introduce different types of similarity measures between intuitionistic fuzzy sets. Li and Cheng (2002) initiated the study of pattern recognition problem using similarity measure. A technique for pattern recognition problem using similarity measure based on Hausdorff distance in intuitionistic fuzzy set was developed by Hung and Yang (2004). Xu (2007) addressed the similarity measure on interval valued intuitionistic fuzzy set and used it for tackling pattern recognition problems. The similarity measure based on distance between soft sets was introduced by Majundar and Samanta (2008). The same authors (2010) have also studied the

similarity measure based on distance between intuitionistic fuzzy soft sets. A distance measure on interval valued intuitionistic fuzzy set for handling group decision making problems was proposed by Xu (2010). Further, Deli and Cagman (2013) proposed a distance based similarity measure on intuitionistic fuzzy soft sets. A general type of similarity measure for intuitionistic fuzzy set was proposed by Boran and Akay (2014). Song et al. (2015) proposed a similarity measure based on distance measure of intuitionistic fuzzy sets with the influence of hesitation degree and showed that this measure overcomes some of the drawbacks in the existing similarity measures. Chen and Chang (2015) introduced a similarity measure based on transformation techniques of IFS and established the need for this measure.

In this study Hamming distance between IVIFSSRT is defined and it is proved to be a metric. A new method for solving decision making problems in fuzzy environment using similarity measure based on this Hamming distance is established. An algorithm for solving decision making problems is developed and its working is explained by means of an example.

The rest of this paper is organized as follows. Section 2 provides the basic definitions needed for our study. In Section 3, we define two topological operators on interval valued intuitionistic fuzzy soft set of root type and discuss some of its properties. In Section 4, we define hamming distance on interval valued intuitionistic fuzzy soft set of root type and establish that it is a metric. We also define a similarity measure based on hamming distance and develop an algorithm for a new decision making method based on