
AN IMPROVED SIMILARITY MEASURE FOR PICTURE FUZZY SETS WITH ITS APPLICATION

Abdul Haseeb Ganie and Surender Singh

School of Mathematics,
Faculty of Science,
Shri Mata Vaishno Devi University, Katra-
Jammu and Kashmir, India

ABSTRACT:

For dealing with imprecision/uncertainty, and vagueness in the real-world, the concept of fuzzy sets (FSs) was introduced by L. A. Zadeh in 1965. A FS is a group of objects in the universe of discourse with vague, ambiguous, and unsharp boundary. A FS is mainly understood and represented with the help of a membership function assigning a value in the unit interval $[0,1]$ to each element of the universe of discourse, and this assigned value known as membership degree indicates the degree of belongingness of the element to the FS. Because of various ways of understanding the vagueness and linguistic imprecision in a system, in the last three decades, researchers came up with different mathematical expressions to capture the ambiguity and vagueness. These varied expressions are considered as extensions or generalizations of the conventional fuzzy set. In contemporary literature, some prominent researches have termed these extensions/generalizations as non-standard fuzzy sets. One such extension is the intuitionistic fuzzy set (IFS) introduced by K. T. Atanassov in 1986. He incorporated the non-membership degree of an element to the FS with the condition that the sum of membership and non-membership degrees should be less or equal to one. Although IFSs are more powerful than FSs in expressing uncertain and vague information, they lack an important concept i.e., degree of neutrality, which has a key role in many situations such as human voting, medical diagnosis, personal selection, etc. In human voting, a person has four options either to vote in favor or to vote against or to abstain or to refuse from voting. In medical diagnosis, the symptoms temperature and headache may have a null effect on the diseases chest problem and stomach problem. Similarly, the effect of the symptoms chest pain and stomach pain may be neutral on the diseases malaria, viral fever, typhoid, etc. So, to address such situations, a new generalization of FSs and IFSs known as PFSs was introduced by B. C. Cuong and V. Kreinovich in 2014. In a PFS, each element is specified by the degree of membership, the degree of non-membership, and degree of neutrality together with the condition that the sum of these grades should be less or equal to one.

In this study, we propose a new PF similarity measure and discuss its properties. With the help of numerical examples, we compare this PF similarity measure with the existing PF similarity measures. Also, we discuss its application in pattern recognition and compare the results with some existing PF compatibility measures for establishing its validity and superiority.

Keywords: Picture fuzzy set, Picture fuzzy similarity measure, pattern recognition, TOPSIS.
