Crispification of Temporal Intuitionistic Fuzzy Sets

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Abstract. Defuzzification methods interpret the fuzzy sets in the form of a precise crisp value needed by the designer and the corresponding crisp values of the fuzzy system are calculated. Defuzzification methods of temporal intuitionistic fuzzy sets are essential in the development of temporal intuitionistic fuzzy systems. There are several defuzzification methods like maxima methods, centroid methods and weighted average methods available in literature for fuzzy sets and also for intuitionistic fuzzy sets. In this paper, some standard crispification methods for temporal intuitionistic fuzzy sets are defined which are useful to apply temporal intuitinistic fuzzy sets for temporal data with uncertainty. The proposed methods play a major role in the dealing of the most common dynamic systems occuring in nature.

I. INTRODUCTION

Fuzziness most commonly prevails in nature which could be met by fuzzy sets introduced by L.Zadeh in 1965 [15], using the specific membership functions for defining fuzzy sets (FSs) where the exact crisp inputs are converted into fuzzy inputs. Elements of the FSs can have partial membership values ranging from 0 to 1. K.T.Atanassov proposed the concept of intuitionistic fuzzy sets (IFSs) which allows space for membership, non-membership and the hesitation degree. He also defined temporal intuitionistic fuzzy sets (TIFSs) for dealing complex temporal data [2]. Membership and non-membership functions (Fuzzification functions) are used to transfer the crisp inputs into fuzzy in order to apply fuzzy inference rules. In a contrary, defuzzification methods select the best crisp value to be applied to the system in concern from the membership values of the linguistic variable(output FS). i.e., Defuzzification is performed to transform the fuzzy results into crisp and provides the action to be taken after processing. Defuzzification results provide a single or a set of values as output. There are different known defuzzification methods for fuzzy sets like maxima methods which include Lambda cut / Alpha cut method, height method, first of maxima, last of maxima, mean of maxima, centroid methods which include center of sums method, center of gravity / centroid of volume method, center of volume / bisector of voulme method and weighted average methods[6], [8]. In the case of IFSs, there are two conversions, one is conversion to crisp sets (crispification [1]) and another one is conversion to fuzzy sets (de-i-fuzzification [5], [14]) and apply known defuzzification methods of fuzzy sets to get the crisp output. Crispification of IFSs gains its importance in the intuitionistic fuzzy environment and are discussed[11]. There are different crispification functions for IFSs available in literature which could produce a crisp set or a most preferred single crisp value. In this paper, some standard crispification methods for TIFSs resulting in a crisp value along with the time that are needed in constructing temporal intuitionistic fuzzy systems are proposed.

The rest of the work is organized as follows. Some preliminary concepts of IFSs, TIFSs and defuzzification functions for FSs are over viewed in Section 2. In Section 3, some standard crispification methods for TIFSs are presented with suitable illustrations. Finally, the paper is concluded with Section 4.