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Grey relational analysis method for MCDM with Interval-valued trapezoidal intuitionistic fuzzy numbers

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Abstract—interval-valued trapezoidal intuitionistic fuzzy number IVTIFNs is a special intuitionistic fuzzy set on a real number set. IVTIFNs are useful to deal with ill-known quantities in decision data and decision making problems. The purpose of this paper is to develop an extended grey relational analysis (GRA) method for solving MCDM problems with interval-valued trapezoidal intuitionistic fuzzy numbers. a illustrative example is given to verify the developed approach and to demonstrate its practicality and effectiveness.

Keywords — Grey relational analysis (GRA), interval-valued trapezoidal intuitionistic fuzzy number, Multiple criteria decision making (MCDM)

I. INTRODUCTION

Multi-criteria decision-making (MCDM) problem is the process of finding the best alternative from all of the feasible alternatives where the evaluated performance of all alternatives under criteria by Decision maker(DM) Depending on the situation can be expressed in different form for example real numbers, fuzzy numbers, intuitionistic fuzzy number. Among the various set mentioned , intuitionistic fuzzy sets [1] have gained more attention from researchers. This attention is due to the consistency of intuitionistic fuzzy sets in modeling many real life situations where hesitation exists, such as fuzzy decision making [2].

Atanassov [3] introduced the interval-valued intuitionistic fuzzy set (IVIFS), which is a generalization of the IFS. The fundamental characteristic of the IVIFS is that the values of its membership function and non-membership function are intervals rather than crisp numbers. Dong Gun Park[4] investigate the group decision making problems in which all the information provided by the decision-makers is presented as interval-valued intuitionistic fuzzy decision matrices where each of the elements is characterized by interval-valued

intuitionistic fuzzy number (IVIFN),and the information about attribute weights is partially known ,use the interval-valued intuitionistic fuzzy hybrid geometric (IIFHG) operator and score function to determine the weights of attributes ,and then use the obtained attribute weights and the interval-valued intuitionistic fuzzy weighted geometric (IIFWG) operator to

fuse the interval-valued intuitionistic fuzzy information in the collective interval-valued intuitionistic fuzzy decision matrix to get the overall interval valued intuitionistic fuzzy values of alternatives, and then rank the alternatives according to the correlation coefficients between IVIFNs. V. Lakshmana [5] investigate Multi-criteria decision-making method based on interval-valued intuitionistic fuzzy sets in which criterion values for alternatives are interval-valued intuitionistic fuzzy sets, a new method for ranking interval-valued intuitionistic fuzzy sets has been introduced and studied ,and then a new method for handling multi-criteria fuzzy decision-making problems based on ranking interval-valued intuitionistic fuzzy sets is presented. Huimin Zhang [6] investigate Multi-criteria decision-making method based on interval-valued intuitionistic fuzzy sets with incomplete weight information of criteria, a series of mathematical programming models based on cross-entropy are constructed and eventually transformed into a single mathematical programming model to determine the weights of attributes, in addition, an extended technique for order preference by similarity to ideal solution (TOPSIS) is suggested to ranking all the alternatives. The reason of using interval-valued intuitionistic trapezoidal fuzzy data number is in the real-life situations, the input data sometimes cannot be obtained exactly, but interval-valued trapezoidal intuitionistic fuzzy data can be given. Guiwu Wei[7] propose some new geometric aggregation operators including interval-valued intuitionistic trapezoidal fuzzy ordered weighted geometric(IITFOWG) operator and interval-valued intuitionistic trapezoidal fuzzy hybrid geometric (IITFHG)