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Group decision making in medical system: An intuitionistic fuzzy soft set approach

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Abstract

In medical system, there may be many critical diseases, where experts do not have sufficient knowledge to handle those problems. For these cases, experts may provide their opinion only about certain aspects of the disease and remain silent for those unknown features. Feeling the need of prioritizing different experts based on their given information, this article uses a novel concept for assigning confident weights to different experts which are mainly based on their provided information. Experts provide their opinions about various symptoms using intuitionistic fuzzy soft matrix (IFSM). In this article, we propose an algorithmic approach based on intuitionistic fuzzy soft set (IFSS) which explores a particular disease reflecting the agreement of all experts. This approach is guided by the group decision making (GDM) model and uses cardinals of IFSS as novel concept. We have used choice matrix (CM) as an important parameter which is based on choice parameters of individual expert. This article has also validated the proposed approach using distance measurements and consents of the majority of experts. The effectiveness of the proposed approach is demonstrated using a suitable case study.

Keywords: **Group decision making, fuzzy soft set, intuitionistic fuzzy soft set, intuitionistic fuzzy soft matrix, distance measurements, cardinal matrix, medical diagnosis.**

1. Introduction

Disease diagnosis is one of the difficult tasks of medical science. As complex decision making, disease diagnosis involves a number of symptoms analysis, so this process sometimes takes too long time to reach conclusion of exact disease. Similarly, this might yield wrong diagnosis due to overlooking of few trivial symptoms, which leads to worse situation. To ease this complex decision making process, use of computing techniques mainly expert system has a long history with disease diagnosis. Success had been achieved respectively with those systems but problem was uncertainty modeling. All those early systems were made to handle crisp data. But in real world there is a degree of uncertainty involved in every decision making process. In 1965, proposal of fuzzy set theory by Zadeh [1] was the corner stone to solve such uncertain scenario. Since then, there are many developments in the field and researchers [2, 3] started to use fuzzy expert system for medical diagnostic procedures.

Several other methods, including statistics, pattern recognition, artificial intelligence and neural networks have been used as an aid to medical diagnosis [4, 5, 6, 7, 8, 9]. Group decision making using fuzzy soft set constitutes another approach to aid medical diagnosis. GDM using fuzzy soft set consists of multiple experts interacting with each other to reach a final conclusion based on their observations. Each decision maker might have their own thought which differs from others' in various aspects but they should have a common goal to reach the ultimate destination. GDM problem consists of finding the best alternative(s) from a set of feasible alternatives according to the preferences provided by a group of experts. The alternatives are classified from best to worst, using the information known according to the set of experts.

Molodtsov [10] presented soft set as a completely generic mathematical tool for modeling uncertainties. He introduced the concept of soft set theory [10] similar to some other traditional tools such as the theory of probability [35], theory of fuzzy sets [1], rough set theory [36], and the interval mathematics. But all these theories have their own difficulties due to the inadequacy of the parameterization. Molodtsov proposed soft set theory [10] which is free from such kind of difficulties. Maji et al. [11, 12] pursued further investigation on soft set theory by defining some operations and established the soft set into decision making problems. As defined by Molodtsov [10], in soft set theory, initial description of any object has an approximate nature and one do not need to introduce the notion of exact solution. In several fields of sciences, engineering, economics, and medicals sciences, the soft set theory is