

AN APPLICATION OF INTERVAL-VALUED INTUITIONISTIC FUZZY SETS FOR MEDICAL DIAGNOSIS OF HEADACHE

JEONG YONG AHN¹, KYUNG SOO HAN¹, SUN YOUNG OH² AND CHONG DEUK LEE³

¹Department of Statistical Informatics (Institute of Applied Statistics)

²Department of Neurology, School of Medicine

³Division of Electronic Engineering
Chonbuk National University

Jeonju, Korea

{ jyahn; kshan; ohsun; cdlee1008 }@jbnu.ac.kr

Received January 2010; revised May 2010

ABSTRACT. *This study is to propose a new approach for medical diagnosis using the distance between interval-valued intuitionistic fuzzy sets. For this purpose, we developed an interview chart with interval fuzzy degrees based on the relation between symptoms and diseases (three types of headache), and utilized the interval-valued intuitionistic fuzzy weighted arithmetic average operator to aggregate fuzzy information from the symptoms. In addition, we proposed a measure based on distance between interval-valued intuitionistic fuzzy sets for medical diagnosis. The proposed method is illustrated by a numerical example.*

Keywords: Diagnosis measure, Aggregate operator, Interview chart, Interval-valued fuzzy sets

1. **Introduction.** A major task of medical science is to diagnose diseases. It, however, is not a direct and simple task at all, because the information available to the physician about his patient and about medical relationships in general is inherently uncertain [1]. To improve the problem, there have proposed many approaches and theories such as fuzzy set theory and rough set theory [10, 20, 35].

Fuzzy set theory makes it possible to define the inexact medical information as fuzzy sets, therefore, it can be utilized for modeling the diagnostic process. An application of fuzzy set on medical science fields already proposed by Zadeh in 1969 [36] and Sanchez [23] invented a fully developed relationships modelling theory of symptoms and diseases using fuzzy sets. Since Atanassov [4] introduced the concept of intuitionistic fuzzy sets, fuzzy set theory has been utilized in many approaches to model the diagnostic process [1, 3, 11, 14, 27, 33, 34].

However, the approaches have some drawbacks. First, some researches such as De *et al.* [11] and Ahn *et al.* [3] applied the max-min-max composition rule to determine the disease of patients. The main problem of the method using the max-min-max compositions is the loss of information because the composition neglects in fact most values except for extreme ones. Second, a disease in general is presented through many symptoms and the symptoms significantly associated with the disease. Therefore, we need to aggregate the symptoms. This is not considered in many studies. In addition, most researches for medical diagnosis don't use the interval data.

To solve these problems, we propose a new approach for medical diagnosis using the distance between interval-valued intuitionistic fuzzy sets. The features and advantages of the approach are as follows: First, it makes a diagnosis by aggregating the information