LETTER

Discussion on “A Fuzzy Method for Medical Diagnosis of Headache”

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SUMMARY This paper is in response to the report of Ahn, Mun, Kim, Oh, and Han published in IEICE Trans. INF. & SYST., Vol.E91-D, No.4, 2008, 1215–1217. They tried to extend their previous paper that published on IEICE Trans. INF. & SYST., Vol.E86-D, No.12, 2003, 2790–2793. However, we will point out that their extension is based on the detailed data of knowing the frequency of three types. Their new occurrence information based on intuitionistic fuzzy set for medical diagnosis of headache becomes redundant. We advise researchers to directly use the detailed data to decide the diagnosis of headache.

key words: fuzzy measure, interview chart, fuzzy differential diagnosis

1. Introduction

Fuzzy set theory has been applied to many practical situations in real life. For example, Sanchez [5] used the doctor's medical information as a fuzzy relation between symptoms and disease. Atanassov [3] extend the fuzzy set to intuitionistic fuzzy set (IFS) such that for a fixed set E , an IFS A is assumed as

$$A = \{ \langle x, \mu_A(x), \nu_A(x) \rangle \mid x \in E \},$$

where $\mu_A : E \rightarrow [0, 1]$ is the degree of membership, and $\nu_A : E \rightarrow [0, 1]$ is the degree of non-membership that satisfies $0 \leq \mu_A(x) + \nu_A(x) \leq 1$. Moreover, the hesitation is assumed as $\pi_A(x) = 1 - \mu_A(x) - \nu_A(x)$.

2. Review the Approach of Ahn et al. (2008)

To concentrate on the discussion of the new derivation of Ahn et al. [2], we overlook the composition of fuzzy relations, and then directly consider the intuitionistic fuzzy relation between a patient and diseases (migraine headache, d_M ; tension headache, d_T , and cluster headache, d_C) as $\langle \mu(P, d_M), \nu(P, d_M) \rangle = \langle 0.6, 0.3 \rangle$, $\langle \mu(P, d_T), \nu(P, d_T) \rangle = \langle 0.5, 0.3 \rangle$, and $\langle \mu(P, d_C), \nu(P, d_C) \rangle = \langle 0.4, 0.3 \rangle$. Based on Klir and Folger [4], Ahn et al. [1] will determine the diagnostic labels of this patient for those diseases, say d_i , that satisfies $0.5 < \mu(P, d_i)$ and $\nu(P, d_i) < 0.5$. Hence, Ahn et al. [1] will diagnose the patient suffered from migraine headache with

60% degree of membership, tension headache with 50% degree, and cluster headache with 40% degree.

Ahn et al. [2] considered that $\mu(P, d_i)$ and $\nu(P, d_i)$ did not include the information about the occurrence frequency of symptoms for patient's disease. If the occurrence frequency is f_i corresponding to a disease d_i , then Ahn et al. [2] suggested that the revised measure should be assumed as

$$\mu'(P, d_i) = \mu(P, d_i) + f_i \times \pi(P, d_i),$$

and

$$\nu'(P, d_i) = \nu(P, d_i) - f_i \times \pi(P, d_i).$$

Where $\pi(P, d_i)$ is $1 - \mu(P, d_T) - \nu(P, d_T)$ and f is the occurrence proportion of symptoms of patient's diseases.

For example, if a patient has three types of headache: migraine headache, tension headache, and cluster headache, and symptoms for each type occur 4, 2 and 14 times respectively, then the occurrence frequency are $f_M = 0.2$, $f_T = 0.1$ and $f_C = 0.7$. Consequently, Ahn et al. [2] derived that $\langle \mu'(P, d_M), \nu'(P, d_M) \rangle = \langle 0.62, 0.28 \rangle$, $\langle \mu'(P, d_T), \nu'(P, d_T) \rangle = \langle 0.52, 0.28 \rangle$, and $\langle \mu'(P, d_C), \nu'(P, d_C) \rangle = \langle 0.61, 0.09 \rangle$, so that they concluded to diagnose the patient suffered from migraine headache with 62% degree of membership, tension headache with 52% degree, and cluster headache with 61% degree.

3. Questionable Results in Their Derivation

We will point out that if the symptoms of a patient for three types: migraine headache, tension headache, and cluster headache, occur 4, 2 and 14 times respectively, then this information will directly imply the patient suffered cluster headache.

Ahn et al. [2] tried to use the occurrence frequency to derive a new setting of IFS that is redundant. They are over studied the pattern recognition problem.

Moreover, their interview chart also contained an interesting record. For migraine headache, it happens 4 times, and then there are M5, M8, M18, and M19 in the interview chart. For tension headache, it happens 2 times, and then there are T3, T5, T10, and T14 in the interview chart. For cluster headache, it happens 14 times, and then there are C4, C11, and C13 in the interview chart.

It reveals that the patient has cluster headache 14 times with concentrate symptoms: C4, C11, and C13. This information will help doctor to decide what kind of cluster

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headache and then find a solution or a relieve treatment for this patient.

4. Conclusion

Ahn et al. [2] overlooked useful information and then they only tried to derive a new setting of IFS. We advise researchers not to apply their approach and thus avoid a questionable diagnosis that may endanger their patient's health.

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