Application of Secant Span in Medical Diagnosis

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Abstract: Many common and specific characteristics engrave most diseases. Water-borne diseases differ slightly in their characteristics. Erroneous diagnoses can be attributed to shared characteristics. Current approaches tend to rely on imprecise diagnoses and lack robust techniques for differentiating between characteristics. Every illness also presents with specific symptoms. To assist doctors in approaching a likely diagnosis, the suggested method is successful in determining the connection between a class of sickness and the people with a specific pathology to the indications. Among n-valued interval neutrosophic sets, a secant span is proposed in this paper and a few of its attributes are talked about here. The idea behind the aforementioned approach is a crucial mechanism for addressing doubts as well as flaws in the current approaches. The application of medical diagnosis is explained to figure out the illness that the people are experiencing. The diagnosis's outcome demonstrated how successful the suggested strategy was.

Keywords: Secant Span; Water-borne Diseases; Neutrosophic Sets; Erroneous Diagnoses.

Symbols
SP - A band that includes people with a specific pathology.
L   - Collection of indications
SK - A class of sickness
H   -n-valued interval neutrosophic connection from a band that includes people with a specific pathology to the collection of indications
J - Interval neutrosophic relation from the collection of indications to the class of sickness
G-Secant span

1. Introduction

The fuzzy sets created by Zadeh [1] can prove helpful in numerous real-life instances as a way of tackling uncertainty. Atanassov's [2] intuitionistic fuzzy sets allow for both truth- and falsity membership and various techniques are suggested and used in a few domains by Ejegwa et al & Edward and Narmadha [3, 4]. By presenting intuitionistic fuzzy multi-sets, Shinoj and Sunil [5] expanded on the idea of fuzzy multi-sets, In addition to this, Edward and Narmadha[6] presented a revolutionary technique. From a philosophical perspective, the neutrosophic set, as defined by Smarandache [7], can deal with ambiguous, imprecise, partial, and inconsistent information that exists in the real world. Said et al. [8] were the first to illustrate rough neutrosophic sets, while Edward and Narmadha [9-12] proposed several methods for these sets. Haibin et al. [13] were the first to illustrate single-valued neutrosophic sets, while Edward and Narmadha [14-16] proposed many methods for these sets. Single-valued neutrosophic multisets were first proposed by Shan Ye and Jun Ye [17] and in this regard, Edward and Narmadha [18] provided a revolutionary technique that was subsequently used in healthcare diagnosis. Said and Irfan[19] & Edward and Narmadha [20-22] offered numerous approaches in neutrosophic refined sets. The idea of n-valued neutrosophic sets is

extended to the situation of n-valued interval neutrosophic sets by Broumi et al. [23] and plenty of methods were introduced by Edward and Narmadha [24–26] which were utilized in medical diagnosis. With greater accuracy than the other methods, the suggested approach was also able to effectively manage the shortcomings and restrictions of the earlier research. Indicators within a band of individuals with a particular pathology and assortment of illnesses are discovered to be related in this investigation. The results of this study will assist the researcher in precisely identifying the illness that affected a group of individuals with a particular disease. There are none of the usual restrictions associated with various research methods while using this one. A novel theory on image processing, cluster analysis, etc., has been created in this study without such restrictions. The article is organized as follows for the most part. The Stated concept and some of its characteristics are covered in section 2. The methodology, procedure, and hypothetical example of medical diagnosis are covered in sections 3, 4, and 5 respectively. In section 6, significance statements are provided. Section 7 provides a conclusion.

1.1 Main contributions

This study finds relationships between indicators among a group of people with certain pathologies and a range of disorders. The findings of this investigation will help the researcher pinpoint the exact ailment that afflicted a subset of people suffering from a specific condition. When employing this research method, there are none of the typical limitations that come with other approaches.

2. Stated Concept

2.1 Secant span

Between two n-valued interval neutrosophic sets

$$R = \begin{cases} z, \left(\left[\inf imum T_R^1(z), \sup remum T_R^1(z) \right], \left[\inf imum T_R^2(z), \sup remum T_R^2(z) \right], \ldots, \left[\inf imum T_R^q(z), \sup remum T_R^q(z) \right] \right), \\ \left(\left[\inf imum I_R^1(z), \sup remum I_R^1(z) \right], \left[\inf imum I_R^2(z), \sup remum I_R^2(z) \right], \ldots, \left[\inf imum I_R^q(z), \sup remum I_R^q(z) \right] \right), \\ \left(\left[\inf imum F_R^1(z), \sup remum F_R^1(z) \right], \left[\inf imum F_R^2(z), \sup remum F_R^2(z) \right], \ldots, \left[\inf imum F_R^q(z), \sup remum F_R^q(z) \right] \right) : z \in Z \end{cases}$$

&

$$S = \begin{cases} z, \left(\left[\inf imum T_S^1(z), \sup remum T_S^1(z) \right], \left[\inf imum T_S^2(z), \sup remum T_S^2(z) \right], \ldots, \left[\inf imum T_R^q(z), \sup remum T_S^q(z) \right] \right), \\ \left(\left[\inf imum I_S^1(z), \sup remum I_S^1(z) \right], \left[\inf imum I_S^2(z), \sup remum I_S^2(z) \right], \ldots, \left[\inf imum I_S^q(z), \sup remum I_S^q(z) \right] \right), \\ \left(\left[\inf imum F_S^1(z), \sup remum F_S^1(z) \right], \left[\inf imum F_S^2(z), \sup remum F_S^2(z) \right], \ldots, \left[\inf imum F_S^q(z), \sup remum F_S^q(z) \right] \right) : z \in Z \end{cases}$$

the secant, span is provided as

$$SEC_{NIS}(R,S) =$$

$$\frac{7}{k} \sum_{d=1}^{q} \left[\sum_{e=1}^{k} \sec \left[6 + \frac{\pi}{4} \left[\begin{array}{l} \left| \inf imum T_R^d(z_e) - \inf imum T_S^d(z_e) \right| + \left| \sup remum T_R^d(z_e) - \sup remum T_S^d(z_e) \right| + \\ \left| \inf imum I_R^d(z_e) - \inf imum I_S^d(z_e) \right| + \\ \left| \sup remum I_R^d(z_e) - \sup remum I_S^d(z_e) \right| + \\ \left| \inf imum F_R^d(z_e) - \inf imum F_S^d(z_e) \right| + \left| \sup remum F_R^d(z_e) - \sup remum F_S^d(z_e) \right| \end{array} \right] \right] \right] \qquad (1)$$

2.2 Proposition

i. $SEC_{NIS}(R,S) > 0$

ii. $SEC_{NIS}(R,S) = SEC_{NIS}(S,R)$

iii. If $R \subseteq S \subseteq U$ then $SEC_{NIS}(R,U) \geq SEC_{NIS}(R,S) \,\&\, SEC_{NIS}(R,U) \geq SEC_{NIS}(S,U)$

Proof

i. The evidence is easy

ii. The evidence is easy

iii. By (1),

$$\inf imum\, T_R^d(z_e) \leq \inf imum\, T_S^d(z_e) \leq \inf imum\, T_U^d(z_e)$$
$$\sup remum\, T_R^d(z_e) \leq \sup remum\, T_S^d(z_e) \leq \sup remum\, T_U^d(z_e)$$
$$\inf imum\, I_R^d(z_e) \geq \inf imum\, I_S^d(z_e) \geq \inf imum\, I_U^d(z_e)$$
$$\sup remum\, I_R^d(z_e) \geq \sup remum\, I_S^d(z_e) \geq \sup remum\, I_U^d(z_e)$$
$$\inf imum\, F_R^d(z_e) \geq \inf imum\, F_S^d(z_e) \geq \inf imum\, I_U^d(F_e)$$
$$\sup remum\, F_R^d(z_e) \geq \sup remum\, F_S^d(z_e) \geq \sup remum\, F_U^d(z_e)$$

In this case, the secant span is a rising function.

$$\therefore SEC_{NIS}(R,U) \geq SEC_{NIS}(R,S) \,\&\, SEC_{NIS}(R,U) \geq SEC_{NIS}(S,U)$$

3. Methodology

This part delivered a clinical evaluation. Ensure that L generates the collection of indications[Temperature, Headache, Stomach pain, Cough, Chest pain], SK reflects a class of sickness[Viral fever**,** Malaria, Stomach problem, Chest problem**]** and SP symbolizes a band that includes people[Adrian**,** Caleb**,** Gabriel] with a specific pathology. Let H be an-valued interval neutrosophic connection from a band that includes people with a specific pathology to the collection of indications and let J be an interval neutrosophic relation from the collection of indications to the class of sickness. The key goals of the calculation method are as follows:

(i) Figuring out the indications.
(ii) Utilizing n-valued interval neutrosophic sets and interval neutrosophic sets to construct scientific knowledge.
(iii) An evaluation using the recently developed computing method.

4. Procedure

Step 1: Table 1 lists a band that includes people with a specific pathology to the collection of indications H.
Step 2: Table 2 lists the collection of indications to the class of sickness J.
Step 3: Tables 1 and 2 yield the calculation G which is reported in Table 3. In every row, the number with the lowest value was chosen to determine the likelihood that a band that includes people with a specific pathology was impacted by the class of sickness.

5. Hypothetical Example

Table 1. Applying step 1.

H	Temperature	Headache	Stomach Pain	Cough	Chest Pain
Adrian	[0.2,0.3],[0.3,0.4],[0.4,0.5] [0.0,0.2],[0.2,0.4],[0.4,0.6] [0.3,0.4],[0.2,0.3],[0.1,0.3]	[0.4,0.6],[0.2,0.4],[0.3,0.5] [0.2,0.4],[0.2,0.4],[0.1,0.2] [0.0,0.1],[0.1,0.2],[0.2,0.5]	[0.1,0.2],[0.2,0.3],[0.5,0.5] [0.0,0.3],[0.1,0.2],[0.3,0.5] [0.2,0.7],[0.4,0.6],[0.2,0.3]	[0.2,0.5],[0.2,0.4],[0.0,0.6] [0.0,0.7],[0.1,0.8],[0.2,0.7] [0.3,0.4],[0.2,0.5],[0.3,0.7]	[0.5,0.5],[0.2,0.6],[0.3,0.4] [0.2,0.5],[0.3,0.4],[0.2,0.5] [0.3,0.6],[0.2,0.5],[0.3,0.7]
Caleb	[0.2,0.4],[0.3,0.4],[0.4,0.6] [0.3,0.4],[0.5,0.5],[0.2,0.6] [0.1,0.7],[0.2,0.3],[0.2,0.4]	[0.1,0.8],[0.2,0.7],[0.3,0.7] [0.2,0.8],[0.1,0.9],[0.3,0.6] [0.1,0.6],[0.2,0.6],[0.3,0.5]	[0.1,0.4],[0.2,0.7],[0.3,0.6] [0.2,0.4],[0.0,0.9],[0.3,0.4] [0.1,0.8],[0.2,0.7],[0.3,0.6]	[0.0,0.9],[0.1,0.4],[0.2,0.5] [0.2,0.4],[0.2,0.5],[0.3,0.6] [0.4,0.6],[0.2,0.5],[0.3,0.6]	[0.2,0.4],[0.3,0.4],[0.2,0.7] [0.1,0.8],[0.2,0.5],[0.3,0.4] [0.2,0.7],[0.3,0.6],[0.2,0.6]
Gabriel	[0.1,0.4],[0.3,0.4],[0.1,0.1] [0.0,0.5],[0.3,0.6],[0.1,0.7] [0.0,0.2],[0.3,0.4],[0.4,0.5]	[0.1,0.2],[0.1,0.6],[0.3,0.4] [0.2,0.5],[0.3,0.4],[0.4,0.5] [0.3,0.5],[0.2,0.8],[0.3,0.6]	[0.0,0.3],[0.2,0.4],[0.5,0.5] [0.4,0.4],[0.2,0.7],[0.0,0.2] [0.3,0.6],[0.2,0.3],[0.3,0.3]	[0.2,0.4],[0.3,0.5],[0.2,0.6] [0.2,0.4],[0.3,0.5],[0.2,0.7] [0.1,0.8],[0.2,0.7],[0.3,0.4]	[0.0,0.3],[0.1,0.9],[0.2,0.8] [0.2,0.5],[0.3,0.5],[0.2,0.6] [0.3,0.4],[0.0,0.8],[0.3,0.3]

Table 2. Applying step 2.

J	Viral fever	Malaria	Stomach Problem	Chest problem
Temperature	[0.2,0.6],[0.4,0.5],[0.2,0.7]	[0.3,0.5],[0.2,0.6],[0.4,0.5]	[0.0,0.9],[0.1,0.3],[0.2,0.4]	[0.0,0.5],[0.2,0.6],[0.0,0.2]
Head Ache	[0.1,0.3],[0.2,0.6],[0.5,0.5]	[0.0,0.1],[0.2,0.3],[0.4,0.5]	[0.3,0.6],[0.2,0.7],[0.3,0.4]	[0.4,0.6],[0.4,0.5],[0.1,0.5]
Stomach Pain	[0.3,0.3],[0.2,0.3],[0.3,0.6]	[0.2,0.3],[0.1,0.6],[0.2,0.8]	[0.4,0.5],[0.2,0.3],[0.3,0.5]	[0.4,0.4],[0.3,0.4],[0.5,0.5]
Cough	[0.2,0.4],[0.3,0.5],[0.2,0.7]	[0.3,0.6],[0.1,0.9],[0.3,0.4]	[0.2,0.6],[0.3,0.5],[0.4,0.5]	[0.2,0.6],[0.1,0.1],[0.4,0.6]
Chest Pain	[0.1,0.6],[0.2,0.3],[0.1,0.6]	[0.1,0.7],[0.2,0.5],[0.0,0.3]	[0.3,0.3],[0.2,0.4],[0.1,0.8]	[0.3,0.5],[0.2,0.5],[0.1,0.7]

Table 3. Applying step 3.

G	Viral fever	Malaria	Stomach Problem	Chest problem
Adrian	7.0708	7.0740	7.0753	7.0742
Caleb	7.0676	7.0751	7.0711	7.0763
Gabriel	7.0659	7.0816	7.0707	7.0737

6. Significance Statements

The results of this study will assist us in precisely identifying the sickness that impacted the people. The technique used is devoid of the restrictions that are frequently present in other research. Without these restrictions, this work has produced new theories on processing pictures, pattern assessment, etc.

7. Conclusion

The connection between a band that includes people with a specific pathology to the indications and the class of sickness has been examined in this study and one method (secant span) has been used to determine which sickness may have impacted the people. This study's techniques are dependable and trustworthy, making them suitable for handling medical diagnosis issues with ease. Due to the method's increased diagnostic accuracy, it may be able to avoid the shortcomings and restrictions of earlier studies.

Author Contributions

All authors contributed equally to this research.

Data availability

The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

Conflict of interest

The authors declare that there is no conflict of interest in the research.

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