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Abstract: In this short note we show that the so-called Ambiguous Set (2019) is a subclass of the Double Refined Indeterminacy Neutrosophic Set (2017) and is a particular case of the Refined Neutrosophic Set (2013). Also, the Ambiguous Set is similar to the Quadripartitioned Neutrosophic Set (2016), and Belnap’s Four-Valued Logic (1975).

Keywords: Double Refined Indeterminacy Neutrosophic Set (DRINS); Refined Neutrosophic Set (RNS); Ambiguous Set (AS); Quadripartitioned Neutrosophic Set (QNS); Belnap’s Four-Valued Logic (BFVL).

1. Introduction

We provide the definitions of the previous five types of sets, and we prove that the Ambiguous Set is a particular case of the Refined Neutrosophic Set (RNS), Quadripartitioned Neutrosophic Set (QNS), and Belnap’s Four-Valued Logic (BFVL), and mostly that the Ambiguous Set coincides with the Double Refined Indeterminacy Neutrosophic Set with the distinction that the sum of quadruple components is ≤ 2 for the AS, which makes it a subclass of the DRINS where the sum is any number between 0 and 4.

2. Ambiguous Set

The definition of the Ambiguous Set (AS) according to [1, 2] is given as follows:
Let \( U = \{g\} \) be the universe for any event \( g \), which is fixed. An AS \( \mathcal{S} \) for \( g \in U \) is defined by:
\[
\mathcal{S} = \{g, \Pi(t)(g), \Pi(f)(g), \Pi(ta)(g), \Pi(fa)(g) \mid g \in U\}
\]
where, \( \Pi(t)(g): U \rightarrow [0,1] \), \( \Pi(f)(g): U \rightarrow [0,1] \), \( \Pi(ta)(g): U \rightarrow [0,1] \), and \( \Pi(fa)(g): U \rightarrow [0,1] \) are...
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while the sum of DRINS quadruple components is ≤ 4 (no restriction), which means that one can take any number between 0 and 4, in the particular case they took the number 2, whence AS is a subclass of the DRINS.

5. Refined Neutrosophic Set

The Definition of Refined Neutrosophic Set is the following.

Let X be a space of points (objects) with generic elements in X denoted by x.

A Refined Neutrosophic Set (RNS) A in X is characterized by n sub-components:

- sub-truth membership functions $T_{1A}(x), T_{2A}(x), \ldots, T_{pA}(x)$;
- sub-indeterminacy membership functions $I_{1A}(x), I_{2A}(x), \ldots, I_{rA}(x)$;
- and sub-falsehood membership functions $F_{1A}(x), F_{2A}(x), \ldots, F_{sA}(x)$;

where $p, r, s \geq 0$ are integers, and $p + r + s = n \geq 2$, such that at least one of $p, r, s$ is ≥ 2 for assuring the refinement of at least one neutrosophic component amongst T, I, or F.

For each generic element $x \in X$, the functions $T_{1A}(x), T_{2A}(x), \ldots, T_{pA}(x), I_{1A}(x), I_{2A}(x), \ldots, I_{rA}(x), F_{1A}(x), F_{2A}(x), \ldots, F_{sA}(x) \in [0, 1]$, with their sum

$0 \leq T_{1A}(x) + T_{2A}(x) + \ldots + T_{pA}(x) + I_{1A}(x) + I_{2A}(x) + \ldots + I_{rA}(x) +$ $+ F_{1A}(x) + F_{2A}(x) + \ldots + F_{sA}(x) \leq n$

Therefore, a RNS A can be represented by

$A_{RNS} = \{ (x, T_{1A}(x), T_{2A}(x), \ldots, T_{pA}(x), I_{1A}(x), I_{2A}(x), \ldots, I_{rA}(x), F_{1A}(x), F_{2A}(x), \ldots, F_{sA}(x)), \mid x \in X \}$.

The Ambiguous Set is a particular case of the Refined Neutrosophic Set, since one takes

$p = 1$ (only one true membership);

$r = 2$ (two types of indeterminacy memberships,

$I_1 = true-ambiguous membership degree (TAMD),$

and

$I_2 = false-ambiguous membership degree (FAMD);$

$s = 1$ (only one false membership).

Therefore, the Ambiguous Set is a particular case of the Refined Neutrosophic Set.

In the same way it is proven that the Double Refined Indeterminacy Neutrosophic Set is a particular of the Refined Neutrosophic Set.

6. Ambiguous Set vs. Refined Neutrosophic Set

Both, the so-called Ambiguous Set and the Double Refined Indeterminacy Neutrosophic Set are particular cases of the Refined Neutrosophic Set [4] introduced by Smarandache in 2013.

7. Quadripartitioned Neutrosophic Set
The Definition of single-valued Quadripartitioned Neutrosophic Set [5]
Let $X$ be a non-empty set. The Quadripartitioned single-valued Neutrosophic Set (QNS) $A$ over $X$ characterizes each element $x$ in $X$ by a truth-membership function $T_A$, a contradiction membership function $C_A$, an ignorance-membership function $U_A$ and a falsity membership function $F_A$ such that:

for each $x \in X$ one has $T_A(x), C_A(x), U_A(x), F_A(x) \in [0,1]$ and

$$0 \leq T_A(x) + C_A(x) + U_A(x) + F_A(x) \in [0,1] \leq 4.$$  

When $X$ is discrete, $A$ is represented as

$$A = \sum_{i=1}^{n} < T_A(x_i), C_A(x_i), U_A(x_i), F_A(x_i) > / x_i, x_i \in X.$$  

However, when $X$ is continuous, $A$ is represented as:

$$\int_x < T_A(x), C_A(x), U_A(x), F_A(x) > / x, x \in X.$$  

It is clear the Quadripartitioned Neutrosophic Set (no matter if it is single-valued, interval-valued, or set-valued in general) is a particular case of the Refined Neutrosophic Set, of the form $T, F$, and indeterminacy $I$ is split into two parts: $I_1 = C$ (contradiction-membership) and $I_2 = U$ (ignorance-membership).

While the Ambiguous Set is similar with the Quadripartitioned Neutrosophic Set, where the two types of sub-indeterminacies $I_1$ and $I_2$ are named differently: true-ambiguous membership and respectively false-ambiguous membership.

Surely, one can rename the sub-indeterminacies $I_1$ and $I_2$ in many ways, since there are many types of indeterminacies / uncertainties / vagueness / conflicting informations etc.

8. Belnap’s Four-Valued Logic

In 1975 Belnap has considered a logic of four values: true, false, both (true and false), and neither (neither true, nor false). We can denote them by $T$ (true), $F$ (false), $C$ (true and false = contradiction), $U$ (neither true not false = ignorance) respectively and we see that the Ambiguous Set and Quadripartitioned Neutrosophic Set are similar to Belnap’s Logic.

Further on, the Belnap’s 4-valued Logic is a particular case of the Refined Neutrosophic $n$-valued Logic that has types of truths $T_1, T_2, ..., T_p$ types of indeterminacies $I_1, I_2, ..., I_r$ and types of falsehoods: $F_1, F_2, ..., F_s$.

9. Conclusion

We proved that the so-called Ambiguous Set coincides with the Double Refined Indeterminacy Neutrosophic Set with respect their quadruple structures, while, with respect to the sum of components, AS is a subclass of the DRINS.
Also, AS is similar with the Quadripartitioned Neutrosophic Set and Belnap Four-Valued Logic as well. Further on, we proved that the AS, DRINS, QNS and BFVL are particular cases of the Refined Neutrosophic Set / Logic respectively.

References


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