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Some Properties of Interval Valued Intuitionistic Fuzzy Sets of Second Type

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ABSTRACT: In this paper, we introduce the modal type operators on Interval Valued Intuitionistic Fuzzy Sets of Second Type and establish some of their properties.

KEYWORDS: Intuitionistic Fuzzy Sets (IFS), Intuitionistic Fuzzy Sets of Second Type (IFSST), Interval Valued Fuzzy Sets (IVFS), Interval Valued Intuitionistic Fuzzy Sets (IVIFS), Interval Valued Intuitionistic Fuzzy Sets of Second Type (IVIFSST).

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I. INTRODUCTION

An Intuitionistic Fuzzy Set (IFS) for a given underlying set X were introduced by K. T. Atanassov [2] which is the generalization of ordinary Fuzzy Sets (FS) and he introduced the theory of Interval Valued Intuitionistic Fuzzy Set (IVIFS) and established some of their properties.

The present authors further introduced the new extension of IVIFS namely Interval Valued Intuitionistic Fuzzy Sets of Second Type [4]. The rest of the paper is designed as follows: In Section II, we give some basic definitions. In Section III, we define the modal type operators like necessity and possibility and the new operator * on Interval valued Intuitionistic Fuzzy Sets of Second Type and establish some relations. This paper is concluded in section IV.

II. PRELIMINARIES

In this section, we give some basic definitions.

Definition 2.1[5] Let X be a non empty set. A Fuzzy Set A in X is characterized by its membership function $\mu_A : X \rightarrow [0,1]$ and $\mu_A(x)$ is interpreted as the degree of membership of the element x in fuzzy set A, for each $x \in X$. It is clear that A is completely determined by the set of tuples

$$A = \{< x, \mu_A(x) > | x \in X\}$$

Definition 2.2[2] Let X be a non empty set. An intuitionistic fuzzy set (IFS) A in a universal set X is defined as an object of the form.

$$A = \{< x, \mu_A(x), v_A(x) > | x \in X\}$$

Where $\mu_A : X \rightarrow [0, 1]$ and $v_A : X \rightarrow [0, 1]$ denote the degree of membership and the degree of non - membership of the element $x \in X$ respectively, satisfying

$$0 \leq \mu_A(x) + v_A(x) \leq 1$$

Definition 2.3[2] An Intuitionistic fuzzy sets of second type (IFSST) A in a universal set X is defined as an object of the form.

$$A = \{< x, \mu_A(x), v_A(x) > | x \in X\}$$

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Where $\mu_A : X \rightarrow [0, 1]$ and $\nu_A : X \rightarrow [0, 1]$ denote the degree of membership and the degree of non - membership of the element $x \in X$ respectively, satisfying $0 \leq \mu_A^2(x) + \nu_A^2(x) \leq 1$

Definition 2.4[2] Let X be an universal set with cardinality n . Let $[0, 1]$ be the set of all closed subintervals of the interval $[0, 1]$ and elements of this set are denoted by uppercase letters. If $M \in [0, 1]$ then it can be represented as $M = [M_L, M_U]$, where M_L and M_U are the lower and upper limits of M . For $M \in [0, 1]$, $\bar{M} = 1 - M$ represents the interval $[1 - M_L, 1 - M_U]$ and $W_M = M_U - M_L$ is the width of M .

An interval-valued fuzzy set (IVFS) A in X is given by

$$A = \{< x, M_A(x) > \mid x \in X\}$$

where $M_A : X \rightarrow [0, 1]$, $M_A(x)$ denote the degree of membership of the element x to the set A .

Definition 2.5[3] An interval-valued intuitionistic fuzzy set (IVIFS) A in X is given by

$$A = \{< x, M_A(x), N_A(x) > \mid x \in X\}$$

where $M_A : X \rightarrow [0, 1]$, $N_A : X \rightarrow [0, 1]$. The intervals $M_A(x)$ and $N_A(x)$ denote the degree of membership and the degree of non-membership of the element x to the set A , where $M_A(x) = [M_{AL}(x), M_{AU}(x)]$, and $N_A(x) = [N_{AL}(x), N_{AU}(x)]$ with the condition that

$$M_{AU}(x) + N_{AU}(x) \leq 1 \text{ for all } x \in X$$

Definition 2.6[4] An Interval Valued Intuitionistic Fuzzy Sets of Second Type (IVIFSST) A in X is given by

$$A = \{< x, M_A(x), N_A(x) > \mid x \in X\}$$

Where $M_A : X \rightarrow [0, 1]$, $N_A : X \rightarrow [0, 1]$. The intervals $M_A(x)$ and $N_A(x)$ denote the degree of membership and the degree of non - membership of the element x to the set A , where $M_A(x) = [M_{AL}(x), M_{AU}(x)]$, and $N_A(x) = [N_{AL}(x), N_{AU}(x)]$ with the condition that

$$M_{AU}(x) + N_{AU}(x) \leq 1 \text{ for all } x \in X$$

Definition 2.7[4] Let $A = \{< x, M_A(x), N_A(x) > \mid x \in X\}$ and $B = \{< x, M_B(x), N_B(x) > \mid x \in X\}$ be two IVIFSSTs of $X = \{x_1, x_2, x_3, \dots, x_n\}$, then we have the following relations and operations

1. $A \subset B$ iff $M_{AU}(x) \leq M_{BU}(x) \& M_{AL}(x) \leq M_{BL}(x) \& N_{AU}(x) \geq N_{BU}(x) \& N_{AL}(x) \geq N_{BL}(x)$
2. $A \supset B$ iff $M_{AU}(x) \geq M_{BU}(x) \& M_{AL}(x) \geq M_{BL}(x) \& N_{AU}(x) \leq N_{BU}(x) \& N_{AL}(x) \leq N_{BL}(x)$
3. $A = B$ iff $A \subset B \& B \subset A$
4. $\bar{A} = \{< x, [N_{AL}(x), N_{AU}(x)], [M_{AL}(x), M_{AU}(x)] > \mid x \in X\}$
5. $A \cup B = \{< x, [\max(M_{AL}(x), M_{BL}(x)), \max(M_{AU}(x), M_{BU}(x))] , [\min(N_{AL}(x), N_{BL}(x)), \min(N_{AU}(x), N_{BU}(x))] > \mid x \in X\}$
6. $A \cap B = \{< x, [\min(M_{AL}(x), M_{BL}(x)), \min(M_{AU}(x), M_{BU}(x))] , [\max(N_{AL}(x), N_{BL}(x)), \max(N_{AU}(x), N_{BU}(x))] > \mid x \in X\}$

III. SOME OPERATORS ON IVIFSST

In this section, we define the modal type operators like necessity and possibility. Also establish some of their relations

Definition 3.1 For every IVIFSST, we define the following operators:

The Necessity operator

$$\square A = \left\{ < x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), \sqrt{1 - M_{AU}(x)}] > \mid x \in X \right\}$$

The Possibility operator

$$\diamond A = \left\{ < x, [M_{AL}(x), \sqrt{1 - N_{AU}(x)}], [N_{AL}(x), N_{AU}(x)] > \mid x \in X \right\}$$

Definition: 3.2 An operator which associates to every IVIFS and IFS. Then we define

$$* A = \{< x, M_{AL}(x), N_{AL}(x) > \mid x \in X\}$$

Where $M_A : X \rightarrow [0, 1]$, $N_A : X \rightarrow [0, 1]$. The intervals $M_{AL}(x)$ and $N_{AL}(x)$ denote the degree of membership and the degree of non-membership of the element x to the set A with the condition that,

$$M_{AU}(x) + N_{AU}(x) \leq 1 \text{ for all } x \in X.$$

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Proposition 3.1 For every IVIFSST A , we have the following

- (i). $\overline{(\square \bar{A})} = \diamond A$
- (ii). $\overline{(\diamond \bar{A})} = \square A$
- (iii). $\square \square A = \square A$
- (iv). $\square \diamond A = \diamond A$
- (v). $\diamond \square A = A$
- (vi). $\diamond \diamond A = \diamond A$

Proof:

(i). Let $A = \{< x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), N_{AU}(x)] > | x \in X\}$

Then, $\bar{A} = \{< x, [N_{AL}(x), N_{AU}(x)], [M_{AL}(x), M_{AU}(x)] > | x \in X\}$

$$\square \bar{A} = \left\{ < x, [N_{AL}(x), N_{AU}(x)], [M_{AL}(x), \sqrt{1 - N^2_{AU}(x)}] | x \in X \right\}$$

$$\begin{aligned} \overline{(\square \bar{A})} &= \left\{ < x, [M_{AL}(x), \sqrt{1 - N^2_{AU}(x)}], [N_{AL}(x), N_{AU}(x)] | x \in X \right\} \\ &= \diamond A \end{aligned}$$

(ii). Let $A = \{< x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), N_{AU}(x)] > | x \in X\}$

Then, $\bar{A} = \{< x, [N_{AL}(x), N_{AU}(x)], [M_{AL}(x), M_{AU}(x)] > | x \in X\}$

$$\diamond \bar{A} = \left\{ < x, [N_{AL}(x), \sqrt{1 - M^2_{AU}(x)}], [M_{AL}(x), M_{AU}(x)] | x \in X \right\}$$

$$\begin{aligned} \overline{(\diamond \bar{A})} &= \left\{ < x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), \sqrt{1 - M^2_{AU}(x)}] | x \in X \right\} \\ &= \square A \end{aligned}$$

(iii). Let $A = \{< x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), N_{AU}(x)] > | x \in X\}$

Then, $\square A = \{< x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), \sqrt{1 - M^2_{AU}(x)}] > | x \in X\}$

$$\begin{aligned} \square \square A &= \left\{ < x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), \sqrt{1 - M^2_{AU}(x)}] > | x \in X \right\} \\ &= \square A \end{aligned}$$

(iv). Let $A = \{< x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), N_{AU}(x)] > | x \in X\}$

Then, $\diamond A = \{< x, [M_{AL}(x), \sqrt{1 - N^2_{AU}(x)}], [N_{AL}(x), N_{AU}(x)] | x \in X\}$

$$\begin{aligned} \square \diamond A &= \left\{ < x, [M_{AL}(x), \sqrt{1 - N^2_{AU}(x)}], [N_{AL}(x), \sqrt{1 - (\sqrt{1 - N^2_{AU}(x)})^2}] > | x \in X \right\} \\ &= \{ < x, [M_{AL}(x), \sqrt{1 - N^2_{AU}(x)}], [N_{AL}(x), N_{AU}(x)] > | x \in X \} \\ &= \diamond A \end{aligned}$$

(v). Let $A = \{< x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), N_{AU}(x)] > | x \in X\}$

Then, $\square A = \{< x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), \sqrt{1 - M^2_{AU}(x)}] > | x \in X\}$

$$\begin{aligned} \diamond \square A &= \left\{ < x, [M_{AL}(x), \sqrt{1 - (\sqrt{1 - M^2_{AU}(x)})^2}], [N_{AL}(x), \sqrt{1 - M^2_{AU}(x)}] > | x \in X \right\} \\ &= \{ < x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), \sqrt{1 - M^2_{AU}(x)}] > | x \in X \} \\ &= \square A \end{aligned}$$

(vi). Let $A = \{< x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), N_{AU}(x)] > | x \in X\}$

Then, $\diamond A = \{< x, [M_{AL}(x), \sqrt{1 - N^2_{AU}(x)}], [N_{AL}(x), N_{AU}(x)] > | x \in X\}$

$$\begin{aligned} \diamond \diamond A &= \left\{ < x, [M_{AL}(x), \sqrt{1 - N^2_{AU}(x)}], [N_{AL}(x), N_{AU}(x)] > | x \in X \right\} \\ &= \diamond A \end{aligned}$$

Proposition 3.2 For every two IVIFSSTs A and B , we have the following:

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- (i). $\square(A \cup B) = \square A \cup \square B$
- (ii). $\square(A \cap B) = \square A \cap \square B$
- (iii). $\diamond(A \cup B) = \diamond A \cup \diamond B$
- (iv). $\diamond(A \cap B) = \diamond A \cap \diamond B$

Proof:

- (i). Let $A = \{x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), N_{AU}(x)] > |x \in X\}$,
 $B = \{x, [M_{BL}(x), M_{BU}(x)], [N_{BL}(x), N_{BU}(x)] > |x \in X\}$

Then,

$$\begin{aligned}
 (A \cup B) &= \{x, [\max(M_{AL}(x), M_{BL}(x)), \max(M_{AU}(x), M_{BU}(x))], \\
 &\quad [\min(N_{AL}(x), N_{BL}(x)), \min(N_{AU}(x), N_{BU}(x))] > |x \in X\} \\
 \square(A \cup B) &= \{x, [\max(M_{AL}(x), M_{BL}(x)), \max(M_{AU}(x), M_{BU}(x))], \\
 &\quad [\min(N_{AL}(x), N_{BL}(x)), \sqrt{1 - \min(N_{AU}(x), N_{BU}(x))^2}] > |x \in X\} \\
 &= \{x, [\max(M_{AL}(x), M_{BL}(x)), \max(M_{AU}(x), M_{BU}(x))], \\
 &\quad [\min(N_{AL}(x), N_{BL}(x)), \min(\sqrt{1 - M^2_{AU}(x)}, \sqrt{1 - M^2_{BU}(x)})] > |x \in X\} \\
 &= \{x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), \sqrt{1 - M^2_{AU}(x)}] > |x \in X\} \cup \\
 &\quad \{x, [M_{BL}(x), M_{BU}(x)], [N_{BL}(x), \sqrt{1 - M^2_{BU}(x)}] > |x \in X\} \\
 &= \square A \cup \square B
 \end{aligned}$$

- (ii). Let $A = \{x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), N_{AU}(x)] > |x \in X\}$,
 $B = \{x, [M_{BL}(x), M_{BU}(x)], [N_{BL}(x), N_{BU}(x)] > |x \in X\}$

Then,

$$\begin{aligned}
 (A \cap B) &= \{x, [\min(M_{AL}(x), M_{BL}(x)), \min(M_{AU}(x), M_{BU}(x))], \\
 &\quad [\max(N_{AL}(x), N_{BL}(x)), \max(N_{AU}(x), N_{BU}(x))] > |x \in X\}
 \end{aligned}$$

Now,

$$\begin{aligned}
 \square(A \cap B) &= \{x, [\min(M_{AL}(x), M_{BL}(x)), \min(M_{AU}(x), M_{BU}(x))], \\
 &\quad [\max(N_{AL}(x), N_{BL}(x)), \sqrt{1 - \min(N_{AU}(x), N_{BU}(x))^2}] > |x \in X\} \\
 &= \{x, [\min(M_{AL}(x), M_{BL}(x)), \min(M_{AU}(x), M_{BU}(x))], \\
 &\quad [\max(N_{AL}(x), N_{BL}(x)), \max(\sqrt{1 - M^2_{AU}(x)}, \sqrt{1 - M^2_{BU}(x)})] > |x \in X\} \\
 &= \{x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), \sqrt{1 - M^2_{AU}(x)}] > |x \in X\} \cap \\
 &\quad \{x, [M_{BL}(x), M_{BU}(x)], [N_{BL}(x), \sqrt{1 - M^2_{BU}(x)}] > |x \in X\} \\
 &= \square A \cap \square B
 \end{aligned}$$

- (iii). Let $A = \{x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), N_{AU}(x)] > |x \in X\}$,
 $B = \{x, [M_{BL}(x), M_{BU}(x)], [N_{BL}(x), N_{BU}(x)] > |x \in X\}$

Then,

$$\begin{aligned}
 (A \cup B) &= \{x, [\max(M_{AL}(x), M_{BL}(x)), \max(M_{AU}(x), M_{BU}(x))], \\
 &\quad [\min(N_{AL}(x), N_{BL}(x)), \min(N_{AU}(x), N_{BU}(x))] > |x \in X\} \\
 \diamond(A \cup B) &= \left\{x, [\max(M_{AL}(x), M_{BL}(x)), \sqrt{1 - \min(N_{AU}(x), N_{BU}(x))^2}], \right. \\
 &\quad \left. [\min(N_{AL}(x), N_{BL}(x)), \min(N_{AU}(x), N_{BU}(x))] > |x \in X\right\} \\
 &= \left\{x, [\max(M_{AL}(x), M_{BL}(x)), \max(\sqrt{1 - N^2_{AU}(x)}, \sqrt{1 - N^2_{BU}(x)})], \right. \\
 &\quad \left. [\min(N_{AL}(x), N_{BL}(x)), \min(N_{AU}(x), N_{BU}(x))] > |x \in X\right\}
 \end{aligned}$$

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$$\begin{aligned}
 &= \left\{ < x, [M_{AL}(x), \sqrt{1 - N^2_{AU}(x)}], [N_{AL}(x), N_{AU}(x)] > | x \in X \right\} \cup \\
 &\quad \left\{ < x, [M_{BL}(x), \sqrt{1 - N^2_{BU}(x)}], [N_{BL}(x), N_{BU}(x)] > | x \in X \right\} \\
 &= \diamond A \cup \diamond B
 \end{aligned}$$

$$\begin{aligned}
 \text{(iv). Let } A &= \{ < x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), N_{AU}(x)] > | x \in X \}, \\
 B &= \{ < x, [M_{BL}(x), M_{BU}(x)], [N_{BL}(x), N_{BU}(x)] > | x \in X \}
 \end{aligned}$$

Then,

$$\begin{aligned}
 (A \cap B) &= \left\{ < x, [\min(M_{AL}(x), M_{BL}(x)), \min(M_{AU}(x), M_{BU}(x))], \right. \\
 &\quad \left. [\max(N_{AL}(x), N_{BL}(x)), \max(N_{AU}(x), N_{BU}(x))] > | x \in X \right\} \\
 \diamond(A \cap B) &= \left\{ < x, [\min(M_{AL}(x), M_{BL}(x)), \sqrt{1 - \max(N_{AU}(x), N_{BU}(x))^2}], \right. \\
 &\quad \left. [\max(N_{AL}(x), N_{BL}(x)), \max(N_{AU}(x), N_{BU}(x))] > | x \in X \right\} \\
 &= \left\{ < x, [\min(M_{AL}(x), M_{BL}(x)), \min(\sqrt{1 - N^2_{AU}(x)}, \sqrt{1 - N^2_{BU}(x)})], \right. \\
 &\quad \left. [\max(N_{AL}(x), N_{BL}(x)), \max(N_{AU}(x), N_{BU}(x))] > | x \in X \right\} \\
 &= \left\{ < x, [M_{AL}(x), \sqrt{1 - N^2_{AU}(x)}], [N_{AL}(x), N_{AU}(x)] > | x \in X \right\} \cap \\
 &\quad \left\{ < x, [M_{BL}(x), \sqrt{1 - N^2_{BU}(x)}], [N_{BL}(x), N_{BU}(x)] > | x \in X \right\} \\
 &= \diamond A \cap \diamond B
 \end{aligned}$$

Proposition 3.3 For every IVIFSST A , we have the following

- (i). $*(\square A) = *A$
- (ii). $*(\diamond A) = *A$
- (iii). $*(\overline{A}) = \overline{*A}$

Proof:

$$\text{(i). Let } A = \{ < x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), N_{AU}(x)] > | x \in X \}$$

Then,

$$\begin{aligned}
 *A &= \{ < x, M_{AL}(x), N_{AU}(x) > | x \in X \}, \\
 \square A &= \{ < x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), \sqrt{1 - M^2_{AU}(x)}] > | x \in X \}
 \end{aligned}$$

$$\text{And } \diamond A = \left\{ < x, [M_{AL}(x), \sqrt{1 - N^2_{AU}(x)}], [N_{AL}(x), N_{AU}(x)] > | x \in X \right\}$$

Now,

$$\begin{aligned}
 \text{(i). } *(\square A) &= * \{ < x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), \sqrt{1 - M^2_{AU}(x)}] > | x \in X \} \\
 &= \{ < x, M_{AL}(x), N_{AL}(x) > | x \in X \} \\
 &= *A
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii). } *(\diamond A) &= * \{ < x, [M_{AL}(x), \sqrt{1 - N^2_{AU}(x)}], [N_{AL}(x), N_{AU}(x)] > | x \in X \} \\
 &= \{ < x, M_{AL}(x), N_{AL}(x) > | x \in X \} \\
 &= *A
 \end{aligned}$$

$$\text{(iii). If } A = \{ < x, [M_{AL}(x), M_{AU}(x)], [N_{AL}(x), N_{AU}(x)] > | x \in X \}$$

Then,

$$\begin{aligned}
 \bar{A} &= \{ < x, [N_{AL}(x), N_{AU}(x)], [M_{AL}(x), M_{AU}(x)] > | x \in X \}, \\
 *(\bar{A}) &= * \{ < x, [N_{AL}(x), N_{AU}(x)], [M_{AL}(x), M_{AU}(x)] > | x \in X \} \\
 &= \{ < x, N_{AL}(x), M_{AL}(x) > | x \in X \} \\
 &= \overline{*A}
 \end{aligned}$$

therefore, $*(\bar{A}) = \overline{*A}$

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Proposition 3.4 For every two IVIFSSTs A and B, we have the following

- (i). $* (A \cup B) = * A \cup * B$
- (ii). $* (A \cap B) = * A \cap * B$

Proof:

Let $(A \cup B) = \{ < x, [\max(M_{AL}(x), M_{BL}(x)), \max(M_{AU}(x), M_{BU}(x))], [\min(N_{AL}(x), N_{BL}(x)), \min(N_{AU}(x), N_{BU}(x))] > | x \in X \}$

Then,

$$\begin{aligned}
 (i). * (A \cup B) &= * \{ < x, [\max(M_{AL}(x), M_{BL}(x)), \max(M_{AU}(x), M_{BU}(x))], \\
 &\quad [\min(N_{AL}(x), N_{BL}(x)), \min(N_{AU}(x), N_{BU}(x))] > | x \in X \} \\
 &= \{ < x, \max(M_{AL}(x), M_{BL}(x)), \min(N_{AL}(x), N_{BL}(x)) > | x \in X \} \\
 &= \{ < x, M_{AL}(x), N_{AL}(x) \} > | x \in X \} \cup \{ < x, M_{BL}(x), N_{BL}(x) \} > | x \in X \} \\
 &= * A \cup * B
 \end{aligned}$$

$$\begin{aligned}
 (ii). (A \cap B) &= \{ < x, [\min(M_{AL}(x), M_{BL}(x)), \min(M_{AU}(x), M_{BU}(x))], \\
 &\quad [\max(N_{AL}(x), N_{BL}(x)), \max(N_{AU}(x), N_{BU}(x))] > | x \in X \}
 \end{aligned}$$

Then,

$$\begin{aligned}
 * (A \cap B) &= * \{ < x, [\min(M_{AL}(x), M_{BL}(x)), \min(M_{AU}(x), M_{BU}(x))], \\
 &\quad [\max(N_{AL}(x), N_{BL}(x)), \max(N_{AU}(x), N_{BU}(x))] > | x \in X \} \\
 &= \{ < x, \min(M_{AL}(x), M_{BL}(x)), \max(N_{AL}(x), N_{BL}(x)) > | x \in X \} \\
 &= \{ < x, M_{AL}(x), N_{AL}(x) \} > | x \in X \} \cap \{ < x, M_{BL}(x), N_{BL}(x) \} > | x \in X \} \\
 &= * A \cap * B
 \end{aligned}$$

IV. CONCLUSION

We have introduced the modal type operators on Interval Valued Intuitionistic Fuzzy Sets of Second Type (IVIFSST) and established some relations. In future study, we will define more operators on IVIFSST and study their applications.

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