BIPOLAR INTERVAL VALUED INTUITIONISTIC FUZZY NECESSITY OPERATOR

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Abstract

In this paper we have introduced the necessity operator on a Bipolar Interval Valued Intuitionistic Fuzzy Subset of a Bipolar Interval Valued Intuitionistic Fuzzy Topological space and verified its property.

Keyword

Bipolar Interval Valued Intuitionistic Fuzzy Topological Space, Bipolar Interval Valued Intuitionistic Fuzzy Set.

1. Introduction:

Lee introduced the concept of Bipolar fuzzy set. In Bipolar Intuitionistic Fuzzy Topology the membership and non-membership degree of the fuzzy set lies in the range [0,1] and [-1,0][21]. In this paper we have introduced the Bipolar Interval Valued Intuitionistic Fuzzy necessity operator on a Bipolar Interval Valued Intuitionistic Fuzzy Subset of a Bipolar Interval Valued Intuitionistic Fuzzy Topological space and verified that the necessity operator on a Bipolar Interval Valued Intuitionistic Fuzzy Subset itself forms a Bipolar Interval Valued Intuitionistic Fuzzy Topological space.

2. Definition:

Let X be a non-empty set, and let A be a Bipolar interval valued intuitionistic fuzzy set on a Bipolar Interval Valued Intuitionistic Topological Space BIVIFTS(X), then the necessity operator on A is defined as

i. $$[\ ]A = \left\{ \left\langle x, \begin{matrix} [\mu^P_{AL}(x), \mu^P_{AU}(x)], [1 - \mu^P_{AU}(x), 1 - \mu^P_{AL}(x)], \\ [\mu^N_{AL}(x), \mu^N_{AU}(x)], [-1 + \mu^N_{AU}(x), -1 + \mu^N_{AL}(x)] \end{matrix} \right\rangle \mid x \in x \right\}$$

2.1. Theorem:

Let (X,τ) be a Bipolar Interval Valued Intuitionistic Fuzzy Topological Space (BIVIFTS). Based on the necessity operator on a Bipolar Interval Valued Intuitionistic Fuzzy set A on X, we can also construct several BIVIFTSs on X as

$$\tau_N = \{[\ ]A \mid A \in \tau\}$$

i.e., the necessity operator defined in the above definition itself forms a topology.

Proof:

In order to prove the topology we have to prove the following

Let S be a set and be a family of bipolar interval valued intuitionistic fuzzy subset of S. The family is called a Bipolar Interval Valued Intuitionistic Fuzzy Topology (BIVIFT) on S if satisfies the following axioms

i. $0_s, 1_s \in \tau$

ii. If $\{A_i; i \in I\} \subseteq \tau, then \bigcup_{i=1}^{\infty} A_i \in \tau$

iii. If $A_1, A_2, A_3 \ldots A_n \in \tau, then \bigcap_{i=1}^{n} A_i \in \tau$

Let $A_1, A_2, \ldots A_i$ be Bipolar interval valued intuitionistic fuzzy subsets on a Bipolar Interval Valued Intuitionistic Topological Space BIVIFTS(X).

To prove necessity operator is a Bipolar Interval Valued Intuitionistic Topological Space BIVIFTS(X)

i. obviously $0_s, 1_s \in \tau_N$

ii.

$$A \cap B = \left\{ \left\langle \begin{array}{l} \left[x, \mu^{P}_{(A\cap B)L}(x), \mu^{P}_{(A\cap B)U}(x)\right], \left[\mu^{N}_{(A\cap B)L}(x), \mu^{N}_{(A\cap B)U}(x)\right], \\ \left[\nu^{P}_{(A\cap B)L}(x), \nu^{P}_{(A\cap B)U}(x)\right], \left[\nu^{N}_{(A\cap B)L}(x), \nu^{N}_{(A\cap B)U}(x)\right] \end{array} \right\rangle \mid x \in X \right\}$$

where

$$\mu^{P}_{(A\cap B)L}(x) = \min\{\mu^{P}(x), \mu^{P}(x)\}$$

$$\mu^{p}_{(A\square B)U}(x) = \max\{\mu^{p}_{AU}(x), \mu^{p}_{BU}(x)\}$$
$$\mu^{N}_{(A\square B)L}(x) = \max\{\mu^{N}_{AL}(x), \mu^{N}_{BL}(x)\}$$
$$\mu^{N}_{(A\square B)U}(x) = \min\{\mu^{N}_{AU}(x), \mu^{N}_{BU}(x)\}$$
$$\mu^{p}_{(A\square B)L}(x) = \min\{\mu^{p}_{AL}(x), \mu^{p}_{BL}(x)\}$$
$$\mu^{p}_{(A\square B)U}(x) = \max\{\mu^{p}_{AU}(x), \mu^{p}_{BU}(x)\}$$
$$\mu^{N}_{(A\square B)L}(x) = \max\{\mu^{N}_{AL}(x), \mu^{N}_{BL}(x)\}$$
$$\mu^{N}_{(A\square B)U}(x) = \min\{\mu^{N}_{AU}(x), \mu^{N}_{BU}(x)\}$$

$$\square[\ ]A_1 \square [\ ]A_2 = \left\{ \left\langle \begin{array}{l} \left[x, \mu^{p}_{([\ ]A_1\square[\ ]A_2)L}(x), \mu^{p}_{([\ ]A_1\square[\ ]A_2)U}(x)\right], \\ \left[\mu^{N}_{([\ ]A_1\square[\ ]A_2)L}(x), \mu^{N}_{([\ ]A_1\square[\ ]A_2)U}(x)\right], \\ \left[\mu^{p}_{([\ ]A_1\square[\ ]A_2)L}(x), \mu^{p}_{([\ ]A_1\square[\ ]A_2)U}(x)\right], \\ \left[\mu^{N}_{([\ ]A_1\square[\ ]A_2)L}(x), \mu^{N}_{([\ ]A_1\square[\ ]A_2)U}(x)\right] \end{array} \right\rangle \mid x \square X \right\}$$

where

$$\mu^{p}_{([\ ]A_1\square[\ ]A_2)L}(x) = \min\{\mu^{p}_{[\ ]A_1L}(x), \mu^{p}_{[\ ]A_2L}(x)\}$$
$$\mu^{p}_{([\ ]A_1\square[\ ]A_2)U}(x) = \max\{\mu^{p}_{[\ ]A_1U}(x), \mu^{p}_{[\ ]A_2U}(x)\}$$
$$\mu^{N}_{([\ ]A_1\square[\ ]A_2)L}(x) = \max\{\mu^{N}_{[\ ]A\,L}(x), \mu^{N}_{[\ ]A_2L}(x)\}$$
$$\mu^{N}_{([\ ]A_1\square[\ ]A_2)U}(x) = \min\{\mu^{N}_{[\ ]A\,U}(x), \mu^{N}_{[\ ]A_2U}(x)\}$$
$$\mu^{p}_{([\ ]A_1\square[\ ]A_2)L}(x) = \min\{\mu^{p}_{[\ ]A\,L}(x), \mu^{p}_{[\ ]A_2L}(x)\}$$
$$\mu^{p}_{([\ ]A_1\square[\ ]A_2)U}(x) = \max\{\mu^{p}_{[\ ]A\,U}(x), \mu^{p}_{[\ ]A_2U}(x)\}$$
$$\mu^{N}_{([\ ]A_1\square[\ ]A_2)L}(x) = \max\{\mu^{N}_{[\ ]A\,L}(x), \mu^{N}_{[\ ]A_2L}(x)\}$$
$$\mu^{N}_{([\ ]A_1\square[\ ]A_2)U}(x) = \min\{\mu^{N}_{[\ ]A\,U}(x), \mu^{N}_{[\ ]A_2U}(x)\}$$

then

$$\mu^{p}_{([\ ]A_1\square[\ ]A_2)L}(x) = \min\{\mu^{p}_{A\,L}(x), \mu^{p}_{A\,L}(x)\}$$
$$\mu^{p}_{([\ ]A_1\square[\ ]A_2)U}(x) = \max\{\mu^{p}(x), \mu^{p}(x)\}$$
$$\mu^{N}_{([\ ]A_1\square[\ ]A_2)L}(x) = \max\{\mu^{N}_{L}(x), \mu^{N}_{L}(x)\}$$

$$\mu^N_{([\,]A_1 \square [\,]A_2)U}(x) = \min\left\{\mu^N_{A_1U}(x), \mu^N_{A_2U}(x)\right\}$$

$$1-\mu^p_{([\,]A_1 \square [\,]A_2)L}(x) = \min\left\{1-\mu^p_{A_1L}(x), 1-\mu^p_{A_2L}(x)\right\}$$

$$1-\mu^p_{([\,]A_1 \square [\,]A_2)U}(x) = \max\left\{1-\mu^p_{A_1U}(x), 1-\mu^p_{A_2U}(x)\right\}$$

$$1-\mu^N_{([\,]A_1 \square [\,]A_2)L}(x) = \max\left\{1-\mu^N_{A_1L}(x), 1-\mu^N_{A_2L}(x)\right\}$$

$$1-\mu^N_{([\,]A_1 \square [\,]A_2)U}(x) = \min\left\{1-\mu^N_{A_1U}(x), 1-\mu^N_{A_2U}(x)\right\}$$

$$\square[\,]A_1 \square [\,]A_2 = \left\{\left\langle \begin{array}{l} x, \left[\mu^p_{([\,]A_1 \square [\,]A_2)L}(x), \mu^p_{([\,]A_1 \square [\,]A_2)U}(x)\right], \\ \left[\mu^N_{([\,]A_1 \square [\,]A_2)L}(x), \mu^N_{([\,]A_1 \square [\,]A_2)U}(x)\right], \\ \left[1-\mu^p_{([\,]A_1 \square [\,]A_2)L}(x), 1-\mu^p_{([\,]A_1 \square [\,]A_2)U}(x)\right], \\ \left[1-\mu^N_{([\,]A_1 \square [\,]A_2)L}(x), 1-\mu^N_{([\,]A_1 \square [\,]A_2)U}(x)\right] \end{array} \right\rangle \mid x \in X \right\}^N$$

$$\square[\,]A_1 \square [\,]A_2 \square \ldots [\,]A_i = \left\{\left\langle \begin{array}{l} x, \left[\mu^p_{([\,]A_1 \square [\,]A_2 \square \ldots [\,]A_i)L}(x), \mu^p_{([\,]A_1 \square [\,]A_2 \square \ldots [\,]A_i)U}(x)\right], \\ \left[\mu^N_{([\,]A_1 \square [\,]A_2 \square \ldots [\,]A_i)L}(x), \mu^N_{([\,]A_1 \square [\,]A_2 \square \ldots [\,]A_i)U}(x)\right], \\ \left[\mu^p_{([\,]A_1 \square [\,]A_2 \square \ldots [\,]A_i)L}(x), \mu^p_{([\,]A_1 \square [\,]A_2 \square \ldots [\,]A_i)U}(x)\right], \\ \left[\mu^N_{([\,]A_1 \square [\,]A_2 \square \ldots [\,]A_i)L}(x), \mu^N_{([\,]A_1 \square [\,]A_2 \square \ldots [\,]A_i)U}(x)\right] \end{array} \right\rangle \mid x \in X \right\}$$

where

$$\mu^p_{([\,]A_1 \square [\,]A_2 \ldots [\,]A_i)L}(x) = \min\left\{\mu^p_{[\,]A_1L}(x), \mu^p_{[\,]A_2L}(x), \ldots, \mu^p_{[\,]A_iL}(x)\right\}$$

$$\mu^p_{([\,]A_1 \square [\,]A_2 \square \ldots [\,]A_i)U}(x) = \max\left\{\mu^p_{[\,]A_1U}(x), \mu^p_{[\,]A_2U}(x), \ldots, \mu^p_{[\,]A_iU}(x)\right\}$$

$$\mu^N_{([\,]A_1 \square [\,]A_2 \ldots [\,]A_i)L}(x) = \max\left\{\mu^N_{[\,]A_1L}(x), \mu^N_{[\,]A_2L}(x), \ldots, \mu^N_{[\,]A_iL}(x)\right\}$$

$$\mu^N_{([\,]A_1 \square [\,]A_2 \ldots [\,]A_i)U}(x) = \min\left\{\mu^N_{[\,]A_1U}(x), \mu^N_{[\,]A_2U}(x), \ldots, \mu^N_{[\,]A_iU}(x)\right\}$$

$$\mu^p_{([\,]A_1 \square [\,]A_2 \ldots [\,]A_i)L}(x) = \min\left\{\mu^p_{[\,]A_1L}(x), \mu^p_{[\,]A_2L}(x), \ldots, \mu^p_{[\,]A_iL}(x)\right\}$$

$$\mu^p_{([\,]A_1 \square [\,]A_2 \ldots [\,]A_i)U}(x) = \max\left\{\mu^p_{[\,]A_1U}(x), \mu^p_{[\,]A_2U}(x), \ldots, \mu^p_{[\,]A_iU}(x)\right\}$$

$$\mu^N_{([\,]A_1 \square [\,]A_2 \ldots [\,]A_i)L}(x) = \max\left\{\mu^N_{[\,]A_1L}(x), \mu^N_{[\,]A_2L}(x), \ldots, \mu^N_{[\,]A_iL}(x)\right\}$$

$$\mu^N_{([\,]A_1 \square [\,]A_2 \ldots [\,]A_i)U}(x) = \min\left\{\mu^N_{[\,]A_1U}(x), \mu^N_{[\,]A_2U}(x), \ldots, \mu^N_{[\,]A_iU}(x)\right\}$$

then

$$\mu^p_{([\,]A_1 \square [\,]A_2 \square \ldots [\,]A_i)L}(x) = \min\left\{\mu^p_{L}(x), \mu^p_{L}(x), \ldots, \mu^p_{L}(x)\right\}$$

$$\mu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x) = \max\left\{\mu^{p}_{A_1U}(x),\mu^{p}_{A_2U}(x),\ldots,\mu^{p}_{A_iU}(x)\right\}$$

$$\mu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x) = \max\left\{\mu^{N}_{A_1L}(x),\mu^{N}_{A_2L}(x),\ldots,\mu^{N}_{A_iL}(x)\right\}$$

$$\mu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x) = \min\left\{\mu^{N}_{A_1U}(x),\mu^{N}_{A_2U}(x),\ldots,\mu^{N}_{A_iU}(x)\right\}$$

$$1-\mu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x) = \min\left\{1-\mu^{p}_{A_1L}(x),1-\mu^{p}_{A_2L}(x),\ldots1-\mu^{p}_{AL}(x)\right\}$$

$$1-\mu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x) = \max\left\{1-\mu^{p}_{A_1U}(x),1-\mu^{p}_{A_2U}(x),\ldots1-\mu^{p}_{AU}(x)\right\}$$

$$1-\mu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x) = \max\left\{1-\mu^{N}_{A_1L}(x),1-\mu^{N}_{A_2L}(x),\ldots1-\mu^{N}_{AL}(x)\right\}$$

$$1-\mu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x) = \min\left\{1-\mu^{N}_{A_1U}(x),1-\mu^{N}_{A_2U}(x),\ldots1-\mu^{N}_{AU}(x)\right\}$$

$$\cup[\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i = \left\{\left\langle \begin{array}{l} x,\left[\mu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x),\mu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x)\right], \\ \left[\mu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x),\mu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x)\right], \\ \left[1-\mu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x),1-\mu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x)\right], \\ \left[1-\mu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x),1-\mu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x)\right] \end{array}\right\rangle \mid x\in X\right\} \in \tau_N$$

Hence the arbitrary union of Bipolar Interval Valued Intuitionistic Necessity Operators is in Bipolar Interval Valued Intuitionistic Fuzzy Topology τ.

iii.

$$A\cap B = \left\{\left\langle \begin{array}{l} \left[x,\mu^{p}_{(A\cap B)L}(x),\mu^{p}_{(A\cap B)U}(x)\right],\left[\mu^{N}_{(A\cap B)L}(x),\mu^{N}_{(A\cap B)U}(x)\right], \\ \left[\nu^{p}_{(A\cap B)L}(x),\nu^{p}_{(A\cap B)U}(x)\right],\left[\nu^{N}_{(A\cap B)L}(x),\nu^{N}_{(A\cap B)U}(x)\right] \end{array}\right\rangle \mid x\in X\right\}$$

where

$$\mu^{p}_{(A\cap B)L}(x) = \max\left\{\mu^{p}_{AL}(x),\mu^{p}_{BL}(x)\right\}$$

$$\mu^{p}_{(A\cap B)U}(x) = \min\left\{\mu^{p}_{AU}(x),\mu^{p}_{BU}(x)\right\}$$

$$\mu^{N}_{(A\cap B)L}(x) = \min\left\{\mu^{N}_{AL}(x),\mu^{N}_{BL}(x)\right\}$$

$$\mu^{N}_{(A\cap B)U}(x) = \max\left\{\mu^{N}_{AU}(x),\mu^{N}_{BU}(x)\right\}$$

$$\nu^{p}_{(A\cap B)L}(x) = \max\left\{\nu^{p}(x),\nu^{p}(x)\right\}$$

$$\nu^{p}_{(A\cap B)U}(x) = \min\left\{\nu^{p}(x),\nu^{p}(x)\right\}$$

$$\nu^{N}_{(A\cap B)L}(x) = \min\left\{\nu^{N}_{AL}(x),\nu^{N}_{BL}(x)\right\}$$

$$\square^{N}_{(A\square B)U}(x) = \max\left\{\square^{N}_{AU}(x), \square^{N}_{BU}(x)\right\}$$

then

$$([\ ]A_1 \square [\ ]A_2) = \left\{ \left\langle \begin{array}{l} \left[x, \square^{p}_{([\ ]A_1\square[\ ]A_2)L}(x), \square^{p}_{([\ ]A_1\square[\ ]A_2)U}(x)\right], \\ \left[\square^{N}_{([\ ]A_1\square[\ ]A_2)L}(x), \square^{N}_{([\ ]A_1\square[\ ]A_2)U}(x)\right], \\ \left[\square^{p}_{([\ ]A_1\square[\ ]A_2)L}(x), \square^{p}_{([\ ]A_1\square[\ ]A_2)U}(x)\right], \\ \left[\square^{N}_{([\ ]A_1\square[\ ]A_2)L}(x), \square^{N}_{([\ ]A_1\square[\ ]A_2)U}(x)\right] \end{array} \right\rangle \mid x \square X \right\}$$

where

$$\square^{p}_{([\ ]A_1\square[\ ]A_2)L}(x) = \max\left\{\square^{p}_{[\ ]A_1L}(x), \square^{p}_{[\ ]A_2L}(x)\right\}$$

$$\square^{p}_{([\ ]A_1\square[\ ]A_2)U}(x) = \min\left\{\square^{p}_{[\ ]A_1U}(x), \square^{p}_{[\ ]A_2U}(x)\right\}$$

$$\square^{N}_{([\ ]A_1\square[\ ]A_2)L}(x) = \min\left\{\square^{N}_{[\ ]A_1L}(x), \square^{N}_{[\ ]A_2L}(x)\right\}$$

$$\square^{N}_{([\ ]A_1\square[\ ]A_2)U}(x) = \max\left\{\square^{N}_{[\ ]A_1U}(x), \square^{N}_{[\ ]A_2U}(x)\right\}$$

$$\square^{p}_{([\ ]A_1\square[\ ]A_2)L}(x) = \max\left\{\square^{p}_{[\ ]A_1L}(x), \square^{p}_{[\ ]A_2L}(x)\right\}$$

$$\square^{p}_{([\ ]A_1\square[\ ]A_2)U}(x) = \min\left\{\square^{p}_{[\ ]A_1U}(x), \square^{p}_{[\ ]A_2U}(x)\right\}$$

$$\square^{N}_{([\ ]A_1\square[\ ]A_2)L}(x) = \min\left\{\square^{N}_{[\ ]AL}(x), \square^{N}_{[\ ]A_2L}(x)\right\}$$

$$\square^{N}_{([\ ]A_1\square[\ ]A_2)U}(x) = \max\left\{\square^{N}_{[\ ]AU}(x), \square^{N}_{[\ ]A_2U}(x)\right\}$$

then

$$\square^{p}_{([\ ]A_1\square[\ ]A_2)L}(x) = \max\left\{\square^{p}_{AL}(x), \square^{p}_{AL}(x)\right\}$$

$$\square^{p}_{([\ ]A_1\square[\ ]A_2)U}(x) = \min\left\{\square^{p}_{AU}(x), \square^{p}_{AU}(x)\right\}$$

$$\square^{N}_{([\ ]A_1\square[\ ]A_2)L}(x) = \min\left\{\square^{N}_{AL}(x), \square^{N}_{AL}(x)\right\}$$

$$\square^{N}_{([\ ]A_1\square[\ ]A_2)U}(x) = \max\left\{\square^{N}_{AU}(x), \square^{N}_{AU}(x)\right\}$$

$$1\square\square^{p}_{([\ ]A_1\square[\ ]A_2)L}(x) = \max\left\{1\square\square^{p}_{AL}(x), 1\square\square^{p}_{AL}(x)\right\}$$

$$1\square\square^{p}_{([\ ]A_1\square[\ ]A_2)U}(x) = \min\left\{1\square\square^{p}(x), 1\square\square^{p}(x)\right\}$$

$$1\square\square^{N}_{([\ ]A_1\square[\ ]A_2)L}(x) = \min\left\{1\square\square^{N}_{L}(x), 1\square\square^{N}_{L}(x)\right\}$$

$$1-\mu^{N}_{([\,]A_1\cup[\,]A_2)U}(x)=\max\left\{1-\mu^{N}_{A_1U}(x),1-\mu^{N}_{A_2U}(x)\right\}$$

$$\square[\,]A_1\cup[\,]A_2=\left\{\left\langle \begin{array}{l} x,\left[\mu^{p}_{([\,]A_1\cup[\,]A_2)L}(x),\mu^{p}_{([\,]A_1\cup[\,]A_2)U}(x)\right],\\ \left[\mu^{N}_{([\,]A_1\cup[\,]A_2)L}(x),\mu^{N}_{([\,]A_1\cup[\,]A_2)U}(x)\right],\\ \left[1-\mu^{p}_{([\,]A_1\cup[\,]A_2)L}(x),1-\mu^{p}_{([\,]A_1\cup[\,]A_2)U}(x)\right],\\ \left[1-\mu^{N}_{([\,]A_1\cup[\,]A_2)L}(x),1-\mu^{N}_{([\,]A_1\cup[\,]A_2)U}(x)\right] \end{array}\right\rangle \middle| x\in X\right\}_N$$

$$\square[\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i=\left\{\left\langle \begin{array}{l} x,\left[\mu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x),\mu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x)\right],\\ \left[\mu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x),\mu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x)\right],\\ \left[\nu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x),\nu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x)\right],\\ \left[\nu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x),\nu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x)\right] \end{array}\right\rangle \middle| x\in X\right\}$$

where

$$\mu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x)=\max\left\{\mu^{p}_{[\,]A_1L}(x),\mu^{p}_{[\,]A_2L}(x),\ldots,\mu^{p}_{[\,]A_iL}(x)\right\}$$

$$\mu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x)=\min\left\{\mu^{p}_{[\,]A_1U}(x),\mu^{p}_{[\,]A_2U}(x),\ldots,\mu^{p}_{[\,]A_iU}(x)\right\}$$

$$\mu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x)=\min\left\{\mu^{N}_{[\,]A_1L}(x),\mu^{N}_{[\,]A_2L}(x),\ldots,\mu^{N}_{[\,]A_iL}(x)\right\}$$

$$\mu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x)=\max\left\{\mu^{N}_{[\,]A_1U}(x),\mu^{N}_{[\,]A_2U}(x),\ldots,\mu^{N}_{[\,]A_iU}(x)\right\}$$

$$\nu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x)=\max\left\{\nu^{p}_{[\,]A_1L}(x),\nu^{p}_{[\,]A_2L}(x),\ldots,\nu^{p}_{[\,]A_iL}(x)\right\}$$

$$\nu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x)=\min\left\{\nu^{p}_{[\,]A_1U}(x),\nu^{p}_{[\,]A_2U}(x),\ldots,\nu^{p}_{[\,]A_iU}(x)\right\}$$

$$\nu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x)=\min\left\{\nu^{N}_{[\,]A_1L}(x),\nu^{N}_{[\,]A_2L}(x),\ldots,\nu^{N}_{[\,]A_iL}(x)\right\}$$

$$\nu^{N}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)U}(x)=\max\left\{\nu^{N}_{[\,]A_1U}(x),\nu^{N}_{[\,]A_2U}(x),\ldots,\nu^{N}_{[\,]A_iU}(x)\right\}$$

then

$$\mu^{p}_{([\,]A_1\cup[\,]A_2\cup\ldots[\,]A_i)L}(x)=\max\left\{\mu^{p}_{A_1L}(x),\mu^{p}_{A_2L}(x),\ldots,\mu^{p}_{A_iL}(x)\right\}$$

$$\mu^{p}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)U}(x) = \min\left\{\mu^{p}_{A_1U}(x), \mu^{p}_{A_2U}(x), \ldots, \mu^{p}_{A_iU}(x)\right\}$$

$$\mu^{N}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)L}(x) = \min\left\{\mu^{N}_{A_1L}(x), \mu^{N}_{A_2L}(x), \ldots, \mu^{N}_{A_iL}(x)\right\}$$

$$\mu^{N}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)U}(x) = \max\left\{\mu^{N}_{A_1U}(x), \mu^{N}_{A_2U}(x), \ldots, \mu^{N}_{A_iU}(x)\right\}$$

$$1-\mu^{p}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)L}(x) = \max\left\{1-\mu^{p}_{A_1L}(x), 1-\mu^{p}_{A_2L}(x), \ldots 1-\mu^{p}_{A_iL}(x)\right\}$$

$$1-\mu^{p}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)U}(x) = \min\left\{1-\mu^{p}_{A_1U}(x), 1-\mu^{p}_{A_2U}(x), \ldots 1-\mu^{p}_{A_iU}(x)\right\}$$

$$1-\mu^{N}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)L}(x) = \min\left\{1-\mu^{N}_{A_1L}(x), 1-\mu^{N}_{A_2L}(x), \ldots 1-\mu^{N}_{A_iL}(x)\right\}$$

$$1-\mu^{N}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)U}(x) = \max\left\{1-\mu^{N}_{A_1U}(x), 1-\mu^{N}_{A_2U}(x), \ldots 1-\mu^{N}_{A_iU}(x)\right\}$$

$$[\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i = \left\{\left\langle \begin{array}{l} x, \left[\mu^{p}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)L}(x), \mu^{p}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)U}(x)\right], \\ \left[\mu^{N}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)L}(x), \mu^{N}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)U}(x)\right], \\ \left[1-\mu^{p}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)L}(x), 1-\mu^{p}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)U}(x)\right], \\ \left[1-\mu^{N}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)L}(x), 1-\mu^{N}_{([\,]A_1 \cap [\,]A_2 \cap \ldots [\,]A_i)U}(x)\right] \end{array} \right\rangle \mid x \in X\right\} \in \tau_N$$

Hence the finite intersection of Bipolar Interval Valued Intuitionistic Necessity Operators is in Bipolar Interval Valued Intuitionistic Fuzzy Topology τ.

Hence the Bipolar Interval Valued Intuitionistic Necessity Operators itself forms a Bipolar Interval Valued Intuitionistic Fuzzy Topology τ.

References:

[1] Andrijevic.D, "Semipreopen sets", Mat.Vesnic, 38 (1986), 24 -32.

[2] Azhagappan. M and M.Kamaraj, "Notes on bipolar valued fuzzy rw-closed and bipolar valued fuzzy rw-open sets in bipolar valued fuzzy topological spaces", International Journal of Mathematical Archive, 7(3), 30-36, 2016.

[3] Bhattacarya.B., and Lahiri. B.K., "Semi-generalized closed set in topology", Indian Jour.Math., 29 (1987), 375 -382.

[4] Chang.C.L., "Fuzzy topological spaces", JI. Math. Anal. Appl., 24(1968), 182 –190.

[5] Dontchev.J., "On generalizing semipreopen sets", Mem. Fac. sci. Kochi. Univ. Ser. A, Math.,16 (1995), 35 - 48.

[6] Ganguly.S and Saha.S, "A note on fuzzy Semipreopen sets in fuzzy topological spaces", Fuzzy sets and system, 18 (1986), 83 - 96.

[7] Indira.R, Arjunan.K and Palaniappan.N, "Notes on interval valued fuzzy rw-closed, interval valued fuzzy rw-open sets in interval valued fuzzy topological space", International Journal of Computational and Applied Mathematics.,Vol.3, No.1(2013), 23 -38.

[8] Jeyabalan.R and K. Arjunan, "Notes on interval valued fuzzy generalized semipreclosed sets", International Journal of Fuzzy Mathematics and Systems, Volume 3, Number 3 (2013), 215 -224.

[9] Jeyabalan,R and Arjunan.K, "Interval valued fuzzy generalized semi-preclosed mappings", IOSR Journal of Mathematics, Vol.8, Issue 5(2013), 40 – 47.

[10] Lee, K.M., "Bipolar-valued fuzzy sets and their operations", Proc. Int. Conf. on Intelligent Technologies, Bangkok, Thailand, (2000), 307 -312.

[11] Levine.N, "Generalized closed sets in topology", Rend. Circ. Math. Palermo, 19 (1970),89 -96.

[12] Mondal.T.K., "Topology of interval valued fuzzy sets", Indian J. Pure Appl.Math. 30, No.1 (1999), 23 - 38.

[13] Murugan.V, U.Karuppiah & M.Marudai, Notes on multi fuzzy rw-closed, multi fuzzy rw-open sets in multi fuzzy topological spaces, Bulletin of Mathematics and Statistics Research, Vo.4, Issue. 1, 2016, 174-179**.**

[14] Sabu Sebastian, T.V.Ramakrishnan, Multi fuzzy sets, International Mathematical Forum, 5, no.50 (2010), 2471-2476.

[15] Saraf.R.K and Khanna.K., "Fuzzy generalized semipreclosed sets", Jour.Tripura. Math.Soc., 3 (2001), 59 - 68.

[16] Selvam.R, K.Arjunan & KR.Balasubramanian,"Bipolar interval valued multi fuzzy generalized semipreclosed sets", JASC Journal, Vol.6, ISS. 5(2019), 2688 -2697.

[17] Vinoth.S & K.Arjunan, "A study on interval valued intuitionistic fuzzy generalized semipreclosed sets", International Journal of Fuzzy Mathematics and Systems, Vol. 5, No. 1 (2015), 47 -55.

[18] Vinoth.S & K.Arjunan, "Interval valued intuitionistic fuzzy generalized semipreclosed mappings", International Journal of Mathematical Archive, 6(8) (2015), 129 -135.

[19] Zadeh.L.A., "Fuzzy sets", Information and control, Vol.8 (1965), 338 -353.

[20] K,, Mohana; Princy R; and F. Smarandache. "An Introduction to Neutrosophic Bipolar Vague Topological Spaces." Neutrosophic Sets and Systems 29, 1 (2020).
[21] R.Selvam, K. Arjunan And Kr.Balasubramanian "Bipolar Interval Valued Multi Fuzzy Generalized Semipre Continuous Mappings" Volume: 06 Issue: 12 | Dec 2019.