# Model Operators on Intuitionistic L Fuzzy Semi Filter

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**Abstract -** ***By using the concept of Intuitionistic L Fuzzy Set and Semi filter of classical set we introduced the concept of intuitionistic L-fuzzy semi filter (ILFSF) [1]. There are various operators defined over Intuitionistic Fuzzy sets which are classified into three. They are model, topological and level operators. Some of the fundamental operations of IFS are satisfied by ILFSF [4]. As a continuation, in this paper we further discuss some new model operators[6] which functions by reducing the degree of membership or non membership of IFS on ILFSF.***

***Key Words:*** *Fuzzy subset, L Fuzzy subset, Intuitionistic L-Fuzzy set, Intuitionistic L-Fuzzy Semi Filter.*

## 1. Introduction

In 1965 Lotfi A.Zadeh [10] introduced the notion of a fuzzy subset of a set as a method for representing uncertainty in real physical world. The concept of intuitionistic fuzzy set was introduced by Atanassov.K.T [5] as a generalization of the notion of fuzzy set. Although a lot of studies have been done for fuzzy order structures, the lattice-valued sets can be more appropriate to model natural problems. The justification to consider lattice valued fuzzy sets has been widely explained in the literature, since lattices are more richer structure and we can obtain non-comparable values of fuzzy sets. The main purpose of this paper is to examine some model operators defined on IFS over Intuitionistic L-fuzzy semi filters.

## 2. PRELIMINARIES

In this section, some well known definitions are recalled. It will be necessary in order to understand the new concepts introduced and theorem proved in this paper.

**Definition 2.1**

An Intuitionistic fuzzy set (IFS) A in a non-empty set X is defined as an object of the form $A = \{< x, \mu_A(x), \nu_A(x)> / x \in X\}$ where $\mu_A : X \to [0, 1]$ is the degree membership and $\nu_A : X \to [0, 1]$ is the degree of nonmembership of the element $x \in X$ satisfying $0 \leq \mu_A(x) + \nu_A(x) \leq 1$.

**Definition 2.2**

Let $(L,\leq)$ be a complete lattice with least element 0 and greatest element 1 and an involutive order reversing operation $N : L \to L$. Then an Intuitionistic L–fuzzy subset (ILFS) A in a nonempty set X is defined as an object of the form $A = \{< x, \mu_A(x), \nu_A(x)> / x \in X\}$ where $\mu_A : X \to L$ is the degree membership and $\nu_A : X \to L$ is the degree of nonmembership of the element $x \in X$ satisfying $\mu_A(x) \leq N(\nu_A(x))$.

**Definition 2.3**

An L – fuzzy semi filter on a set P is a function $\mu: P \to L$ such that for $x, y \in P$, $x \leq y \Rightarrow \mu(x) \leq \mu(y)$.

**Definition 2.4**

An Intuitionistic L-fuzzy set of a Lattice is called as an Intuitionistic L-fuzzy semi filter (ILFSF) whenever $x \leq y$, we have $\mu_A(x) \leq \mu_A(y)$ and $\nu_A(x) \geq \nu_A(y)$

**Definition 2.5**

An Intuitionistic L-fuzzy set of a Lattice is called as an Intuitionistic L-fuzzy semi ideal (ILFSI) whenever $x \leq y$, we have $\mu_A(x) \geq \mu_A(y)$ and $\nu_A(x) \leq \nu_A(y)$

**Definition 2.6**

1. $\boxplus A = \{<x, \frac{\mu_A(x)}{2}, \frac{\nu_A(x)+1}{2}, >| \; x \in E\}$
2. $\boxtimes A = \{<x, \frac{\mu_A(x)+1}{2}, \frac{\nu_A(x)}{2}>| \; x \in E\}$
3. $\boxplus_\alpha A = \{<x, \alpha.\mu_A(x), \alpha.\nu_A(x)+1-\alpha>| x \in E\}$
   where $\alpha \in [0, 1]$
4. $\boxtimes_\alpha A = \{<x, \alpha.\mu_A(x)+1-\alpha, \alpha.\nu_A(x) >| x \in E\}$
   where $\alpha \in [0, 1]$
5. $\boxplus_{\alpha,\beta} A = \{<x, \alpha.\mu_A(x), \alpha.\nu_A(x)+\beta>| x \in E\}$
   where $\alpha, \beta, \alpha+\beta \in [0, 1]$
6. $\boxtimes_{\alpha,\beta} A = \{<x, \alpha.\mu_A(x)+\beta, \alpha.\nu_A(x) >| x \in E\}$
   where $\alpha, \beta, \alpha+\beta \in [0, 1]$
7. $\boxplus_{\alpha,\beta,\gamma} A = \{<x, \alpha.\mu_A(x), \beta.\nu_A(x)+\gamma>| x \in E\}$
   where $\alpha, \beta, \gamma \in [0, 1]$ and $\max(\alpha,\beta)+\gamma \le 1$
8. $\boxtimes_{\alpha,\beta} A = \{<x, \alpha.\mu_A(x)+\gamma, \beta.\nu_A(x) >| x \in E\}$
   where $\alpha, \beta, \gamma \in [0, 1]$ and $\max(\alpha,\beta)+\gamma \le 1$

## Model Operators over ILFSF

**Theorem 2.1:** If A is an Intuitionistic L-Fuzzy Semi filter then the following are also ILFSF.

1. $\boxplus A = \{<x, \frac{\mu_A(x)}{2}, \frac{\nu_A(x)+1}{2}, >| \; x \in E\}$
2. $\boxtimes A = \{<x, \frac{\mu_A(x)+1}{2}, \frac{\nu_A(x)}{2}>| \; x \in E\}$
3. $\boxplus_\alpha A = \{<x, \alpha.\mu_A(x), \alpha.\nu_A(x)+1-\alpha>| x \in E\}$
   where $\alpha \in [0, 1]$
4. $\boxtimes_\alpha A = \{<x, \alpha.\mu_A(x)+1-\alpha, \alpha.\nu_A(x) >| x \in E\}$
   where $\alpha \in [0, 1]$
5. $\boxplus_{\alpha,\beta} A = \{<x, \alpha.\mu_A(x), \alpha.\nu_A(x)+\beta>| x \in E\}$
   where $\alpha, \beta, \alpha+\beta \in [0, 1]$
6. $\boxtimes_{\alpha,\beta} A = \{<x, \alpha.\mu_A(x)+\beta, \alpha.\nu_A(x) >| x \in E\}$
   where $\alpha, \beta, \alpha+\beta \in [0, 1]$
7. $\boxplus_{\alpha,\beta,\gamma} A = \{<x, \alpha.\mu_A(x), \beta.\nu_A(x)+\gamma>| x \in E\}$
   where $\alpha, \beta, \gamma \in [0, 1]$ and $\max(\alpha,\beta)+\gamma \le 1$
8. $\boxtimes_{\alpha,\beta} A = \{<x, \alpha.\mu_A(x)+\gamma, \beta.\nu_A(x) >| x \in E\}$
   where $\alpha, \beta, \gamma \in [0, 1]$ and $\max(\alpha,\beta)+\gamma \le 1$

**Proof:**

Let A be an Intuitionistic L-Fuzzy Semi filter

$\boxplus A = \{<x, \frac{\mu_A(x)}{2}, \frac{\nu_A(x)+1}{2}, >| \; x \in E\}$

To Prove: $\boxplus A$ is an intuitionistic L-Fuzzy Semi filter

since A is an ILFSF we have

$x \le y \Rightarrow \mu_A(x) \le \mu_A(y)$ and $\nu_A(x) \ge \nu_A(y)$

$\Rightarrow \frac{\mu_A(x)}{2} \le \frac{\mu_A(y)}{2}$ and $\nu_A(x) + 1 \ge \nu_A(y) + 1$

$\Rightarrow \frac{\mu_A(x)}{2} \le \frac{\mu_A(y)}{2}$ and $\frac{\nu_A(x)+1}{2} \ge \frac{\nu_A(y)+1}{2}$

Hence $\boxplus A$ is an Intuitionistic L-fuzzy Semi Filter

ii) To Prove: $\boxtimes A$ is an intuitionistic L-Fuzzy Semi filter

$\boxtimes A = \{<x, \frac{\mu_A(x)+1}{2}, \frac{\nu_A(x)}{2}>| \; x \in E\}$

since A is an ILFSF we have

$x \le y \Rightarrow \mu_A(x) \le \mu_A(y)$ and $\nu_A(x) \ge \nu_A(y)$

$\Rightarrow \mu_A(x) + 1 \le \mu_A(y) + 1$ and $\frac{\nu_A(x)}{2} \ge \frac{\nu_A(y)}{2}$

$\Rightarrow \frac{\mu_A(x)+1}{2} \le \frac{\mu_A(y)+1}{2}$ and $\frac{\nu_A(x)}{2} \ge \frac{\nu_A(y)}{2}$

Hence $\boxtimes A$ is an Intuitionistic L-Fuzzy Semi Filter

iii) To prove: $\boxplus_\alpha A$ is an ILFSF

$\boxplus_\alpha A = \{<x, \alpha.\mu_A(x), \alpha.\nu_A(x)+1-\alpha>| x \in E\}$where $\alpha \in [0, 1]$

since A is an ILFSF we have

$x \le y \Rightarrow \mu_A(x) \le \mu_A(y)$ and $\nu_A(x) \ge \nu_A(y)$

$\Rightarrow \alpha \cdot \mu_A(x) \le \alpha \cdot \mu_A(y)$ and $\alpha \cdot \nu_A(x) \ge \alpha \cdot \nu_A(y)$

$\Rightarrow \alpha.\nu_A(x)+1 \ge \alpha.\nu_A(y)+1$

$\Rightarrow \alpha.\nu_A(x)+1-\alpha \ge \alpha.\nu_A(y)+1-\alpha$

Thus $x \le y \Rightarrow$

$\alpha \cdot \mu_A(x) \le \alpha \cdot \mu_A(y)$ and $\alpha.\nu_A(x)+1-\alpha \ge \alpha.\nu_A(y)+1-\alpha$

Hence $\boxplus_\alpha A$ is an ILFSF.

iv) To prove $\boxtimes_\alpha A$ is an ILFSF

$\boxtimes_\alpha A = \{<x, \alpha.\mu_A(x)+1-\alpha, \alpha.\nu_A(x) >| x \in E\}$where $\alpha \in [0, 1]$

since A is an ILFSF we have

$x \le y \Rightarrow \mu_A(x) \le \mu_A(y)$ and $\nu_A(x) \ge \nu_A(y)$

$\Rightarrow \alpha \cdot \mu_A(x) \le \alpha \cdot \mu_A(y)$ and $\alpha \cdot \nu_A(x) \ge \alpha \cdot \nu_A(y)$

$\Rightarrow \alpha \cdot \mu_A(x) +1 \le \alpha \cdot \mu_A(y)+1$

$\Rightarrow \alpha \cdot \mu_A(x)+1-\alpha \le \alpha \cdot \mu_A(y)+1-\alpha$

Thus $x \le y \Rightarrow$

$\alpha \cdot \mu_A(x)+1-\alpha \le \alpha \cdot \mu_A(y)+1-\alpha$ and $\alpha.\nu_A(x) \ge \alpha.\nu_A(y)$

v) To prove: $\boxplus_{\alpha,\beta} A$ is an ILFSF

$\boxplus_{\alpha,\beta} A = \{<x, \alpha.\mu_A(x), \alpha.\nu_A(x)+\beta>| x \in E\}$

where $\alpha, \beta, \alpha+\beta \in [0, 1]$

since A is an ILFSF we have

$x \le y \Rightarrow \mu_A(x) \le \mu_A(y)$ and $\nu_A(x) \ge \nu_A(y)$

$\Rightarrow \alpha \cdot \mu_A(x) \le \alpha \cdot \mu_A(y)$ and $\alpha \cdot \nu_A(x) \ge \alpha \cdot \nu_A(y)$

$\Rightarrow \alpha \cdot \nu_A(x)+\beta \ge \alpha \cdot \nu_A(y)+\beta$

Thus $x \le y \Rightarrow$

$\alpha \cdot \mu_A(x) \le \alpha \cdot \mu_A(y)$ and $\alpha \cdot \nu_A(x)+\beta \ge \alpha \cdot \nu_A(y)+\beta$

vi) To prove: $\boxtimes_{\alpha,\beta} A$ is an ILFSF

$\boxtimes_{\alpha,\beta} A = \{<x, \alpha.\mu_A(x)+\beta, \alpha.\nu_A(x) >| x \in E\}$

where $\alpha, \beta, \alpha+\beta \in [0, 1]$

since A is an ILFSF we have

$x \le y \Rightarrow \mu_A(x) \le \mu_A(y)$ and $\nu_A(x) \ge \nu_A(y)$

$\Rightarrow \alpha \cdot \mu_A(x) \le \alpha \cdot \mu_A(y)$ and $\alpha \cdot \nu_A(x) \ge \alpha \cdot \nu_A(y)$

$\Rightarrow \alpha \cdot \mu_A(x)+\beta \le \alpha \cdot \mu_A(y)+\beta$

Thus $x \le y \Rightarrow$

$\alpha \cdot \mu_A(x)+\beta \le \alpha \cdot \mu_A(y)+\beta$ and $\alpha \cdot \nu_A(x) \ge \alpha \cdot \nu_A(y)$

Hence $\boxtimes_{\alpha,\beta} A$ is an ILFSF

vii) To prove: $\boxplus_{\alpha,\beta,\gamma} A$ is an ILFSF

$\boxplus_{\alpha,\beta,\gamma} A = \{<x, \alpha.\mu_A(x), \beta.\nu_A(x)+\gamma>| x \in E\}$

where $\alpha, \beta, \gamma \in [0, 1]$ and $\max(\alpha,\beta)+\gamma \le 1$
since A is an ILFSF we have

$x \le y \Rightarrow \mu_A(x) \le \mu_A(y)$ and $\nu_A(x) \ge \nu_A(y)$

$\Rightarrow \alpha\cdot\mu_A(x) \le \alpha\cdot\mu_A(y)$ and $\beta\cdot\nu_A(x) \ge \beta\cdot\nu_A(y)$

$\Rightarrow \beta\cdot\nu_A(x)+\gamma \ge \beta\cdot\nu_A(y)+\gamma$

Thus $x \le y \Rightarrow$

$\alpha\cdot\mu_A(x) \le \alpha\cdot\mu_A(y)$ and $\beta\cdot\nu_A(x)+\gamma \ge \beta\cdot\nu_A(y)+\gamma$

Hence $\boxplus_{\alpha,\beta,\gamma}A$ is an ILFSF

viii) To prove: $\boxtimes_{\alpha,\beta}A$ is an ILFSF

$\boxtimes_{\alpha,\beta}A = \{<x, \alpha.\mu_A(x)+\gamma, \beta.\nu_A(x) >|x\in E\}$

where $\alpha, \beta, \gamma \in [0, 1]$ and $\max(\alpha,\beta)+\gamma \le 1$
since A is an ILFSF we have

$x \le y \Rightarrow \mu_A(x) \le \mu_A(y)$ and $\nu_A(x) \ge \nu_A(y)$

$\Rightarrow \alpha\cdot\mu_A(x) \le \alpha\cdot\mu_A(y)$ and $\beta\cdot\nu_A(x) \ge \beta\cdot\nu_A(y)$

$\Rightarrow \alpha\cdot\mu_A(x)+\gamma \le \alpha\cdot\mu_A(y)+\gamma$

Thus $x \le y \Rightarrow$

$\alpha\cdot\mu_A(x)+\gamma \le \alpha\cdot\mu_A(y)+\gamma$ and $\beta\cdot\nu_A(x) \ge \beta\cdot\nu_A(y)$

Hence $\boxtimes_{\alpha,\beta}A$ is an ILFSF

## 3. CONCLUSION

In this paper some new model operators defined over Intuitionistic Fuzzy sets are applied on Intuitionistic L-fuzzy Semi Filter and we have proved that all model operators are also ILFSF.

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