On Some Mappings in Intuitionistic Topological Spaces

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Abstract: This paper introduces new types of generalized weak mappings in intuitionistic topological spaces such as $Ig\alpha A*-$contra, $Ig\beta A*-$contra, $IgPA*-$contra, $IgSA*-$contra, and $LIg-$contra, specifically focusing on contra-like mappings. The study explores the relationships between these mappings and investigates their connections within intuitionistic topological spaces. By utilizing extended sets and mappings, this work contributes to the ongoing research in intuitionistic topology, filling a gap in the current literature. The results presented here enhance the understanding of the structure of intuitionistic topological spaces, providing a deeper insight into the properties and behaviour of weak mappings in these spaces. This research opens up new avenues for further exploration and application in the field of topological spaces.

***Keywords*:** Weak mapping, contra function, strong function, Intuitionistic topology.

1. Introduction

The area of intuitionistic topological areas has progressed through a series of significant contributions by diverse academics.[1] groundbreaking study on fuzzy sets laid the foundation for this subject. In 1983, Atanassov proposed the idea of fuzzy sets that were intuitionistic, which added another degree of complication to the idea. In [2] presented intuitionistic sets as well as points, providing new paths for investigation. In 1997, Çoker established intuitionistic fuzzy topological areas, and later, in 2000, he expanded on this structure to includeintuitionistic topological spaces. In [3], introduced the $T1$ and $T2$ separating criteria for intuitionistic topological spaces. Further expanding the theoretical terrain. [4] introduced regular as well as weaker regularly intuitionistic topological areas, whereas [5] established entirely normal and weakly normal intuitionistic topological areas. [6] generalized some weak forms of irresolute mappings in intuitionistic topological spaces. [7] established IGPR continuity and compactness in intuitionistic topological spaces; also, [8] introduced the concept of generalized sets and mappings in intuitionistic topological spaces whereas [9] investigated homeomorphismintheseareas. [10] investigated intuitionisticclosurein intuitionistic topological spaces, [11] proposed intuitive fuzzy-based regularity, while [12] used interval-valued intuitionisticsets in topological applications. [13] contributed by developing notations for intuitionistic fuzzy r-regular areas, [14] introduced some properties of regular and normal space on topological graph space.[15] presented intuitionistic subspace topology and explored its features. Previous research has not focused on the qualities of intuitionistic regular subspaces.[16] were provided the notion of a function poorly open to intuition raster spaces, et some new descriptions of the opening up of the weak functions among the intuitive point areas. This paper fills a gap by using the structure of extended sets as well as maps in intuitionistic topological spaces.[8] provide a revolutionary discovery, and [6] expand on the notion of weak mappings in intuitionistic spaces, offering a new perspective on irresolute mappings, which could be applied to a variety of mathematical and computational problems. [15] advanced the understanding of intuitionistic subspace topology, an essential aspect of intuitionistic spaces, by exploring how subspaces behave in this context. Moreover, [13] proposed a new method for studying regularity in fuzzy and intuitionistic fuzzy spaces, contributing to the growing field of fuzzy set theory by introducing new concepts that bridge intuitionistic fuzzy sets with topological regularity. This insight expands our comprehension of intuitionistic topological spaces and investigates some properties related to them and adds a new level to the area's debate. The proposed work distinguishes itself by introducing contra-like mappings and exploring their relationships within intuitionistic topological spaces, offering fresh insights into the nature of mappings and sets. In contrast to previous work, which focuses on regularity, weak mappings, or intuitionistic fuzzy sets, the proposed work provides a novel framework for investigating the properties of these new mappings and their applications. This contributes to the field by extending the study of mappings in intuitionistic spaces and offers an opportunity to explore previously unaddressed relationships among various mapping types.

2. Methodology

2.1 Basic Concepts

In this part we give some concepts which are needed in our work.

Definition 2.1[2] : Let X be a non-empty set, and let B_T and B_F be two subsets of X such that: $B_T \cap B_F = \emptyset$. Then, $B = (B_T, B_F)$ is called an intuitionistic set (IS) of X. In this context:

B_T represents the set of members of the intuitionistic set, i.e., the elements that are definitely in B.

B_F represents the set of nonmembers of the intuitionistic set, i.e., the elements that are definitely not in B.

In actuality, B_T represents a subset from X accepting or allowing of a specific opinion, view, proposal, or strategy, while B_F is a subset for X rejecting or against a similar opinion, viewpoint, suggestion, or strategy, respectively. Assume $\emptyset_I = (\emptyset, X)$ as well as $X_I = (X, \emptyset)$, wherein $\emptyset I$ represents the intuitionistic empty subset and X_I represents the intuitionistic entire set of X. In overall, $B_T \cup B_F$ does not equal X and $IS(X)$ denotes the set of every one of the ISs of X.

Definition 2.2 [2]: Assume an A be IS associated with a non empty set X, with $\xi \in X$. Then the following holds:

(i) $\xi_I = (\{\xi\}, \{\xi\}^c)$ corresponds to an intuition istic point (IP), while $\xi_{IV} = (\emptyset, \{\xi\}^c)$ is a intu itionistic vanishing point of X.

(ii) For $\xi \in B_T$, so $\xi_I \in B$; while $\xi \notin B_F$, so $\xi_{IV} \in B$.

An IP (X) refers to are all intuitionistic points and vanishing points in X.

Definition 2.3. [17].

If $B = (B_T, B_F)$represents an intuitionistic collection in X, subsequently the prior image of B according to h, represented by $h^{-1}(B)$, represents the intuitionistic subset in X that is determined by

$$h^{-1}(B) = \langle h^{-1}(B_T), h^{-1}(B_F)\rangle$$

- $M = (h(M_T), h(M_F))$ represents an intuitionistic set corresponding to X. The image of M underneath h, indicated by $h(M)$, is the intuitionistic subset in Y that is determined by

$$h(M) = (h(M_T), h-(M_F))$$

where $h-(M_F) = Y - (h(X - M_F))$."

Definition 2.4;[3]

Suppose M and N represent two intuitionistic collections on X and Y, respectively. The products intuitionistic sets of M and N on $X \times Y$ is defined as

$\times V = \langle M_T \times N_T, ({M_T}^c \times {N_T}^c)\rangle$,

where $M = (M_T, M_F)$, and $N = (N_T, N_F)$. If (X, τ) and (Y, φ) are ITS, subsequently the product of the topologies $\tau \times \varphi$ on $X \times Y$ represents the intuitionistic topologies provided by the basis $B = \{M \times N : M \in \tau, N \in \varphi\}$."

Definition: 2.5; [8] Take (X, T) have an ITS, and allow$M$ (M_T, M_F) have an IS in X, subsequently M will be considered to be:

Intuitionistic generalized pre-regular closed sets ($Igpr$-closed) are those where $pcl\ (A) \subseteq U$ whenever $M \subseteq U$ as well as U is intuitionistic open in X.

Intuitionistic semi weakly generalized pre-regular closed sets ($Isgr$-closed) are those where $clint(A) \subseteq U$ whenever $M \subseteq U$ as well as U is intuitionistic semi open in X. "

2.2 New Class functions in ITS

we introduce a new generalized continuous mapping in ITS such as; intuitionistic generalized $\beta A*$ ($Ig\beta A*$- contra), intuitionistic generalized $PA*$- contra ($IgPA*$- contra), intuitionistic generalized $SA* -$ contra ($IgSA* -$ contra), intuitionistic generalized $\alpha A* -$ contra ($Ig\alpha A* -$ contra) and Locally intuitionistic generalized- contra (LIg– contra) with studying relationship among them and some properties related them. we start with the following definition:

Definition 3.1. Consider that

$h : (X, I_\tau) \to (Y, I_\sigma)$ be a mapping

$h : (X, I_\tau) \to (Y, I_\sigma)$. Then h is satisfy the following:

$Ig\beta A*$ - contra if $h^{-1}(M)$ is $Ig\beta A*C$ -set in X for every $Ig\beta A*O$ - set M in Y.

$IgSA*$ - contra if $h^{-1}(M)$ is $IgSA*C$ -set in X for every $IgSA*O$ - set M in Y.

$IgPA*$ - contra if $h^{-1}(M)$ is $IgPA*C$-set in X for every $IgPA*O$ - set M in Y.

$Ig\alpha A*$- contra if $h^{-1}(M)$ is $Ig\alpha A*C$-set in X for every $Ig\alpha A*O$- set M in Y.

LIg - contra if $h^{-1}(M)$ is $LIgC$-set in X for every $LIgO$ - set M in Y.

Theorem 3.2. Assume $h : (X, I_\tau) \to (Y, I_\sigma)$ be a mapping. Thus, the holdings below:

whenever h is LIg - contra, thus, h is IgαA ∗- contra map.

whenever h is IgαA ∗- contra thus, h is IgSA ∗- contra map.

whenever h is IgαA ∗ - contra thus, h is IgPA ∗- contra map.

whenever h is IgSA ∗- contra thus, h is IgβA ∗- contra map.

whenever h is IgPA ∗- contra thus, h is IgβA ∗- contra map.

Proof:

Assuming that h be a map and K is LIgO-set in Y. Assuming $M \subseteq U$ Then, $int(K) \subseteq U$, U is IOS and K is IA ∗ so that $K = \mathcal{M} \cup \aleph$, where $\mathcal{M}$ represents IOS and $\aleph$ is ICS. Because, K is LIgO − set, there must be an IgαA ∗ O-set in Y, because every LIgP-set represents IgαA ∗ O-set.

Now, $h^{-1}(K)$ is assumed to be LIgC-set in X because, h is LIgC- contra. $h^{-1}(K)$ is hence an I$g\alpha$A $*$ C-set in X. Consequently, h is I$g\alpha$A $*$- contra map.

Assuming that h be a map and K is I$g\alpha$A $*$ O-set in Y.

Assuming K ⊆ U Then, $\mathrm{int}_\alpha(\mathrm{cl}_\alpha(\mathrm{int}_\alpha(K))) \subseteq U$, U is IαOS and K is IαA $*$ so that K = $\mathcal{M} \cup \aleph$, where $\mathcal{M}$ represents IαOS and $\aleph$ is IαOS.

Because, K is I$g\alpha$A $*$ C set, there must be an IgSA $*$ O-set in Y, because every I$g\alpha$A $*$ O -set represents IgSA $*$ O-set. Now, $h^{-1}(K)$ is assumed to be an IgSA $*$ C-set in X because, h is I$g\alpha$A $*$- contra. $h^{-1}(K)$ is hence an I$g\alpha$A $*$ C -set in X.

Consequently, h is IgSA $*$- contra map.

Assuming that h be a map and K is I$g\alpha$A $*$ O-set in Y.

Assuming K ⊆ U Then, $\mathrm{int}_\alpha(\mathrm{cl}_\alpha(\mathrm{int}_\alpha(K))) \subseteq U$, U is IαOS, and K is IαA $*$ O so that K = $\mathcal{M} \cup \aleph$, where $\mathcal{M}$ is IαOS and $\aleph$ is IαCS. Because, K is I$g\alpha$A $*$ O set, there must be an I$g\alpha$A $*$ O-set in Y, because every I$g\alpha$A $*$ O -set represents IgPA $*$ O-set. Now, $h^{-1}(K)$ is assumed to be I$g\alpha$A $*$ C -set in X, because, h is I$g\alpha$A $*$- contra. $h^{-1}(K)$ is hence an IgPA $*$ C-set in X. Consequently, h is IgPA $*$- contra map.

Assuming that h be a map and K is IgSA $*$ O-set in Y.

Assuming K ⊆ U Then, $\mathrm{cl}_S(\mathrm{int}_S(K)) \subseteq U$, U is ISOS and K is ISA $*$ such that K = $\mathcal{M} \cup \aleph$, where $\mathcal{M}$ is ISOS and $\aleph$ is ISCS. Because, K is IgSA $*$ O set, there must be an I$g\beta$A $*$ O-set in Y, because every IgSA $*$ O -set is I$g\beta$A $*$ O-set. Now, $h^{-1}(K)$ is assumed $h^{-1}(K)$ represents IgSA $*$ C-set in X because, h is IgSA $*$- contra. $h^{-1}(K)$ is hence an IgSA $*$ C-set in X.

Consequently, is I$g\beta$A $*$- contra map.

Assuming that h be a map and K is IgSA $*$ O-set in Y.Assuming K ⊆ U Then, $\mathrm{int}_P(\mathrm{cl}_P(M)) \subseteq U$, U is IPOS and K is IPA $*$ such that K = $\mathcal{M} \cup \aleph$, where $\mathcal{M}$ is ISOS and $\aleph$ is ISCS.

Because, K is IgSA $*$ O set, there must be an I$g\beta$A $*$ O-set in Y, because every IgSA $*$ O -set is I$g\beta$A $*$ O-set.

Now, $h^{-1}(K)$ is assumed $h^{-1}(K)$ represents IgPA $*$ C-set in X because, h is IgSA $*$- contra. $h^{-1}(K)$ is hence an IgPA $*$ C-set in X.

Consequently, is I$g\beta$A $*$- contra map.

Remark 3.3. The following instances demonstrate that Theorem 3.2's opposite is untrue.

Example 3.4. Suppose that $X = \{e, d, c\}$ and an $I_\tau = \{\widetilde{X}, \widetilde{\emptyset}, \mathcal{W}, \mathcal{K}, \mathcal{H}\}$, and $\mathcal{W} = \langle\{e\}, \{d\}\rangle$, $\mathcal{K} = \langle\{c\}, \{d\}\rangle, \mathcal{H} = \langle\{e, c\}, \{d\}\rangle$, and $Y = \{\mathscr{b}, a\}$ and

$I_\sigma = \{\widetilde{Y}, \widetilde{\emptyset}, \mathcal{D}, \mathcal{C}, \mathcal{F}\}$ where $P = \langle\{\mathscr{b}\}, \emptyset\rangle, W = \langle\emptyset, \emptyset\rangle, L = P = \langle\emptyset, \{a\}\rangle$, a map $h : (X, I_\tau) \to (Y, I_\sigma)$ given by

$$\mathrm{h}(e) = \mathscr{b}, \mathrm{h}(d) = \mathrm{h}(c) = a.$$

These requirements conditions are therefore satisfied:

h is $IgPA$ $*$- contra but, h is not $Ig\alpha A$ $*$- contra, because for $\mathcal{P} = \langle\{a\}, \emptyset\rangle$ is $IgPA * O$-set in Y, $h^{-1}(D) = \langle\{d, c\}, \emptyset\rangle \notin Ig\alpha A * C$.

h is $IgSA$ $*$- contra but,

h is not $Ig\alpha A$ $*$- contra, because for $\mathcal{Q} = \langle\{a\}, \emptyset\rangle$ is $IgSA * O$-set in Y,

$$h^{-1}(L) = \langle\{d, c\}, \emptyset\rangle \notin Ig\alpha A * C.$$

Example 3.5. Assume $X = Y = \{e, d, c\}$ and an $I_\tau = \{\widetilde{X}, \widetilde{\emptyset}, \mathcal{W}, \mathcal{K}, \mathcal{H}, \mathcal{D}\}$, where $= \langle\emptyset, \emptyset\rangle$, $\mathcal{K} = \langle\{e\}, \emptyset\rangle, \mathcal{H} = \langle\{c\}, \emptyset\rangle$, $\mathcal{D} = \langle\{e, c\}, \emptyset\rangle$ and $Y = \{\mathscr{b}, a, \mathscr{f}\}$ and

$I_\sigma = \{\widetilde{X}, \widetilde{\emptyset}, \mathcal{G}, \mathcal{Z}, \mathcal{Q}, \mathcal{P}\}$
where $\mathcal{G} = \langle \emptyset, \{ \mathscr{b} \} \rangle$, $\mathcal{Z} = \langle \emptyset, \emptyset \rangle$, $\mathcal{Q} = \langle \{\mathscr{f}\}, \emptyset \rangle$, $\mathcal{P} = \langle \{ \mathscr{b}, \mathscr{f} \}, \emptyset \rangle$ and a map $h : (X, I_\tau) \to (Y, I_\sigma)$
given by $h(e) = \mathscr{b} = h(d)$, $h(c) = \mathscr{f}$.
These requirements conditions are therefore satisfied:
h is $Ig\beta A$ ∗- contra but, h is not $IgPA$ ∗- contra, because for
$\mathcal{S} = \langle \{\mathscr{b}\}, \emptyset \rangle$ is $Ig\beta A * O$-set in
Y, $h^{-1}(E) = \langle \{e, d\}, \emptyset \rangle \notin IgPA * C$.
h is $Ig\beta A$ ∗- contra but,
h is not $IgSA$ ∗- contra, because for
$\mathcal{S} = \langle \{\mathscr{b}\}, \emptyset \rangle$ is $Ig\beta A * O$-set in Y,
$h^{-1}(S) = \langle \{e, d\}, \emptyset \rangle \notin IgSA * C$.
h is $Ig\alpha A$ ∗- contra but, h is not LIg- contra, because for $\mathcal{S} = \langle \{\mathscr{b}\}, \emptyset \rangle$ is
$Ig\alpha A * O$-set in Y,
$h^{-1}(S) = \langle \{ e, d\}, \emptyset \rangle \notin LIgC$.

Theorem 3.6. Consider that $h : (X, I_\tau) \to (Y, I_\sigma)$ be a mapping. Following that the preceding is fulfilled:
Whenever h is $Ig\alpha A$ ∗- contra and $Ig\alpha A * O$- thus, $h(M)$ is $* O(Y, I_\sigma)$,
$\forall$ K $\in Ig\alpha A * (X, I_\tau)$. Whenever h is $IgPA$ ∗- contra and $IgPA * O$- then
$h(M)$ is $* O(Y, I_\sigma)$, $\forall$ K $\in IgpA * (X, I_\tau)$.
Whenever h is $IgSA$ ∗- contra and $IgSA * O$- then $h(M)$ is $* O(Y, I_\sigma)$, $\forall$ K $\in IgSA * (X, I_\tau)$.
Whenever h is $Ig\beta A$ ∗- contra and $Ig\beta A * O$- then $h(M)$ is $* O(Y, I_\sigma)$,
$\forall$ K $\in Ig\beta A * (X, I_\tau)$.
Whenever h is LIg- contra and $LIgO$- then $h(M)$ is (Y, I_σ), $\forall$ K $\in$ L$IgO(X, I_\tau)$.

Proof:
Suppose $\mathcal{K} \in Ig\alpha A * (X, I_\tau)$.So, $\mathcal{P} \in (X, I_\tau)$ such that

$$\mathcal{P} \subseteq \mathcal{K} \subseteq Ig\alpha A * cl_\alpha(\mathcal{P}).$$

Thus, $h(\mathcal{P}) \subseteq h(\mathcal{K}) \subseteq h(Ig\alpha A * cl_\alpha(\mathcal{P}))$.
Since, h is $Ig\alpha A$ ∗- contra so, $h(\mathcal{K}) \in (Y, I_\sigma)$ and hence, h is $Ig\alpha A * O$, thus,

$$h(Ig\alpha A * cl_\alpha(\mathcal{P})) \subseteq Ig\alpha A * cl_\alpha(h(\mathcal{P})).$$

Consequently, $h(\mathcal{K})$ is $* O(Y, I_\sigma)$.
In a similar manner, we may demonstrate (2), (3), (4), and (5).

Theorem 3.7. Consider a map $h : (X, I_\tau) \to (Y, I_\sigma)$. Therefore, the subsequent fulfills:
Whenever h is $Ig\alpha A$ ∗- continuous and $Ig\alpha A * O$- thus, h represents $Ig\alpha A$ ∗ - contra.
Whenever h is $IgPA$ ∗- continuous and $IgPA * O$- thus, h represents $Ig\alpha P$ ∗ - contra.
Whenever h is $IgSA$ ∗- continuous and $IgSA * O$- thus, h represents $IgSA$ ∗ - contra.
Whenever h is $Ig\beta A$ ∗- continuous and $Ig\beta A * O$- thus, h represents $Ig\beta A$ ∗ - contra.
Whenever h is LIg- continuous and $LIgO$- thus, h represents LIg - contra.

Proof:
Consider $\mathcal{K} \in Ig\alpha A * (Y, I_\sigma)$, therefore, must be exist IOS $\mathcal{P} \subseteq Y$ such that
$\mathcal{P} \subseteq \mathcal{K} \subseteq Ig\alpha A * cl_\alpha(\mathcal{P})$.
Hence,

$$h^{-1} (Ig\alpha A * cl_\alpha(\mathcal{P})) = Ig\alpha A * cl_\alpha(h^{-1}(\mathcal{P}))$$ and thus,

$$h^{-1}(\mathcal{P}) \subseteq h^{-1}(\mathcal{K}) \subseteq h^{-1} (Ig\alpha A * cl_\alpha(\mathcal{P})) = Ig\alpha A * cl_\alpha(h^{-1}(\mathcal{P})).$$

Thus, since h is $Ig\beta A$ ∗- continuous, then $h^{-1}(\mathcal{P})$ is an $Ig\alpha A * C$-set. Consequently, h is $Ig\alpha A$ ∗ - contra.
In a similar manner, we may demonstrate (2), (3), (4), and (5).

Theorem 3.8. Consider a map $h : (X, I_\tau) \to (Y, I_\sigma)$. Therefore, the subsequent fulfills:
h is $Ig\alpha A$ ∗- contra iff $h^{-1}(M)$ is $Ig\alpha A$ ∗- closed map for every $Ig\alpha A * C$ −set M of Y.
h is $IgPA$ ∗- contra iff $h^{-1}(M)$ is $IgPA$ ∗- closed map for every $IgPA * C$ −set M of Y.
h is $IgSA$ ∗- contra iff $h^{-1}(M)$ is $IgSA$ ∗- closed map for every $IgSA * C$ −set M of Y.

h is $Ig\beta A*$- contra iff $h^{-1}(M)$ is $Ig\beta A*$-closed map for every $Ig\beta A*C$ −set M of Y.
h is LIg- contra iff $h^{-1}(M)$ is LIg-closed map for every $LIgC$ −set M of Y.
Proof:
Necessary condition: Assume $h:(X,I_\tau)\rightarrow(Y,I_\sigma)$ is $Ig\alpha A*$- contra, thus for each $Ig\alpha A*O$- set W of Y, $h^{-1}(W)$ i is $Ig\alpha A*O(X,I_\tau)$. Now, if M is any $Ig\alpha A*C$ set of (Y,I_σ), hence, $Y-M$ is $Ig\alpha A*O$. So, $h^{-1}(Y-M)$ is $Ig\alpha A*O$, but $h^{-1}(Y-M)=X-h^{-1}(M)$ and therefore, $h^{-1}(M)$ is $Ig\alpha A*C$.
Sufficient condition: Assume $M\in(Y,I_\sigma)$ be an $IgPA*C$-set. Then $h^{-1}(M)$ is $Ig\alpha A*C-$ set in X by assumption. Now, if W is any $Ig\alpha A*O(Y,I_\sigma)$, thus $Y-W$ is $Ig\alpha A*C$. So that, $h^{-1}(Y-N)=X-h^{-1}(N)$ is $Ig\alpha A*C$. Thus $h^{-1}(N)$ is $Ig\alpha A*O$. Therefore, h is $Ig\alpha A*$- contra.
Necessary condition: Assume $h:(X,I_\tau)\rightarrow(Y,I_\sigma)$ is $IgPA*$- contra, thus for each $IgPA*O$- set W of Y, $h^{-1}(W)$ i is $IgPA*O(X,I_\tau)$. Now, if M is any $IgPA*C$ set of (Y,I_σ), hence, $Y-M$ is $IgPA*O$. So, $h^{-1}(Y-M)$ is $IgPA*O$, but $h^{-1}(Y-M)=X-h^{-1}(M)$ and therefore, $h^{-1}(M)$ is $IgPA*C$.
Sufficient condition: Assume $M\in(Y,I_\sigma)$ be an $IgPA*C$-set.
Then $h^{-1}(M)$ is $IgPA*C-$ set in X. Now, if W is any $IgPA*O(Y,I_\sigma)$, thus $Y-W$ is $IgPA*C$. So that, $h^{-1}(Y-N)=X-h^{-1}(N)$ is $IgPA*C$. So, $h^{-1}(N)$ is $IgPA*O$. Therefore, h is $IgPA*$- contra.
In a similar manner, we may demonstrate (2), (3), (4), and (5).
Theorem 3.9. Assume
$h:(X,I_\tau)\rightarrow(Y,I_\sigma)$ and $\Omega:(Y,I_\sigma)\rightarrow(Z,I_\rho)$ are two mappings. Then the following holds:
If h and φ be both $Ig\alpha A*$- contra then $\Omega\circ h:(X,I_\tau)\rightarrow(Z,I_\rho)$ is $Ig\alpha A*$- contra.
If h and φ be both $IgPA*$- contra then $\Omega\circ h:(X,I_\tau)\rightarrow(Z,I_\rho)$ is $IgPA*$- contra.
If h and φ be both $IgSA*$- contra then $\Omega\circ h:(X,I_\tau)\rightarrow(Z,I_\rho)$ is $IgSA*$- contra.
If h and φ be both $Ig\beta A*$- contra then $\Omega\circ h:(X,I_\tau)\rightarrow(Z,I_\rho)$ is $Ig\beta A*$- contra.
If h and φ be both LIg- contra then $\Omega\circ h:(X,I_\tau)\rightarrow(Z,I_\rho)$ is LIg- contra.
Proof:
Let $F\subseteq Z$ is an $Ig\alpha A*O$ then $\Omega^{-1}(F)$ is $Ig\alpha A*$- contra so $(\mathrm{h}^{-1}(\Omega^{-1}(F)))$ is $Ig\alpha A*C$ because, h, Ω are both $Ig\alpha A*$- contra. Hence,
$(\Omega\circ h)^{-1}(F)=(\mathrm{h}^{-1}(\Omega^{-1}(F)))$ is an $Ig\alpha A*C$. Therefore, $\Omega\circ h$ is $Ig\alpha A*$- contra.
In a similar manner, we may demonstrate (2), (3), (4), and (5).
Theorem 3.10. Assume
$h:(X,I_\tau)\rightarrow(Y,I_\sigma)$ and $\Omega:(Y,I_\sigma)\rightarrow(Z,I_\rho)$ are two mappings. Then the following holds:
If h is an $Ig\alpha A*$- continuous and Ω is an $Ig\alpha A*$- contra then
$\Omega\circ h:(X,I_\tau)\rightarrow(Z,I_\rho)$ is $Ig\alpha A*$- contra.
If h is an $IgPA*$- continuous and Ω is an $IgPA*$- contra then
$\Omega\circ h:(X,I_\tau)\rightarrow(Z,I_\rho)$ is $IgPA*$- contra.
If h is an $IgSA*$- continuous and Ω is an $IgSA*$- contra then
$\Omega\circ h:(X,I_\tau)\rightarrow(Z,I_\rho)$ is $IgSA*$- contra.
If h is an $Ig\beta A*$- continuous and Ω is an $Ig\beta A*$- contra then
$\Omega\circ h:(X,I_\tau)\rightarrow(Z,I_\rho)$ is $Ig\beta A*$- contra.
If h is an LIg- continuous and Ω is an LIg-contra then $\Omega\circ h:(X,I_\tau)\rightarrow(Z,I_\rho)$ is LIg-contra.
Proof.
Assume M is $Ig\alpha A*C(Z,I_\rho)$, so, $\Omega^{-1}(M)$ is $Ig\alpha A*C(Y,I_\sigma)$.

Consequently, $h^{-1}(\Omega^{-1}(\bar{M})) = (\Omega \circ h)^{-1}(\bar{M})$ is $Ig\alpha A * C(X, I_\tau)$, because h is $Ig\alpha A *$- continuous.

Hence, $h^{-1}\left(\Omega^{-1}(M)\right) = (\Omega \circ h)^{-1}(M)$ is $Ig\alpha A * C(X, I_\tau)$ Therefore, $\Omega \circ h$ is also an $Ig\alpha A *$- contra.

In a similar manner, we may demonstrate (2), (3),(4),and(5).

3. Results and Discussion

4. Conclusion

The article you cited presents the idea of a generalized weak continuous mappings in intuitionistic topological environments and analyzes numerous results associated with this new sets. It implies that the concepts and results provided in the work can be applied to different kinds of topological spaces, like ideal topological spaces and others.

References

[1] Zadeh, L. A., 1965, Fuzzy sets, information andcontrol,8(3),338–353. https://doi.org/https://doi.org/10.1 016/S0019-9958(65)90241-X

[2] Coker, D., 1996, A note on intuitionistic sets and intuitionistic points, *Turkish Journal of Mathematics*, 20(3), 343-351.

[3] Bayhan, S., & Çoker, D., 2001, On separation axioms in intuitionistic topological spaces, *International Journal of Mathematics and Mathematical Sciences*, 27, 621-630.

[4] Yaseen, Y. J., & Mohammad, R. A., 2012, Regular and weak regular in intuitionistic topological spaces, *Journal of University of Anbar for Pure Science*, 6(3).

[5] Jassim, T. H., 2013, Completely normal and weak completely normal in intuitionistic topological spaces, *International Journal of Scientific & Engineering Research*, 4(10), 438–442.

[6] Yaseen, S. R., Aziz, N. I., & Aziz, S. I., 2022, Generalized Weak Forms of Irresolute Mappings in Intuitionistic Topological Spaces, *Kirkuk Journal of Science*, 13(4), 34-44.

[7] Selvanayaki, S., & Ilango, G., 2015, IGPR-continuity and compactness intuitionistic topological spaces, *British Journal of Mathematics & Computer Science*, 11(2), 1-8.

[8] Jassim, T. H., R Yaseen, S., & S AbdualBaqi, L., 2015, Some generalized sets and mappings in intuitionistic topological spaces, *Journal of AL-Qadisiyah for computer science and mathematics*, 7(2), 80-96.

[9] Selvanayaki, S., & Ilango, G., 2016, Homeomorphism on intuitionistic topological spaces, *Ann. Fuzzy Math. Inform*, 11(6), 957-966.

[10] Ilango, G., & Albinaa, T. A., 2016, Properties of α-interior and α-closure in intuitionistic topological spaces, *IOSR Journal of Mathematics (IOSR-JM),* 12(6), 91-95.

[11] Prova, T. T., & Hossain, M. S., 2020, Intuitionistic fuzzy based regular and normal spaces, *Notes on Intuitionistic Fuzzy Sets*, 26(4), 53-63.

[12] Chae, G. B., Kim, J., Lee, J. G., & Hur, K., 2020, Interval-valued intuitionistic sets and their application to topology, *Annals of Fuzzy Mathematics and Informatics*.

[13] Islam, S., Hossain, S., & Mahbub, A., 2021, On intuitionistic fuzzy r-regular spaces, *International Journal of Fuzzy Mathematical Archive*, 19(2), 149-159.

[14] Isewid, R. A., Aziz, N. I., Yaseen, S. R., & Qasem, M. R., 2021, Some Properties of Regular and Normal Space on Topological Graph Space, *In Journal of Physics: Conference Series*, 1879(2), p. 022106. IOP Publishing.

[15] Haque, A., Akhter, R., & Murshed, M., 2022, Exploring Intuitionistic Subspace Topology and Its Features, *Journal of Topological Studies*, 45(3), 115-130.

[16] Isewid, R. A., & Yaseen, S. R., 2022, Some results of weakly mapping in intuitionisticbi-topologicalspaces, *International Journalof Nonlinear Analysis and Applications*, 13(1), 3191-3195.

[17] Coker, D., 1996, A note on intuitionistic sets and intuitionistic points, *Turkish Journal of Mathematics*, 20(3), 343-351.

[18] Coker D, 2000, An introduction to intuitionistic topological spaces, Busefal, 51-56.

[19] Kim, J. H., Lim, P. K., Lee, J. G., & Hur, K., 2017, Intuitionistic topological space, *Annals of Fuzzy Mathematics and Informatics*.