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RESEARCH ARTICLE

VAGUE MAGNIFIED TRANSLATION IN Γ-NEAR RINGS

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ABSTRACT

In this paper, we introduce and study the concept of vague magnified translation of a vague set in Γ-Near ring, vague magnified translation of a vague ideal in Γ-Near ring and vague magnified translation of a vague Bi-ideal in Γ-Near ring.

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1. INTRODUCTION

The concept of vague set theory was introduced by Gau and Buehrer in 1993, as a improvement of the theory of fuzzy sets by Zadeh (1965) in approximating the real life situations. The idea of fuzzy magnified translation has been introduced by Majumder and Sardar (2008). In 1995, Rao (1995) introduced the notion of Γ-Semi ring as a generalization of Γ-ring as well as Near ring and studied the concepts of Γ-Semi rings and its sub Γ-Near rings with a left (resp. Right) unity. Moreover the concept of Γ-Semi ring not only generalizes the concepts of Semi ring and Γ-ring but also the notion of ternary Semi ring. In this paper we introduce and study the concept of vague magnified translation of a vague set in Γ-Near ring with membership and non membership functions taking values in unit interval of real numbers and established some of the properties. Further we prove that, if A is a left (resp. right) vague ideal of a Γ-Near ring M then the vague magnified translation $A^T_{\beta\alpha}$ of A is a vague βα bi-ideal of M and if A is a left(resp. right) vague ideal of a left (resp. right) zero Γ-Near ring M then $A^T_{\beta\alpha}$ is a constant vague set. Moreover, We characterize vague Γ-Near ring, left(resp. right) vague ideal and vague bi-ideal in terms of vague magnified translation. Throughout this paper, M stands for Zero symmetric Γ-Near ring.

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2. Preliminaries

In this section, we recall some of the fundamental concepts and definitions, which are necessary for this paper. Definition 2.1: A Γ-Near ring M is called left-zero (resp. right-zero) Γ-Near ring if $x\gamma y = x$(resp. $x\gamma y = y$), ∀ x, y ∈ M ; γ ∈ Γ. Definition 2.2: Let μ be a non-empty fuzzy subset of X and α ∈ [0, 1−sup{μ(x)/x∈X }] and β∈ [0, 1]. A mapping $\mu^T_{\beta\alpha} : X \to [0, 1]$ is called a fuzzy magnified translation of μ if $\mu^T_{\beta\alpha} = \beta\mu(x)+\alpha$, ∀ x ∈ X.

Definition 2.3: A vague set A in the universe of discourse U is a pair (t_A , f_A), where $t_A : U\to[0,1]$ and $f_A : U\to[0,1]$ are mappings such that $t_A (u) + f_A (u) \leq 1$, ∀ u ∈ U . The functions t_A and f_A are called true membership function and false membership function respectively.

Definition 2.4: A vague set A of a Γ-Near ring M is called a constant vague set if $V_A(x) = V_A (y)$, ∀x, y ∈ M.

Definition 2.5: A vague set $A = (t_A , f_A)$ on M is said to be vague Γ-Near ring if the following conditions are true:
For all x, y ∈ M ; γ ∈ Γ, $V_A (x - y) \geq \min\{V_A (x), V_A (y)\}$ and $V_A (x\gamma y) \geq \min\{V_A (x), V_A (y)\}$. i.e.,

(i) $t_A (x-y) \geq \min\{t_A (x), t_A (y)\}$, $1 - f_A (x - y) \geq \min\{1 - f_A (x), 1 - f_A (y)\}$ and (ii).$t_A(x\gamma y) \geq \min\{t_A(x), t_A(y)\}$, $1 - f_A(x\gamma y) \geq \min\{1 - f_A(x), 1 - f_A(y)\}$.

Definition 2.6: A vague set $A = (t_A, f_A)$ of M is said to be left (resp. right) vague ideal of M if the following conditions are true: For all x, y, a, b ∈ M ; $\gamma 1 \in \Gamma$

1) $V_A(x - y) \geq \min\{V_A(x), V_A(y)\}$
2) $V_A(y + x - y) \geq V_A(x)$
3) $V_A(a\gamma_1(x + b) - a\gamma_1 b) \geq V_A(x)$ (resp. $V_A(x\gamma_1 a) \geq V_A(x)$)

i.e.,

1) $t_A(x - y) \geq \min\{t_A(x), t_A(y)\}$
2) $t_A(y + x - y) \geq t_A(x)$
3) $t_A(a\gamma_1(x + b) - a\gamma_1 b) \geq t_A(x)$ (resp. $t_A(x\gamma_1 a) \geq t_A(x)$) and
1) $1 - f_A(x - y) \geq \min\{1 - f_A(x), 1 - f_A(y)\}$
2) $1 - f_A(y + x - y) \geq 1 - f_A(x)$
3) $1 - f_A(a\gamma_1(x + b) - a\gamma_1 b) \geq 1 - f_A(x)$ (resp. $1 - fA(x\gamma_1 a) \geq 1 - fA(x)$)

If A is both left and right vague ideal of M, then A is called a vague ideal of M.

Definition 2.7: A vague set $A = (t_A, f_A)$ of M is said to be vague bi-ideal of M if the following conditions are true: For all x, y, z ∈ M ; $\gamma_1, \gamma 2 \in \Gamma$

1) $V_A(x - y) \geq \min\{V_A(x), V_A(y)\}$
2) $V_A(y + x - y) \geq V_A(x)$
3) $V_A((x\gamma_1 y\gamma_2 z) \wedge (x\gamma_1(y + z) - x\gamma_1 z)) \geq \min\{V_A(x), V_A(z)\}$

i.e.,

1) $t_A(x - y) \geq \min\{t_A(x), t_A(y)\}$
2) $t_A(y + x - y) \geq t_A(x)$
3) $t_A((x\gamma_1 y\gamma_2 z) \wedge (x\gamma_1(y + z) - x\gamma_1 z)) \geq \min\{t_A(x), t_A(z)\}$

and

1) $1 - f_A(x - y) \geq \min\{1 - f_A(x), 1 - f_A(y)\}$
2) $1 - f_A(y + x - y) \geq 1 - f_A(x)$
3) $1 - f_A((x\gamma_1 y\gamma_2 z) \wedge (x\gamma_1(y + z) - x\gamma_1 z)) \geq \min\{1 - f_A(x), 1 - f_A(z)\}$

3. Vague Magnified Translation of a Vague set

We introduce the concept of vague magnified translation of a vague set in Γ-Near ring. We prove that, if A is a left (resp. right) vague ideal of a Γ-Near ring M then the vague magnified translation $A^T_{\beta\alpha}$ of A is a vague bi-ideal of M and if A is a left (resp. right) vague ideal of a left (resp. right) zero Γ-Near ring M, then $A^T_{\beta\alpha}$ is a constant vague . We begin with the following set.

Definition 3.1: Let A be a non-empty vague set of M and $\alpha \in [0, 1 - \sup\{tA(p) + fA(p) / p \in M\}]$ and $\beta \in [0, 1]$. The vague magnified translation of A, $A^T_{\beta\alpha}$ is a pair $(t_{A^T_{\beta\alpha}}, f_{A^T_{\beta\alpha}})$ where $t_{A^T_{\beta\alpha}}: M \to [0, 1]$ and $f_{A^T_{\beta\alpha}}: M \to [0, 1]$ are mappings such that $t_{A^T_{\beta\alpha}}(p) = \beta t_A(p) + \alpha$ and $f_{A^T_{\beta\alpha}} = \beta f_A(p) - \alpha$, ∀ p ∈ M.

Verification 3.2: Vague magnified translation is also a vague set. Let $A = (t_A, f_A)$ be a vague set of a M.

Let $\alpha \in [0, 1\text{-}\sup\{t_A(p) + f_A(p)/p \in M\}]$ and $\beta \in [0,1]$.

The vague magnified translation of A is $A^T_{\beta\alpha} = (t_{A^T_{\beta\alpha}}, f_{A^T_{\beta\alpha}})$. Let p ∈ M.

Now $t_{A^T_{\beta\alpha}}(p) + f_{A^T_{\beta\alpha}}(p) = \beta t_A(p) + \alpha + \beta f_A(p) - \alpha$
$= \beta[t_A(p) + f_A(p)] \leq 1$.

Thus $A^T_{\beta\alpha}$ is a vague set.

Example 3.3: Let M be the set of natural numbers including zero and Γ be the set of positive even integers.

Define aγb = a.γ.b, where '.' is the usual multiplication on M, for all a, b ∈ M , γ ∈ Γ.

Therefore M is a Γ-Near ring.

Let $A = (t_A, f_A)$, where $t_A : M \to [0,1]$ and $f_A : M \to [0,1]$ such that

$$tA(p) = \begin{cases} 0.7 \text{ if } x = 0 \\ 0.5 \text{ if } x \text{ is even} \\ 0.4 \text{ if } x \text{ is odd} \end{cases} \text{ and } fA(p) = \begin{cases} 0.3 \text{ if } x = 0 \\ 0.4 \text{ if } x \text{ is even} \\ 0.5 \text{ if } x \text{ is odd} \end{cases}$$

Therefore A is a vague set.

Now, $A^T_{\beta\alpha} = (t_{A^T}, f_{A^T})$, where β ∈ [0,1] and

$\alpha \in [0.1 - \sup\{1, 0.9, 0.9\}] = [0, 1 - 1] = 0$
put β = 0.3.

Then

$$t_{A^T_{\beta\alpha}}(x) = \begin{cases} 0.21 \text{ if } x = 0 \\ 0.15 \text{ if } x \text{ is even} \\ 0.12 \text{ if } x \text{ is odd} \end{cases} \text{ and}$$

$$f_{A^T_{\beta\alpha}}(x) = \begin{cases} 0.09 \text{ if } x = 0 \\ 0.12 \text{ if } x \text{ is even} \\ 0.15 \text{ if } x \text{ is odd} \end{cases}$$

Therefore $A^T_{\beta\alpha} = (t_{A^T_{\beta\alpha}}, f_{A^T_{\beta\alpha}})$ is a vague set.

Theorem 3.4: Let $A = (t_A, f_A)$ and $B = (t_B, f_B)$ be two vague sets of M. Then

1.$(A \cap B)^T_{\beta\alpha} = A^T_{\beta\alpha} \cap B^T_{\beta\alpha}$

2.$(A \cup B)^T_{\beta\alpha} = A^T_{\beta\alpha} \cup B^T_{\beta\alpha}$

Proof: Let p ∈ M .

1.Now, $t_{(A \cap B)^T_{\beta\alpha}} = \beta t_{A \cap B}(p) + \alpha$
$= \beta \min\{t_A(p), t_B(p)\} + \alpha$
$= \min\{\beta t_A(p) + \alpha, \beta t_B(p) + \alpha\}$
$= \min\{t_{A^T_{\beta\alpha}}(p), t_{B^T_{\beta\alpha}}(p)\}$
$= t_{A^T_{\beta\alpha} \cap B^T_{\beta\alpha}}(p)$

$f_{(A\cap B)^T_{\beta\alpha}} = \beta f_{A\cap B}(p) - \alpha$
$= \beta \min\{f_A(p), f_B(p)\} - \alpha$
$= \min\{\beta f_A(p) - \alpha, \beta f_B(p) - \alpha\}$
$= \min\{f_{A^T_{\beta\alpha}}(p), f_{B^T_{\beta\alpha}}(p)\}$
$= f_{A^T_{\beta\alpha}\cap B^T_{\beta\alpha}}(p)$
Hence $(A\cap B)^T_{\beta\alpha} = A^T_{\beta\alpha}\cap B^T_{\beta\alpha}$
Similarly we can prove $(A\cup B)^T_{\beta\alpha} = A^T_{\beta\alpha}\cup B^T_{\beta\alpha}$.

Theorem 3.5: Let A = (t_A , f_A) be a vague set of M. Then A is a vague Γ-Near ring of M if and only if the vague magnified translation of A, $A^T_{\beta\alpha}$ is vague Γ-Near ring of M.

Proof: Suppose A is a vague Γ-Near ring of M. Let p,q ∈ M ; γ ∈ Γ.

Now,

$t_{A^T_{\beta\alpha}}(p-q) = \beta t_A(p-q) + \alpha$
$\geq \beta \min\{t_A(p), t_A(q)\} + \alpha$
$= \min\{\beta t_A(p) + \alpha, \beta t_A(q) + \alpha\}$
$= \min\{t_{A^T_{\beta\alpha}}(p), t_{A^T_{\beta\alpha}}(q)\}$

and

$f_{A^T_{\beta\alpha}}(p-q) = \beta f_A(p-q) - \alpha$
$\leq \beta \max\{f_A(p), f_A(q)] - \alpha$
$= \max\{\beta f_A(p) - \alpha, \beta f_A(q) - \alpha\}$
$= \max\{f_{A^T_{\beta\alpha}}(p), f_{A^T_{\beta\alpha}}(q)\}$

Similarly we can prove that $t_{A^T_{\beta\alpha}}(p\gamma q) \geq \min\{t_{A^T_{\beta\alpha}}(p), t_{A^T_{\beta\alpha}}(q)]$ and $f_{A^T_{\beta\alpha}}(p\gamma q) \leq \min\{f_{A^T_{\beta\alpha}}(p), f_{A^T_{\beta\alpha}}(q)]$

Hence $A^T_{\beta\alpha}$ is a vague Γ-Near ring of M.

Conversely suppose that $A^T_{\beta\alpha}$ is a vague Γ-Near ring of M. Let p, q ∈ M ; γ ∈ Γ.

Now,

$t_A(p-q) = \frac{1}{\beta}(t_{A^T_{\beta\alpha}}(p-q) - \alpha)$
$\geq \frac{1}{\beta}(\min\{t_{A^T_{\beta\alpha}}(p), t_{A^T_{\beta\alpha}}(q)\} - \alpha)$
$= \frac{1}{\beta}(\min\{t_{A^T_{\beta\alpha}}(p) - \alpha, t_{A^T_{\beta\alpha}}(q) - \alpha\}$
$= \min\{\frac{1}{\beta}\left(t_{A^T_{\beta\alpha}}(p) - \alpha\right), \frac{1}{\beta}(t_{A^T_{\beta\alpha}}(q) - \alpha)\}$
$= \min\{t_A(p), t_A(q)\}$ and
$f_A(p-q) = \frac{1}{\beta}\left(f_{A^T_{\beta\alpha}}(p-q) + \alpha\right) \leq \frac{1}{\beta}\left(\max\{f_{A^T_{\beta\alpha}}(p), f_{A^T_{\beta\alpha}}(q)\} + \alpha\right)$
$= \frac{1}{\beta}(\max\{f_{A^T_{\beta\alpha}}(p) + \alpha, f_{A^T_{\beta\alpha}}(q) + \alpha\}$
$= \max\{\frac{1}{\beta}\left(f_{A^T_{\beta\alpha}}(p) + \alpha\right), \frac{1}{\beta}\left(f_{A^T_{\beta\alpha}}(q) + \alpha\right)\}$
$= \max\{f_A(p), f_A(q)\}$

Similarly we can prove that tA (pγq) ≥ min $\{t_A(p), t_A(q)\}$ and fA (pγq) ≤ max{fA (p), fA (q)}. Hence A is a vague Γ-Near ring of M.

The following two theorems follows theorem: 3.5.

Theorem 3.6: Let A = (t_A , f_A) be a vague set of M. Then A is a left(resp. right) vague ideal of M if and only if the vague magnified translation of A, $A^T_{\beta\alpha}$ is left(right) vague ideal of M.

Theorem 3.7: Let A = (tA , fA) be a vague set of M . Then A is a vague bi-ideal of M if and only if the vague magnified translation of A, $A^T_{\beta\alpha}$ is vague bi-ideal of M.

Theorem 3.8: If A is a left (resp. right) vague ideal of M , then $A^T_{\beta\alpha}$ is a vague bi-ideal of M.

Proof: Let p, q, r ∈ M ; γ_1, γ_2 ∈ Γ

1. $t_{A^T_{\beta\alpha}}(p) = \beta t_A(p-q) + \alpha$
$\geq \beta \min\{t_A(p), t_A(q)\} + \alpha$
$= \min\{\beta t_A(p) + \alpha, \beta t_A(q) + \alpha)$
$= \min\{t_{A^T_{\beta\alpha}}(p), t_{A^T_{\beta\alpha}}(q)\}$

2. $t_{A^T_{\beta\alpha}}(q+p-q) = \beta t_A(q+p-q) + \alpha$ Type equation here.
$\geq \beta t_A(p) + \alpha$
$= t_{A^T_{\beta\alpha}}(p)$

3. $t_{A^T_{\beta\alpha}}((p\gamma_1 q)\wedge(p\gamma_1(r+p) - p\gamma_1 q))$
$=$
$\beta t_A((p\gamma_1 q\gamma_2 r)\wedge(p\gamma_1(r+p) - p\gamma_1 q)) + \alpha$
$\geq \beta \min\{t_A(\mathrm{p}), t_A(\mathrm{r})\} + \alpha$
$= \min\{\beta t_A(\mathrm{p}) + \alpha, \beta t_A(\mathrm{r}) + \alpha\}$
$= \min\{t_{A^T_{\beta\alpha}}(p), t_{A^T_{\beta\alpha}}(r)\}$

Similarly we can prove

1. $f_{A^T_{\beta\alpha}}(p-q) \leq \max\{f_{A^T_{\beta\alpha}}(p), f_{A^T_{\beta\alpha}}(q)\}$
2. $f_{A^T_{\beta\alpha}}(q+p-q) \leq f_{A^T_{\beta\alpha}}(p)$ and
3. $f_{A^T_{\beta\alpha}}((p\gamma_1 q\gamma_2 r)\wedge(p\gamma_1(r+p) - p\gamma_1 q)) \leq \max\{f_{A^T_{\beta\alpha}}(p), f_{A^T_{\beta\alpha}}(r)\}$

Hence $A^T_{\beta\alpha}$ is a vague bi-ideal of M.

Theorem 3.9: The vague magnified translation of the intersection of an arbitrary collection of vague bi-ideals of M is a vague bi-ideal of M if it is not empty.

Proof: Let A be the intersection of arbitrary collection of vague bi-ideals of M. We have arbitrary collection of vague bi-ideals of M is a vague bi-ideal of M. Hence from theorem: 4.7. $A^T_{\beta\alpha}$ is a vague bi-ideal of M.

Theorem 3.10: Let A be a left (resp. right) vague ideal of a left (right) zero Γ-Near ring M. Then $A^T_{\beta\alpha}$ is a constant vague set.
Proof. : Let p, q ∈ M ; γ ∈ Γ.

Since M is a left zero Γ-Near ring, we have pγq = p and qγp = q.

Now, $t_{A^T_{\beta\alpha}}(p) = \beta t_A(\text{p}) + \alpha$ = $\beta t_A(p\gamma q) + \alpha \geq \beta t_A(\text{q}) + \alpha$)= $t_{A^T_{\beta\alpha}}(q)$

Again $t_{A^T_{\beta\alpha}}(q) = \beta t_A(\text{q}) + \alpha$ = $\beta t_A(p\gamma q) + \alpha \geq \beta t_A(\text{q}) + \alpha$)= $t_{A^T_{\beta\alpha}}(p)$

Similarly $t_{A^T_{\beta\alpha}}(p) = t_{A^T_{\beta\alpha}}(q)$

Thus $A^T_{\beta\alpha}$ is a constant vague set.

Similarly we can prove other case also.

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