

Parameter Reduction of Turiyam Soft Sets using Indiscernibility Relation with an Application to Cyclone Relief Prioritization

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Abstract

Parameter reduction minimizes redundancy while preserving the essential information and helps in optimizing decision making models. In this paper, we define the Concept of Turiyam Soft Set by combining Turiyam Set and Soft Set. Further we propose a Parameter Reduction using the concept of Indiscernibility Relation of Turiyam Soft Set. We introduce the ideas of 'Dispensable Set' and 'Indispensable Set' of the parameter set of Turiyam Soft Set. Using them, we define the concepts of Decision Partition, Parameter Reduction, and the Degree of Importance of a Parameter. Then we define an algorithm using the Degree of Importance of a Parameter in the context of Turiyam Soft Set. Then, we applied this algorithm to a real life situation.

1. Introduction

Soft Set Theory, introduced by Molodtsov in 1999 [1], provides a way to handle uncertainty in decision-making. In 2005, Smarandache proposed the Neutrosophic Set [2], extending Intuitionistic Fuzzy Sets [3] by adding an indeterminacy membership. Maji (2011) introduced the Neutrosophic Soft Set [4], and later, in 2020 Parameter Reduction of Neutrosophic Soft Sets [5] was introduced by Abhijit Saha and Said Broumi. Recently (2021), Prem Kumar Singh proposed Turiyam Set Theory [6,7,8], which adds a fourth component, the turiyam state (I), to represent what lies beyond the known, unknown, and unknowable. In this paper, we defined the concept of Turiyam Soft Set and proposed the parameter reduction using Indiscernibility Relation of Turiyam Soft Set and presented an algorithm along with a real life application.

2. Preliminaries

Definition – 2.1 [1]

Let U be an initial universe and E be the set of parameters. Let $P(U)$ denotes the power set of U . Consider a nonempty set A , $A \subset E$. A pair (F, A) is called a Soft Set over U , where F is a mapping given by $F: A \rightarrow P(U)$.

Definition 2.2 [6]

A Turiyam set A on U has the form

$$A = \{ \langle u, t_A(u), i_A(u), f_A(u), l_A(u) \rangle : u \in U \}$$

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where $t_A(u): U \rightarrow [0, 1]$, $i_A(u): U \rightarrow [0, 1]$, $f_A(u): U \rightarrow [0, 1]$ and $l_A(u): U \rightarrow [0, 1]$ denote the truth value, the indeterminacy value, the falsity value and the Turiyam state (or liberal) value for each $u \in U$, correspondingly by which $t_A(u)$, $i_A(u)$, $f_A(u)$ and $l_A(u)$ satisfies the condition $0 \leq t_A(u) + i_A(u) + f_A(u) + l_A(u) \leq 4, \forall u \in U$.

3. Turiyam Soft Set

In this section, we introduce the concept of the Turiyam Soft Set, a novel extension of the traditional soft set framework designed to handle an additional dimension of uncertainty. The definition of a Turiyam Soft Set is presented along with an example to illustrate its structure.

Definition 3.1

A Turiyam Soft Set $(F, A)_L$ on the universe U over the fixed parameter E is defined as,

$$(F, A)_L = \{(e, F(e)): e \in A, F(e) \in T(U)\}$$

Where, $T(U)$ denotes the set of all Turiyam Sets of U and F is a mapping from $F: A \rightarrow T(U)$; $A \subset E$.

Example 3.2

Let $U = \{u_1, u_2, u_3\}$, $E = \{e_1, e_2, e_3, e_4, e_5\}$

$$A = \{e_1, e_2\} \subset E$$

Let,

$$F(e_1) = \left\{ \left(e_1, \left\{ \frac{u_1}{0.3, 0.4, 0.6, 0.5}, \frac{u_2}{0.2, 0.4, 0.5, 0.3}, \frac{u_3}{0.7, 0.8, 0.4, 0.6} \right\} \right) \right\}$$

$$F(e_2) = \left\{ \left(e_2, \left\{ \frac{u_1}{0.6, 0.4, 0.5, 0.6}, \frac{u_2}{0.4, 0.5, 0.3, 0.1}, \frac{u_3}{0.1, 0.3, 0.5, 0.7} \right\} \right) \right\}$$

then, the Turiyam Soft Set is,

$$(F, A)_L = \left\{ \left(e_1, \left\{ \frac{u_1}{0.3, 0.4, 0.6, 0.5}, \frac{u_2}{0.2, 0.4, 0.5, 0.3}, \frac{u_3}{0.7, 0.8, 0.4, 0.6} \right\} \right), \left(e_2, \left\{ \frac{u_1}{0.6, 0.4, 0.5, 0.6}, \frac{u_2}{0.4, 0.5, 0.3, 0.1}, \frac{u_3}{0.1, 0.3, 0.5, 0.7} \right\} \right) \right\}$$

4. Parameter Reduction of Turiyam Soft Set

In this section, we discuss the Parameter Reduction of Turiyam Soft Set. The concepts of Indiscernibility Relation, Dispensable Set, and Indispensable Set are introduced along with an example to illustrate the reduction process.

Definition 4.1

Let $U = \{u_1, u_2, \dots, u_n\}$ be the set of n objects in the fixed universe and $E = \{e_1, e_2, \dots, e_m\}$ be the set of parameters. Let $(F, E)_L$ be a Turiyam Soft Set. Define a function F_E on $(F, E)_L$ such that,

$$F_E(u_i) = \sum_j F_{e_j}(u_i), \quad \forall u_i \in U$$

Where $F_{e_j}(u_i) = (t_{F(e_j)}(u_i) + i_{F(e_j)}(u_i) + f_{F(e_j)}(u_i) + l_{F(e_j)}(u_i))$. An Indiscernibility Relation denoted by $IndR_A$, is defined by,

$$IndR_A = \{(u_k, u_l) \in U \times U: F_A(u_k) = F_A(u_l)\}$$

Let the partition of the objects in U be defined as,

$$P_E^U = \{\{u_1, u_2, \dots, u_k\}_{U_1}, \{u_{k+1}, u_{k+2}, \dots, u_l\}_{U_2}, \dots, \{u_o, u_{o+1}, \dots, u_n\}_{U_s}\}$$

Which partitions and ranks the objects in U according to the values of $F_E(u_i)$ based on the indiscernibility Relation $IndR_E$.

P_E^U is the decision partition whose subclasses are: $\{u_1, u_2, \dots, u_k\}, \{u_{k+1}, u_{k+2}, \dots, u_l\}, \dots, \{u_o, u_{o+1}, \dots, u_n\}$ and the number of subclasses of P_E^U is s and $U_1 > U_2 > \dots > U_s$.

For any subclass, say, $\{u_1, u_2, \dots, u_k\}_{U_1}$, $[F_E(u_1)] = [F_E(u_2)] = \dots = [F_E(u_k)] = U_1$, where $[\cdot]$ denotes the greatest integer function.

Example 4.2

Let $U = \{u_1, u_2, u_3\}$ and $E = \{e_1, e_2, e_3, e_4\}$. Then, let

$$(F, E)_L = \left\{ \begin{array}{l} \left(e_1, \left\{ \frac{u_1}{(0.2,0.8,0.4,0.5)}, \frac{u_2}{(0.7,0.3,0.6,0.9)}, \frac{u_3}{(0.4,0.2,0.8,0.5)} \right\} \right), \\ \left(e_2, \left\{ \frac{u_1}{(0.3,0.7,0.5,0.4)}, \frac{u_2}{(0.8,0.5,0.6,0.3)}, \frac{u_3}{(0.7,0.6,0.4,0.5)} \right\} \right), \\ \left(e_3, \left\{ \frac{u_1}{(0.5,0.7,0.3,0.8)}, \frac{u_2}{(0.4,0.6,0.2,0.9)}, \frac{u_3}{(0.7,0.2,0.4,0.2)} \right\} \right), \\ \left(e_4, \left\{ \frac{u_1}{(0.6,0.2,0.8,0.5)}, \frac{u_2}{(0.4,0.9,0.2,0.3)}, \frac{u_3}{(0.8,0.3,0.4,0.3)} \right\} \right) \end{array} \right\}$$

The tabular form of the above Turiyam Soft Set can be represented as,

	e_1	e_2	e_3	e_4	$F_E(\cdot)$
u_1	(0.2,0.8,0.4,0.5)	(0.3,0.7,0.5,0.4)	(0.5,0.7,0.3,0.8)	(0.6,0.2,0.8,0.5)	8.2
u_2	(0.7,0.3,0.6,0.9)	(0.8,0.5,0.6,0.3)	(0.4,0.6,0.2,0.9)	(0.4,0.9,0.2,0.3)	8.6
u_3	(0.4,0.2,0.8,0.5)	(0.7,0.6,0.4,0.5)	(0.7,0.2,0.4,0.2)	(0.8,0.3,0.4,0.3)	7.4

$$P_E^U = \{\{u_1, u_2\}_{U_1}, \{u_3\}_{U_2}\}; U_1 = 8, U_2 = 7$$

$F_E(u_1) = 8.2, F_E(u_2) = 8.6, F_E(u_3) = 7.4$ and hence the optimal choice is u_1 or u_2 and the suboptimal choice is u_3 .

Definition 4.3

For the Turiyam Soft Set $(F, E)_L$ with $E = \{e_1, e_2, \dots, e_m\}$, if there exists a subset $B \subseteq E$ such that $B = \{e'_1, e'_2, \dots, e'_c\} \in E$ satisfying $F_B(u_1) = F_B(u_2) = \dots = F_B(u_n)$, then B is said to be dispensable or else it is indispensable.

$B \subset E$ is called the normal parameter reduction of E if B is indispensable and $F_{E-B}(u_1) = F_{E-B}(u_2) = \dots = F_{E-B}(u_n)$.

Example 4.4

From the Example 4.2,

The subset $B = \{e_2, e_4\} \subset E$ satisfies $F_B(u_1) = F_B(u_2) = F_B(u_3) = 4.0$. Hence, B is dispensable.

5. Algorithm of normal parameter reduction

For the Turiyam Soft Set $(F, E)_L$,

$$P_E^U = \{\{u_1, u_2, \dots, u_k\}_{U_1}, \{u_{k+1}, u_{k+2}, \dots, u_l\}_{U_2}, \dots, \{u_o, u_{o+1}, \dots, u_n\}_{U_s}\}$$

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is the decision partition of objects in U . Now deleting the parameter e_c from E , we get a new decision partition for the deleted parameters e_c denoted by $P_{E-\{e_c\}}^U$, given by,

$$P_{E-\{e_c\}}^U = \{\{u'_1, u'_2, \dots, u'_k\}_{U'_1}, \{u'_{k+1}, u'_{k+2}, \dots, u'_l\}_{U'_2}, \dots, \{u'_o, u'_{o+1}, \dots, u'_n\}_{U'_s}\}$$

Let us denote them by,

$$P_E^U = \{E_{U_1}, E_{U_2}, \dots, E_{U_s}\}$$

$$P_{E-\{e_c\}}^U = \{\overline{E - \{e_c\}}_{U'_1}, \overline{E - \{e_c\}}_{U'_2}, \dots, \overline{E - \{e_c\}}_{U'_s}\}$$

where,

$$E_{U_1} = \{u_1, u_2, \dots, u_k\}_{U_1}, E_{U_2} = \{u_{k+1}, u_{k+2}, \dots, u_l\}_{U_2}, \dots, E_{U_s} = \{u_o, u_{o+1}, \dots, u_n\}_{U_s}$$

$$\overline{E - \{e_c\}}_{U'_1} = \{u'_1, u'_2, \dots, u'_k\}_{U'_1}$$

$$\overline{E - \{e_c\}}_{U'_2} = \{u'_{k+1}, u'_{k+2}, \dots, u'_l\}_{U'_2}$$

...

$$\overline{E - \{e_c\}}_{U'_s} = \{u'_o, u'_{o+1}, \dots, u'_n\}_{U'_s}$$

Definition 5.1

The degree of importance of e_h for the decision partition is denoted by $DI(e_h)$ and is defined by

$$DI(e_h) = \frac{1}{|U|} \sum_{q=1}^s (\alpha_{1,e_h} + \alpha_{2,e_h} + \dots + \alpha_{s,e_h})$$

where,

$$\alpha_{q,e_h} = \begin{cases} |E_{U_q} - \overline{E - \{e_c\}}_{U'_r}|, & \text{if there exists } r' \text{ such that } U_q = U'_r, \\ & 1 \leq r' \leq s', 1 \leq q \leq s \\ |E_{U_q}|, & \text{otherwise} \end{cases}$$

Definition 5.2

Let $B = \{e'_1, e'_2, \dots, e'_n\} \in E$ be the decision partition for the deleted subset B of E, denoted by P_{E-B}^U and is given by $P_{E-B}^U = \{\overline{E - \{e_c\}}_{U'_1}, \overline{E - \{e_c\}}_{U'_2}, \dots, \overline{E - \{e_c\}}_{U'_s}\}$. The degree of importance of B for the decision partition is defined by,

$$DI(B) = \frac{1}{|U|} (\alpha_{1,B} + \alpha_{2,B} + \dots + \alpha_{s,B})$$

where,

$$\alpha_{q,B} = \begin{cases} |E_{U_q} - \overline{E - B}_{U'_r}|, & \text{if there exists } r' \text{ such that } U_q = U'_r, \\ & 1 \leq r' \leq s', 1 \leq q \leq s \\ |E_{U_q}|, & \text{otherwise} \end{cases}$$

Proposition 5.3

For a Turiyam Soft Set $(F, E)_L$ with the parameter set $E = \{e_1, e_2, \dots, e_m\}, 0 \leq DI(e_r) \leq 1$.

Proof:

$$DI(e_h) = \frac{1}{|U|} \sum_{q=1}^s \alpha_{q,e_h}$$

$\alpha_{q,B} = |E_{U_q} - \overline{E - \{e_c\}_{U_r'}}| \leq |E_{U_q}|$, (if there exists r' such that $U_q = U_{r'}$, $1 \leq r' \leq s'$, $1 \leq q \leq s$). It is clear that, $|E_{U_1}| + |E_{U_2}| + \dots + |E_{U_s}| = |U|$, therefore,

$$DI(e_h) = \frac{1}{|U|} (\alpha_{1,e_h} + \alpha_{2,e_h} + \dots + \alpha_{s,e_h})$$

$$\leq \frac{1}{|U|} (|E_{U_1}| + |E_{U_2}| + \dots + |E_{U_s}|) = 1$$

We know that $0 \leq DI(e_r) \leq 1$.

Application 5.4

After a severe cyclone, the disaster management officer needs to decide which area should receive help first according to the severity of the situation. Let $U = \{u_1, u_2, u_3, u_4, u_5, u_6, u_7, u_8\}$ be the regions affected by the cyclone and $E = \{e_1, e_2, e_3, e_4, e_5, e_6, e_7\}$ be set of parameters for disaster relief planning. Where, $e_1 =$ Severity of damage, $e_2 =$ Accessibility of area, $e_3 =$ Population density, $e_4 =$ Availability of local infrastructure, $e_5 =$ Urgency of medical needs, $e_6 =$ Predicted weather stability, $e_7 =$ Availability of skilled relief personnel.

Let the liberalisation value be how strongly this parameter helps speed up the overall effectiveness of relief operations in the affected region.

	e_1	e_2	e_3	e_4	e_5	e_6	e_7	$F_E(\cdot)$
u_1	(0.1,0.8,0.3, 0.7)	(0.4,0.7,0.5, 0.6)	(0.9,0.2,0.6, 0.4)	(0.3,0.8,0.4, 0.5)	(0.6,0.5,0.8, 0.7)	(0.2,0.9,0.5, 0.6)	(0.3,0.5,0.9, 0.2)	14.4
u_2	(0.2,0.6,0.5, 0.1)	(0.5,0.6,0.7, 0.4)	(0.7,0.4,0.3, 0.6)	(0.4,0.5,0.3, 0.8)	(0.6,0.4,0.6, 0.5)	(0.4,0.7,0.4, 0.7)	(0.5,0.2,0.1, 0.8)	13.5
u_3	(0.6,0.1,0.4, 0.2)	(0.6,0.5,0.5, 0.6)	(0.4,0.3,0.8, 0.6)	(0.4,0.4,0.6, 0.6)	(0.7,0.3,0.6, 0.5)	(0.5,0.5,0.6, 0.6)	(0.5,0.9,0.2, 0.1)	13.6
u_4	(0.3,0.8,0.1, 0.6)	(0.7,0.6,0.5, 0.4)	(0.2,0.9,0.7, 0.4)	(0.3,0.4,0.7, 0.6)	(0.6,0.6,0.5, 0.4)	(0.5,0.7,0.4, 0.6)	(0.5,0.3,0.2, 0.9)	14.4
u_5	(0.3,0.2,0.4, 0.1)	(0.5,0.6,0.6, 0.5)	(0.6,0.3,0.4, 0.2)	(0.4,0.5,0.5, 0.6)	(0.6,0.6,0.4, 0.5)	(0.5,0.5,0.6, 0.6)	(0.5,0.5,0.1, 0.3)	12.4
u_6	(0.7,0.1,0.9, 0.4)	(0.6,0.5,0.5, 0.6)	(0.3,0.6,0.2, 0.8)	(0.4,0.6,0.4, 0.6)	(0.5,0.5,0.6, 0.5)	(0.6,0.6,0.5, 0.5)	(0.5,0.9,0.4, 0.2)	14.5
u_7	(0.2,0.5,0.6, 0.1)	(0.5,0.6,0.6, 0.5)	(0.4,0.5,0.3, 0.2)	(0.6,0.5,0.4, 0.5)	(0.6,0.6,0.4, 0.5)	(0.6,0.5,0.5, 0.6)	(0.4,0.6,0.1, 0.2)	12.6
u_8	(0.6,0.2,0.3, 0.5)	(0.6,0.6,0.5, 0.5)	(0.1,0.5,0.6, 0.2)	(0.5,0.5,0.5, 0.5)	(0.4,0.5,0.6, 0.6)	(0.5,0.6,0.5, 0.6)	(0.7,0.4,0.2, 0.6)	13.4

$$P_E^U = \{\{u_1, u_4, u_6\}_{U_1}, \{u_2, u_3, u_8\}_{U_2}, \{u_5, u_7\}_{U_3}\}; U_1 = 14, U_2 = 13, U_3 = 12$$

Hence the optimal choices are u_1 or u_2 and the suboptimal choice is u_3 .

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The subset $B = \{e_2, e_4, e_5, e_6\} \subset E$ satisfies $F_B(u_1) = F_B(u_2) = F_B(u_3) = F_B(u_4) = F_B(u_5) = F_B(u_6) = F_B(u_7) = F_B(u_8)$. Therefore, B is dispensable.

	e_1	e_3	e_7	$F_E(\cdot)$
u_1	(0.1,0.8,0.3,0.7)	(0.9,0.2,0.6,0.4)	(0.3,0.5,0.9,0.2)	5.9
u_2	(0.2,0.6,0.5,0.1)	(0.7,0.4,0.3,0.6)	(0.5,0.2,0.1,0.8)	5.0
u_3	(0.6,0.1,0.4,0.2)	(0.4,0.3,0.8,0.6)	(0.5,0.9,0.2,0.1)	5.1
u_4	(0.3,0.8,0.1,0.6)	(0.2,0.9,0.7,0.4)	(0.5,0.3,0.2,0.9)	5.9
u_5	(0.3,0.2,0.4,0.1)	(0.6,0.3,0.4,0.2)	(0.5,0.5,0.1,0.3)	3.9
u_6	(0.7,0.1,0.9,0.4)	(0.3,0.6,0.2,0.8)	(0.5,0.9,0.4,0.2)	6.0
u_7	(0.2,0.5,0.6,0.1)	(0.4,0.5,0.3,0.2)	(0.4,0.6,0.1,0.2)	4.1
u_8	(0.6,0.2,0.3,0.5)	(0.1,0.5,0.6,0.2)	(0.7,0.4,0.2,0.6)	4.9

$$P_{E-\{e_2, e_4, e_5, e_6\}}^U = \{\{u_6\}_{U'_1}, \{u_1, u_2, u_3, u_4\}_{U'_2}, \{u_7, u_8\}_{U'_3}, \{u_5\}_{U'_4}\};$$

$$U'_1 = 6, U'_2 = 5, U'_3 = 4, U'_4 = 3$$

$$P_{E-\{e_1\}}^U = \{\{u_1, u_4\}_4, \{u_2, u_3, u_6, u_8\}_3, \{u_5, u_7\}_2\}$$

$$P_{E-\{e_3\}}^U = \{\{u_6\}_4, \{u_1, u_2, u_3, u_4, u_8\}_3, \{u_5, u_7\}_2\}$$

$$P_{E-\{e_7\}}^U = \{\{u_1, u_4, u_6\}_4, \{u_2, u_3, u_8\}_3, \{u_5, u_7\}_2\}$$

$$\alpha_{1,e_1} = |\{u_1, u_4, u_6\}| = 3, \alpha_{2,e_1} = |\{u_2, u_3, u_8\}| = 3, \alpha_{3,e_1} = |\{u_5, u_7\}| = 2$$

$$\alpha_{1,e_3} = |\{u_1, u_4, u_6\}| = 3, \alpha_{2,e_3} = |\{u_2, u_3, u_8\}| = 3, \alpha_{3,e_3} = |\{u_5, u_7\}| = 2$$

$$\alpha_{1,e_7} = |\{u_1, u_4, u_6\}| = 3, \alpha_{2,e_7} = |\{u_2, u_3, u_8\}| = 3, \alpha_{3,e_7} = |\{u_5, u_7\}| = 2$$

$$DI(e_1) = 1, \quad DI(e_3) = 1, \quad DI(e_7) = 1$$

	e_1	e_3	e_7	c_i
u_1	(0.1,0.8,0.3,0.7)	(0.9,0.2,0.6,0.4)	(0.3,0.5,0.9,0.2)	$c_1 = (0.1 + 0.8 + 0.3 + 0.7) \times 1 + (0.9 + 0.2 + 0.6 + 0.4) \times 1 + (0.3 + 0.5 + 0.9 + 0.2) \times 1 = 5.9$
u_2	(0.2,0.6,0.5,0.1)	(0.7,0.4,0.3,0.6)	(0.5,0.2,0.1,0.8)	$c_2 = (0.2 + 0.6 + 0.5 + 0.1) \times 1 + (0.7 + 0.4 + 0.3 + 0.6) \times 1 + (0.5 + 0.2 + 0.1 + 0.8) \times 1 = 5.0$
u_3	(0.6,0.1,0.4,0.2)	(0.4,0.3,0.8,0.6)	(0.5,0.9,0.2,0.1)	$c_3 = (0.6 + 0.1 + 0.4 + 0.2) \times 1 + (0.4 + 0.3 + 0.8 + 0.6) \times 1 + (0.5 + 0.9 + 0.2 + 0.1) \times 1 = 5.1$
u_4	(0.3,0.8,0.1,0.6)	(0.2,0.9,0.7,0.4)	(0.5,0.3,0.2,0.9)	$c_4 = (0.3 + 0.8 + 0.1 + 0.6) \times 1 + (0.2 + 0.9 + 0.7 + 0.4) \times 1 + (0.5 + 0.3 + 0.2 + 0.9) \times 1 = 5.9$

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u_5	(0.3,0.2,0.4,0.1)	(0.6,0.3,0.4,0.2)	(0.5,0.5,0.1,0.3)	$c_5 = (0.3 + 0.2 + 0.4 + 0.1) \times 1 + (0.3 + 0.2 + 0.4 + 0.1) \times 1 + (0.5 + 0.5 + 0.1 + 0.3) \times 1 = 3.9$
u_6	(0.7,0.1,0.9,0.4)	(0.3,0.6,0.2,0.8)	(0.5,0.9,0.4,0.2)	$c_6 = (0.7 + 0.1 + 0.9 + 0.4) \times 1 + (0.3 + 0.6 + 0.2 + 0.8) \times 1 + (0.5 + 0.9 + 0.4 + 0.2) \times 1 = 6.0$
u_7	(0.2,0.5,0.6,0.1)	(0.4,0.5,0.3,0.2)	(0.4,0.6,0.1,0.2)	$c_7 = (0.2 + 0.5 + 0.6 + 0.1) \times 1 + (0.4 + 0.5 + 0.3 + 0.2) \times 1 + (0.4 + 0.6 + 0.1 + 0.2) \times 1 = 4.1$
u_8	(0.6,0.2,0.3,0.5)	(0.1,0.5,0.6,0.2)	(0.7,0.4,0.2,0.6)	$c_7 = (0.6 + 0.2 + 0.3 + 0.5) \times 1 + (0.1 + 0.5 + 0.6 + 0.2) \times 1 + (0.7 + 0.4 + 0.2 + 0.6) \times 1 = 4.9$

From the above table, the choice value c_6 is the maximum, so, the cyclone affected region u_6 is the most affected region and it is the optimal choice for immediate relief operations.

6. Conclusion

The Concept of Turiyam Soft Sets have been defined and the Parameter Reduction method for Turiyam Soft Sets simplifies decision-making by eliminating redundancy while preserving essential information. We proposed an algorithm based on the Indiscernibility Relation of Turiyam Soft Set and demonstrated its application in disaster management.

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