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Received: 17/01/2026

Accepted: 16/02/2026

Published: 07/03/2026

Citation: Vaishali S, Mary Mejrullo Merlin M (2026) An Investigation into Interval Valued Plithogenic Intuitionistic Fuzzy Sets with Likelihood & CoCoSo Ranking Method for evaluating a person's perception towards using Robotics in Health Care Decision-Making. Indian Journal of Science and Technology 19(8): 553-559. <https://doi.org/10.17485/IJST/v19i8.70>

* **Corresponding author.**

marymejrullomerlin@hcctrichy.ac.in

Funding: None

Competing Interests: None

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Published By Indian Society for Education and Environment ([iSee](https://www.indjst.org/))

ISSN

Print: 0974-6846

Electronic: 0974-5645

An Investigation into Interval Valued Plithogenic Intuitionistic Fuzzy Sets with Likelihood & CoCoSo Ranking Method for evaluating a person's perception towards using Robotics in Health Care Decision-Making

S Vaishali¹, M Mary Mejrullo Merlin^{2*}

¹ Research Scholar, PG & Research Department of Mathematics, Holy Cross College (Autonomous), Affiliated to Bharathidasan University, Tiruchirappalli-620002, Tamil Nadu, India

² Assistant Professor, PG & Research Department of Mathematics, Holy Cross College (Autonomous), Affiliated to Bharathidasan University, Tiruchirappalli-620002, Tamil Nadu, India

Abstract

Objectives: The development of Robotics Technology accomplished tremendous advances in several sectors, including healthcare. To evaluate the person's perception of robotics in the healthcare & to demonstrate the proposed model's accuracy. **Methods:** An Interval Valued Plithogenic Intuitionistic Fuzzy Set (IVPIFS) with Likelihood & Combined Compromise Solution (CoCoSo) ranking method is combined to analyse the Multi-Attribute Decision Making (MADM) Problem. Lingo Software is utilised to find the Relative Closeness Coefficient Intervals among the alternatives. **Findings:** The incorporation of robotics in medical science has provided new, novel opportunities that lead to significant improvement in medical diagnosis, recuperation, surgeries and patient care. The results showed the significance of the Integrated Algorithm in solving real-world Decision-making problems. The result discusses the importance of using advanced technologies in the medical field and evaluates the person's opinion regarding using these technologies in healthcare sector. **Novelty:** A Novel integrated technique for MADM is created by incorporating IVPIFS with Likelihood & CoCoSo ranking to analyse the person's opinion in utilising advanced robotic technologies in Medicine field.

2020 Mathematics Subject Classification: 03B52.

Keywords: Plithogenic Set; Interval Valued Plithogenic Intuitionistic Fuzzy Set; CoCoSo Ranking Method; Likelihood Method; Medical Robotics

1 Introduction

To deal with uncertainties, ambiguity & unclear data in decision making process, it's necessary to use a reliable mathematical technique. Zadeh introduced Fuzzy sets⁽¹⁾, the extension of crisp sets in 1965, with membership Values ranging from 0 to 1. FS are expanded to Intuitionistic Fuzzy Sets IFS⁽²⁾ by Atanassov to address non-membership degrees. Interval-valued intuitionistic fuzzy sets were proposed by Atanassov in 2020. Merlin MM & Mystica AR, proposed an integrated approach of Interval Valued Intuitionistic Fuzzy Sets (IVIFS) with the Likelihood concept for MADM. Smarandache invented Neutrosophic Fuzzy Sets (NFS) as an extension of IFS. To meet the accuracies Florentin Smarandache introduced the concept of Plithogenic Sets (PS), the main feature of PS is the incorporation of contradiction degree & degree of appurtenance among the attributes. Plithogenic Hypersoft Sets (PHS) was invented by Florentine and its further extended to Combined Plithogenic Hypersoft Sets⁽³⁾ by Nivetha Martin & Florentine. Hema, Sudharani & Kavitha invented a novel plithogenic Interval-Valued Neutrosophic hypersoft set for Decision Making⁽⁴⁾. Comparative Study of Plithogenic Neutrosophic PIPRECIA over neutrosophic AHP in Logistic Selection was proposed by Sudha S & Martin N⁽⁵⁾. Furthermore, Extended Plithogenic Sets in Plithogenic Sociogram⁽⁶⁾ & Extended Plithogenic Hypersoft Sets (EPHS) were invented by Sathya P, Martin N and were applied in Electric Vehicle Charging infrastructure Decision Making Problem⁽⁷⁾.

In real life, AI & Robotic Technologies play a vital role in various sectors. The significance of utilising robotics in healthcare services is noteworthy. As the adoption of robotics & AI in Health Care grows, there are great expectations for increased service efficiencies & Quality⁽⁸⁾,⁽⁹⁾. But, patients may have different experience & expectations with these devices. This research evaluated people's views on the use of robots to provide health care services through MADM process. This study shows how Interval Valued Plithogenic Intuitionistic fuzzy Sets (IVPIFS) with Likelihood & CoCoSo Ranking Method helps in evaluating the individual perception regarding using robotics in the health care sector. The significance of this algorithm is its effectiveness, as we are considering the contradiction degree among the attributes, along with a combined compromise solution method for the alternatives.

2 Methodology

2.1 Preliminaries

2.1.1. Interval Valued Intuitionistic Fuzzy Sets (IVIFS)

Let $\tilde{R}$ on $\dot{U}$ be an IVIFS, defined as $\tilde{R} = \{ \langle \kappa, [\varphi_1(\kappa), \overline{\varphi}_1(\kappa)], [\varphi_2(\kappa), \overline{\varphi}_2(\kappa)] \rangle : \kappa \in \dot{U} \}$, where, $[\varphi_1(\kappa), \overline{\varphi}_1(\kappa)] \rightarrow$ membership degree & $[\varphi_2(\kappa), \overline{\varphi}_2(\kappa)] \rightarrow$ non-membership degree⁽¹⁰⁾.

2.1.2. Operations on IVIFS

Let us consider two IVIFS, $\tilde{R}_1 = ([\varphi_1, \overline{\varphi}_1], [\varphi_2, \overline{\varphi}_2])$ & $\tilde{R}_2 = ([\sigma_1, \overline{\sigma}_1], [\sigma_2, \overline{\sigma}_2])$, then

$$\begin{aligned} \tilde{R}_1 \oplus \tilde{R}_2 &= \left(\left[\frac{\varphi_1 + \sigma_1 - 2\varphi_1 \cdot \sigma_1}{1 - \varphi_1 \cdot \sigma_1}, \frac{\overline{\varphi}_1 + \overline{\sigma}_1 - 2\overline{\varphi}_1 \cdot \overline{\sigma}_1}{1 - \overline{\varphi}_1 \cdot \overline{\sigma}_1} \right], \left[\frac{\varphi_2 \cdot \sigma_2}{\varphi_2 + \sigma_2 - \varphi_2 \cdot \sigma_2}, \frac{\overline{\varphi}_2 \cdot \overline{\sigma}_2}{\overline{\varphi}_2 + \overline{\sigma}_2 - \overline{\varphi}_2 \cdot \overline{\sigma}_2} \right] \right) \\ \tilde{R}_1 \otimes \tilde{R}_2 &= \left(\left[\frac{\varphi_1 \cdot \sigma_1}{\varphi_1 + \sigma_1 - \varphi_1 \cdot \sigma_1}, \frac{\overline{\varphi}_1 \cdot \overline{\sigma}_1}{\overline{\varphi}_1 + \overline{\sigma}_1 - \overline{\varphi}_1 \cdot \overline{\sigma}_1} \right], \left[\frac{\varphi_2 + \sigma_2 - 2\varphi_2 \cdot \sigma_2}{\varphi_2 \cdot \sigma_2}, \frac{\overline{\varphi}_2 + \overline{\sigma}_2 - 2\overline{\varphi}_2 \cdot \overline{\sigma}_2}{\overline{\varphi}_2 \cdot \overline{\sigma}_2} \right] \right) \end{aligned} \quad (11)$$

2.1.3. Plithogenic Set

Let $\dot{U}$ denotes universal set, $\mathcal{P} \in \dot{U}$ & u is an element. $\mathcal{P}$ is a plithogenic set represented as $(\mathcal{P}, A_t, \mathbb{V}, \mathcal{D}_\ell, \mathbb{C}_\ell)$, where A_t - attribute, $\mathbb{V}$ - value of attributes, $\mathcal{D}_\ell$ -degree of Appurtenance, $\mathbb{C}_\ell$ - contradiction degree⁽¹²⁾.

2.1.4. Operations on Plithogenic Fuzzy Set (PFS)

PFS Union: $\varphi \vee_\rho \sigma = (1 - C_0) \cdot (\varphi \vee \sigma) + C_0 \cdot (\varphi \wedge \sigma)$

PFS Intersection: $\varphi \wedge_\rho \sigma = (1 - C_0) \cdot (\varphi \wedge \sigma) + C_0 \cdot (\varphi \vee \sigma)$ ⁽¹³⁾.

2.1.5. Operations on PIFS

Union: $(\varphi_1, \varphi_2) \vee_\rho (\sigma_1, \sigma_2) = (\varphi_1 \vee_\rho \sigma_1, \varphi_2 \wedge_\rho \sigma_2)$

Intersection: $(\varphi_1, \varphi_2) \wedge_\rho (\sigma_1, \sigma_2) = (\varphi_1 \wedge_\rho \sigma_1, \varphi_2 \vee_\rho \sigma_2)$ ⁽¹⁴⁾.

2.1.6. Operations on IVPIFS

IVPIFS Union:

$$([\varphi_1, \overline{\varphi_1}], [\varphi_2, \overline{\varphi_2}]) \vee_{\varphi} ([\sigma_1, \overline{\sigma_1}], [\sigma_2, \overline{\sigma_2}]) = ([\varphi_1 \vee_{\varphi} \sigma_1, \overline{\varphi_1} \vee_{\varphi} \overline{\sigma_1}], [\varphi_2 \wedge_{\varphi} \sigma_2, \overline{\varphi_2} \wedge_{\varphi} \overline{\sigma_2}])$$

IVPIFS Intersection:

$$([\varphi_1, \overline{\varphi_1}], [\varphi_2, \overline{\varphi_2}]) \wedge_{\varphi} ([\sigma_1, \overline{\sigma_1}], [\sigma_2, \overline{\sigma_2}]) = ([\varphi_1 \wedge_{\varphi} \sigma_1, \overline{\varphi_1} \wedge_{\varphi} \overline{\sigma_1}], [\varphi_2 \vee_{\varphi} \sigma_2, \overline{\varphi_2} \vee_{\varphi} \overline{\sigma_2}])$$

2.1.7. Likelihood Method

The Likelihood $f_{\ell} > g_{\ell}$ is $\varphi(f_{\ell} > g_{\ell}) = \begin{cases} 1, & f_{\ell} < g_{\ell} \\ 0, & f_{\ell} \geq g_{\ell} \end{cases}$, f_{ℓ} & g_{ℓ} are real numbers.

The Likelihood of $f_{\ell} \geq g_{\ell}$ is $\varphi(f_{\ell} \geq g_{\ell}) = \max\{1 - \max(\frac{g_{\ell}^+ - f_{\ell}^-}{L(f_{\ell}) + L(g_{\ell})}, 0), 0\}$, where $f_{\ell} = [f_{\ell}^-, f_{\ell}^+]$, $g_{\ell} = [g_{\ell}^-, g_{\ell}^+]$, $L(f_{\ell}) = [f_{\ell}^+ - f_{\ell}^-]$ and $L(g_{\ell}) = [g_{\ell}^+ - g_{\ell}^-]$ (15).

2.1.8. CoCoSo Ranking Method

- Create a matrix with 'u' rows and 'v' columns to analyze and rank the Alternatives

$$\text{Decision Matrix : } \mathcal{D} = \begin{matrix} & \begin{matrix} At_1 & At_2 & \dots & At_v \end{matrix} \\ \begin{matrix} At_1 \\ At_2 \\ \vdots \\ At_u \end{matrix} & \begin{bmatrix} e_{11} & e_{12} & \dots & e_{1v} \\ e_{21} & e_{22} & \dots & e_{2v} \\ \vdots & \vdots & \dots & \vdots \\ e_{u1} & e_{u2} & \dots & e_{uv} \end{bmatrix} \end{matrix}$$

- The value of decision matrix is normalized by the formula

$$\eta_{uv} = \frac{\max_{u,v} e_{uv} - e_{uv}}{\max_{u,v} e_{uv} - \min_{u,v} e_{uv}} \dots (a)$$

- Consider τ_v , the weight of the attributes. Based on the weights the sum & product of Normalized Values are calculated from the equation (b) & (c)

$$S_u = \sum_{v=1}^n \tau_v \cdot \eta_{uv} \dots (b)$$

$$P_u = \sum_{v=1}^n (\eta_{uv})^{\tau_v} \dots (c)$$

- The significant Aspect of CoCoSo Ranking entails that it incorporates three strategies to analyze the alternatives. The three strategies are,

$$Q_1 = \frac{P_u + S_u}{\sum_{u=1}^m (P_u + S_u)} \dots (d); Q_2 = \frac{S_u}{\min S_u} + \frac{P_u}{\min P_u} \dots (e); Q_3 = \frac{\lambda_c \cdot S_u + (1 - \lambda_c) \cdot P_u}{\lambda_c \cdot \max S_u + (1 - \lambda_c) \cdot \max P_u} \dots (f)$$

- The final Quantity Q is obtained through

$$Q = (Q_1 \cdot Q_2 \cdot Q_3)^{1/3} + 1/3(Q_1 + Q_2 + Q_3) \dots (g)$$

- The alternatives are ranked in descending order by Quantity Q (16), (17).

2.2 Integrated Algorithm of IVPIFS with Likelihood & CoCoSo Ranking Method:

Step 1: Categorize the decision making Problem with Alternatives, Attributes and their corresponding values.

Step 2: Construct the IVPIF Decision Matrix, employing the Linguistic Concepts and determine the contradiction degree for the attributes via the expert's DM₁ & DM₂.

Step 3: Utilize the IVPIFS Intersection operators to combine the decision matrixes.

Step 4: Acquire the Experts Weight for the Alternatives, and determine the overall weight utilizing the IVIF operators.

Step 5: Compute and resolve the auxillary LPP to get the relative Closeness Coefficient intervals for the Alternatives

$$C_r^u = \max\{\sum_{s=1}^n [x_s \varphi_{rs}^u + y_s (1 - \sigma_{rs}^l)]\}, s.t \begin{cases} \vartheta \gamma_s^l \leq x_s \leq \vartheta \gamma_s^u (s = 1, 2, 3 \dots, n) \\ \vartheta \rho_s^l \leq y_s \leq \vartheta \rho_s^u (s = 1, 2, 3 \dots, n) \\ \sum_{s=1}^n (x_s + y_s) = 1 \\ \vartheta \geq 0 \end{cases} \quad (1)$$

$$C_r^l = \min\{\sum_{s=1}^n [x_s \varphi_{rs}^l + y_s (1 - \sigma_{rs}^u)]\}, s.t \begin{cases} \vartheta \gamma_s^l \leq x_s \leq \vartheta \gamma_s^u (s = 1, 2, 3 \dots, n) \\ \vartheta \rho_s^l \leq y_s \leq \vartheta \rho_s^u (s = 1, 2, 3 \dots, n) \\ \sum_{s=1}^n (x_s + y_s) = 1 \\ \vartheta \geq 0 \end{cases} \quad (2)$$

Step 6: Compute the likelihood of $\varepsilon_r \geq \varepsilon_s$ of alternatives $\varepsilon_r, \varepsilon_s$ by applying,

$$\wp(\varepsilon_r \geq \varepsilon_s) = \wp(C_r \geq C_s) = \max\left\{1 - \max\left(\frac{C_s^u - C_r^l}{\mathcal{L}(C_r) + \mathcal{L}(C_s)}, 0\right), 0\right\}$$

Where, $C_r = [C_r^l, C_r^u]$; $C_s = [C_s^l, C_s^u]$; $\mathcal{L}(C_r) = C_r^u - C_r^l$; $\mathcal{L}(C_s) = C_s^u - C_s^l$

Step 7: Determine the pairwise comparison of alternatives (i.e. Likelihood Matrix)

$\mathcal{Z}_1 \quad \mathcal{Z}_2 \quad \dots \quad \mathcal{Z}_v$

$$\wp = (\wp_{rs})_{u \times v} = \begin{matrix} \mathcal{Z}_1 & \mathcal{Z}_2 & \dots & \mathcal{Z}_v \\ \begin{matrix} \mathcal{Z}_1 \\ \mathcal{Z}_2 \\ \vdots \\ \mathcal{Z}_u \end{matrix} & \begin{bmatrix} \wp_{11} & \wp_{12} & \dots & \wp_{1v} \\ \wp_{21} & \wp_{22} & \dots & \wp_{2v} \\ \vdots & \vdots & \dots & \vdots \\ \wp_{u1} & \wp_{u2} & \dots & \wp_{uv} \end{bmatrix} \end{matrix}$$

Step 8: Apply the CoCoSo Ranking Method to rank the Alternatives, based on the descending Order of Quantity Q .

2.3 Numerical Illustration

The recent development of robotics in medicine field has led to automated, reliable services for patients. Robots have gained greater autonomy & can perform fundamental tasks independently. To analyze the opinions on implementing robotics in the medical sector, among individuals is employed as an MADM problem, to ensure the validation of the proposed algorithm. The alternatives of the decision-making problem are

$\mathring{A}l_1$ - Trust and confidence in New Technology,

$\mathring{A}l_2$ - Increased Precision & perceived ease to use,

$\mathring{A}l_3$ - Concern about Safety & Doctor Patient Relationship,

$\mathring{A}l_4$ - Fear of Job Displacements,

and the attributes are the age groups, with values At_1 - 18 – 24; At_2 - 25 – 35; At_3 - 36 – 50; At_4 - Above 50.

The dissimilarity degree of the attributes with the predominant attribute value At_1 is defined as $\mathcal{C}(\mathring{A}t_1, \mathring{A}t_1) = 0$, $\mathcal{C}(\mathring{A}t_1, \mathring{A}t_2) = \frac{1}{3}$, $\mathcal{C}(\mathring{A}t_1, \mathring{A}t_3) = \frac{2}{3}$, $\mathcal{C}(\mathring{A}t_1, \mathring{A}t_4) = 1$.

The IVPIF decision matrix is constructed through the Linguistic terms from the experts DM_1 and DM_2 . The attribute weights were obtained from the decision makers.

Table 1. IVPIF Decision matrix utilizing Linguistic Terms and the contradiction degree given by the Experts

Alternatives	Contradiction Degree	DM_1				DM_2			
		$\mathring{A}l_1$	$\mathring{A}l_2$	$\mathring{A}l_3$	$\mathring{A}l_4$	$\mathring{A}l_1$	$\mathring{A}l_2$	$\mathring{A}l_3$	$\mathring{A}l_4$
Attributes									
$\mathring{A}t_1$	0	[[0.68,0.78], ([0.68,0.78], ([0.30,0.45], ([0.20,0.30], ([0.68,0.78], ([0.55,0.65], ([0.45,0.55], ([0.30,0.45], [0.55,0.65]) [0.10,0.22]) [0.25,0.30]) [0.30,0.45]) [0.45,0.50]) [0.10,0.22]) [0.10,0.22]) [0.45,0.50])							
$\mathring{A}t_2$	1/3	[[0.55,0.65], ([0.68,0.78], ([0.45,0.55], ([0.30,0.45], ([0.55,0.65], ([0.55,0.65], ([0.45,0.55], ([0.30,0.45], [0.25,0.30]) [0.10,0.22]) [0.30,0.45]) [0.45,0.50]) [0.25,0.30]) [0.25,0.30]) [0.30,0.45]) [0.45,0.50])							
$\mathring{A}t_3$	2/3	[[0.45,0.55], ([0.55,0.65], ([0.55,0.65], ([0.55,0.65], ([0.55,0.65], ([0.55,0.65], ([0.55,0.65], ([0.68,0.78], [0.30,0.45]) [0.25,0.30]) [0.25,0.30]) [0.25,0.30]) [0.25,0.30]) [0.25,0.30]) [0.25,0.30]) [0.25,0.30]) [0.10,0.22])							
$\mathring{A}t_4$	1	[[0.20,0.30], ([0.55,0.65], ([0.68,0.78], ([0.55,0.65], ([0.45,0.55], ([0.20,0.30], ([0.55,0.65], ([0.68,0.78], [0.55,0.65]) [0.25,0.30]) [0.25,0.30]) [0.30,0.45]) [0.55,0.65]) [0.25,0.30]) [0.10,0.22])							

Derived Relative Closeness Coefficient Intervals of Alternatives from step 5

$$C_1^l = 0.52054 \quad C_1^U = 0.649297$$

$$C_2^l = 0.544479 \quad C_2^U = 0.675032$$

Table 2. Acquiring the experts weight for attributes and calculating the total weight through the IVIF operator

Attributes	18-24	25-35	36-50	Above 50
DM ₁	([0.65,0.72], [0.22,0.27])	([0.72,0.82], [0.10,0.18])	([0.56,0.75], [0.15,0.25])	([0.45,0.55], [0.35,0.40])
DM ₂	([0.72,0.82], [0.10,0.18])	([0.72,0.82], [0.10,0.18])	([0.65,0.72], [0.22,0.27])	([0.56,0.75], [0.15,0.25])
Total Weight	([0.82,0.88], [0.074,0.12])	([0.84,0.9], [0.053,0.1])	([0.76,0.835], [0.034,0.07])	([0.68,0.81], [0.055,0.11])

Table 3. IVPIF Aggregation Results with weighted decision matrix

Weight	Alternatives Attributes	Contradiction Degree $\mathring{A}l_1$	$DM_1 \wedge_p DM_2$			
			$\mathring{A}l_2$	$\mathring{A}l_3$	$\mathring{A}l_4$	
([0.82,0.88], [0.074,0.12])	18-24	0	([0.462,0.61], [0.19,0.392])	([0.37,0.53], [0.325,0.45])	([0.135,0.25], [0.615,0.73])	([0.06,0.135], [0.75,0.825])
([0.84,0.9], [0.053,0.1])	25-35	1/3	([0.47,0.57], [0.31,0.37])	([0.535,0.65], [0.30,0.33])	([0.37,0.47], [0.37,0.53])	([0.34,0.415], [0.45,0.55])
([0.76,0.835], [0.034,0.07])	36-50	2/3	([0.584,0.68], [0.345,0.45])	([0.63,0.725], [0.187,0.23])	([0.63,0.725], [0.187,0.23])	([0.694,0.78], [0.13,0.19])
([0.68,0.81], [0.055,0.11])	Above 50	1	([0.56,0.68], [0.165,0.29])	([0.64,0.755], [0.14,0.195])	([0.856,0.92], [0.025,0.066])	([0.86,0.92], [0.025,0.066])

$$\mathbb{C}_3^l = 0.473145 \quad \mathbb{C}_3^l = 0.603048$$

$$\mathbb{C}_4^l = 0.457135 \quad \mathbb{C}_4^l = 0.539903$$

Obtained pairwise comparison of alternatives (i.e) Likelihood Matrix from step 6 & 7

$$\mathring{A}l_1 \quad \mathring{A}l_2 \quad \mathring{A}l_3 \quad \mathring{A}l_4$$

$$\mathring{\wp} = \begin{bmatrix} \mathring{A}l_1 & \mathring{A}l_2 & \mathring{A}l_3 & \mathring{A}l_4 \\ 0.5 & 0.9 & 1 & 1 \\ 1 & 0.5 & 1 & 1 \\ 0.82 & 0.72 & 0.5 & 1 \\ 0.48 & 0.366 & 0.7 & 0.5 \end{bmatrix}_{4 \times 4}$$

Applying the CoCoSo Ranking Method to rank the alternatives

$$\text{The Normalized Decision Matrix } \mathcal{N} = \begin{bmatrix} 0 & 0.8 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 0.64 & 0.44 & 0 & 1 \\ 0.34 & 0 & 1 & 0.4 \end{bmatrix}_{4 \times 4}$$

Weight $\tau_v = [0.751, 0.792, 0.753, 0.66]$ obtained by utilising the IVIF Score Function

$$\text{The Sum \& Product of normalised values are } \mathcal{S}_u = \begin{bmatrix} 2.10 \\ 2.38 \\ 1.57 \\ 1.15 \end{bmatrix}_{4 \times 1} \quad \mathcal{P}_u = \begin{bmatrix} 2.17 \\ 2.39 \\ 1.73 \\ 1.44 \end{bmatrix}_{4 \times 1}$$

$$\text{Quantities } Q_1 = \begin{bmatrix} 0.29 \\ 0.32 \\ 0.22 \\ 0.17 \end{bmatrix}_{4 \times 1}, \quad Q_2 = \begin{bmatrix} 3.34 \\ 3.73 \\ 2.56 \\ 2 \end{bmatrix}_{4 \times 1}, \quad Q_3 = \begin{bmatrix} 0.895 \\ 1 \\ 0.691 \\ 0.54 \end{bmatrix}_{4 \times 1}$$

$$\therefore Q_u = \begin{bmatrix} 2.46 \\ 2.74 \\ 2.63 \\ 1.22 \end{bmatrix}_{4 \times 1}$$

3 Results and Discussion

By utilising the proposed framework, it is significantly proven that Q_1 , Q_2 , Q_3 & Q_u , The rank has a parametric order. According to these quantities, the alternatives are ranked as

$$\dot{A}l_2 \geq \dot{A}l_1 \geq \dot{A}l_3 \geq \dot{A}l_4$$

The incorporation of Likelihood with IVPIFS, significantly enhances the decision outcomes by considering the Relative Closeness Coefficient of alternatives, and while integrated with CoCoSo ranking, this method produces a combined compromise-based ranking. In comparison to the conventional IVIFS utilising likelihood & optimal ranking method⁽¹⁵⁾, it is evident that our proposed integrated algorithm of IVPIFS with likelihood and CoCoSo ranking method gives a finer solution for real-life decision-making problems as it combines all the attributes and their values to get the ranking of alternatives. The results indicate that the person's perception towards utilising robotics in health care is predominantly driven by the increased precision and ease of use of robotics systems. This signifies that users' willingness to utilise robotic technology in the medical sector increases if they perceive it to be reliable, accurate and user-friendly.

4 Conclusion

This study framed a new algorithm by combining the Interval Valued Plithogenic Intuitionistic Fuzzy Sets with the likelihood & CoCoSo ranking method. By integrating Interval Valued Numbers, Plithogenic Attributes and likelihood measures with CoCoSo ranking, the integrated approach encompasses a wider range of ambiguity, contradiction and attribute interaction than the conventional IVIFS with likelihood & optimal ranking method. The proposed method is highly suitable for assessing an individual's perception of adopting the robotic technology in health care due to the vague nature of Human's opinion. People's opinion on utilising robotics in medicine field is ranked as- Increased Precision & perceived ease to use, Trust and confidence in New Technology, Concern about Safety and Doctor Patient Relationship & fear of job displacements. This demonstrates the versatility and adaptability of the proposed IVPIF framework in Health Care decision-making environment. Moreover, Future research can extend this model using Extended Plithogenic Sets for dynamic decision-making scenarios.

5 Acknowledgements

The authors thank the Department of Science and Technology, Government of India, for providing support through the Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST) program (Grant No. SR/FIST/College-/2020/943).

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