TOPSIS BY USING PLITHOGENIC SET IN COVID-19 DECISION MAKING

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Abstract

COVID-19 is pandemic affecting most of the country globally. It is an infectious disease that is affecting most of the people and it is very difficult to diagnose and treat the diseased patient. Generally asymptotic patients recover without any treatment. Patients with other illness such as Hypertension, Heart and Lung problems, Diabetic patients require intense care and treatment. In such cases, a team of doctors work together. The combination of all the experts' opinions is needed for efficient treatment. Often, the opinion of doctors depends on their experience and involves some differences. Further, the expert's opinion is in linguistic terms. Plithogenic sets provide a mathematical tool for aggregation of the experts' opinion expressed in linguistic terms. Thus, this work aims to employ plithogenic neutrosophic number to rank the diseased patients affected with COVID-19. Hence, we propose an Order Preference Technique by Similarity to Ideal Solutions (TOPSIS) using Plithogenic sets.

Keywords: Plithogenic sets, COVID-19, Medical decision making, TOPSIS method.

1. Introduction

Multi-Criteria Decision Making (MCDM) is applied to numerous pragmatic problems. Approaches to building a dynamic model are additionally differing what's more, rich. The dynamic relies upon the data gathered and the subjectivity of the choice creator. Data might be unclear, wrong and unsure. To this type of situation, neutrosophic

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number was introduced and the scale neutrosophic sets, was proposed by Smarandache in 1998 [1,2,5], as an integral part to manage incomplete, uncertain and inconsistent data which exist in reality as they are characterized by truth value (T), indeterminacy value (I) and false value (F). This is significant in numerous application zones since indeterminacy is measured expressly and reality participation work, indeterminacy enrollment capacity and misrepresentation participation capacities are free. Wang.et.al in 2010[3,5] introduced the idea of single valued neutrosophic set. The single valued neutrosophic set can autonomously communicate truth-enrollment degree, indeterminacy-participation degree and deception enrollment degree and manages inadequate, vague and conflicting data. All the variables portrayed by the single-valued neutrosophic set are entirely reasonable for human intuition because of the defect of information that human gets or sees from the outside world. Single valued neutrosophic set has been growing quickly because of its wide scope of hypothetical polish and application regions.
Single valued neutrosophic number is an augmentation of fuzzy numbers and intuitionistic fuzzy numbers. Single valued fuzzy number is an extraordinary instance of single valued neutrosophic set and is of significance for dynamic issues.

Application of multi-valued neutrosophic sets in tending to issue with uncertain, imprecise, incomplete and inconsistent data existing in genuine logical and building applications. Tian,et al. in 2016[4,5], characterized the idea of rearranged neutrosophic linguistic sets. Rearranged neutrosophic linguistic sets have empowered incredible advancement in portraying linguistic information to a certain extent.

MCDM is the vital tool for solving problems in real time Decision making (DM). DM is to choose, organize, and rank the limited number of strategies. Since an excessive number of strategies is included, Hwang and Yoon gave a scientific categorization of ordering the procedures by such as: the sorts of data from DMs, striking highlights of data, and a significant class of techniques. This categorisation gives better understanding of MCDM procedures. Among these methods, the categorisation of data based on criteria from DMs with cardinal data is convenient for making decision. In TOPSIS, the idea of separation measures, of the options from the PIS and the NIS was proposed by Hwang and Yoon [6].

Chen.et.al further developed TOPSIS to solve the decision-making problems with different criteria given in fuzzy theory [7]. Positive Ideal Solution (PIS) and Negative Ideal Solution (NIS) for reducing n-dimensional objective problem into 2-dimensional objective problems in [8]. Ta-Chung.et al. developed a fuzzy TOPSIS model under group decision making to solve the problem of location selection [9]. Shih.et.al, proposed a new method to overcome the problem due to the inappropriately assigned criteria or their weights in MCDM [10]. Shih. et. al, produced a new methodology in normalization operations, distance and mean operators. Moreover, in decision making two or more preferences are aggregated internally in the TOPSIS procedure [11]. Jahanshahloo.et.al, introduced a new TOPSIS for dealing interval data [12]. Liu, P. recommended a TOPSIS method to solve multi-attribute DM problems which depends on its attribute weight [13]. Jadidi.et.al, came out with another strategy dependent on TOPSIS ideas in grey theory to manage the issue of choosing providers [14]. Kao, C. introduced a proportion of relative separation, which includes the figuring of the overall situation of an option between the anti-ideal and the ideal for positioning [15]. Tsaur, R.C. introduced another TOPSIS technique for positioning the choices from the data normalization [16]. Zhang.et.al, built up an improved model to discover the characteristic weights for MADM issues with lacking weight information measures under IVIFSs condition in [17]. Umran.et.al, created the MCDM technique for ranking renewable energy supply systems in Turkey[18].Sorin.et.al, presented a general view of the developments of fuzzy TOPSIS methods in [19]. Claudia.et.al, introduced ranking strategy for instructional videos by considering choice standards of various characteristics such as exact and loose, and a reference arrangement in [20]. Husin.et.al., introduced ranking the risk variables in [21].

P.Biswas.et.al, introduced decision making in neutrosophic environment [22]. Sorin Nadaban.et.al, A survey on MCDM problems with neutrosophic sets is in [23]. Azeddine.et.al, presented an improved TOPSIS strategy and

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extended to simplified neutrosophic - TOPSIS using single valued neutrosophic values[24].Hagar.et.al, The proposed procedure opens the entryway of using neutrosophic sets in conjunction with game theory principles in solving competitive MCGDM issues under uncertainty conditions [25].K.Mondal.et.al, Introduced, another methodology for MCGDM problems is developed by expanding the TOPSIS technique under rough neutrosophic condition[26]. Akram.et.al, Presented bipolar neutrosophic TOPSIS technique and bipolar neutrosophic ELECTRE-I strategy in [27].Xu.et.al, Introduced, another neutrosophic approach based on TOPSIS technique, which can utilize NS data, is proposed to isolate the designs. Initially, the picture is changed into the NS space. By then, two exercises, modified mean and enhancement tasks are used to overhaul picture edges and to diminish uncertainity [28]. P.Biswas.et.al, developed nonlinear programming approach in TOPSIS method [29] and weights of DM are dictated by using closeness measure dependent on Hamming distance in [30]. Saqlain.et.al, explored MCDM problem with multiple-valued neutrosophic data [31]. Azeddine.et.al proposed lite TOPSIS from simplified TOPSIS (S-TOPSIS) [32]. A propelled kind of neutrosophic procedure, named type 2 neutrosophic numbers, and characterizes a portion of its operational guidelines in [33]. Nada.et.al introduced neutrosophic AHP and TOPSIS to improve the traditional methods of personal selection to achieve the ideal solutions in [34].

Similar to generalisation of fuzzy sets, intuitionistic sets, neutrosophic sets, Florentin Smaranche introduced the new notion of plithogenic sets in [35]. Plithogenic sets whose elements are characterised by multiple attributes is explained in [36]. Extension of plithogenic hypersoft set hyperset is discussed by Florentin Smarandache[37]. Shazia Rana et. Al. developed matrix representation and operators for plithogenic fuzzy set and plithogenic fuzzy whole hypersoft set [38]. Mohamed Abdel-Basset et. Al. discussed supply chain problem using plithogenic sets in [39] and also proposed hybrid plithogenic decision making approach [40], a TOPSIS-CITRIC model for supply chain is developed in [41]. Application of plithogenic sets in hospital medical care systems is in [42]. Prem Kumar Singh proposed multivariable data analysis using plithogenic sets in [43].

In this paper, we consider single-valued neutrosophic sets and plithogenic sets. Let R be a universal set. A single valued neutrosophic set D on R is defined as $D=\{\langle \delta_D(x),\eta_D(x),\mu_D(x)\rangle : x\in R\}$. Where $\delta_D(x),\eta_D(x),\mu_D(x): R\rightarrow[0,1]$ represents the membership value degree, indeterministic value degree and non-membership value degree respectively of the elements $x\in R$ such that $0\leq \delta_D(x)+\eta_D(x)+\mu_D(x)\leq 3$. Every attribute value v has corresponding (neutrosophic) degree of appurtenance $d(x,v)$ of the element x to the plithogenic set P, with regard to predefined criteria. Further, it includes contradiction degree function to each attribute value with respect to the dominant one. For neutrosophic set, the appurtenance degree $d: P\times V\rightarrow P([0,1]^3)$, contradiction degree $c: V\times V\rightarrow P([0,1]^3)$, for set V of values of attributes. The proposed method of TOPSIS with plithogenic sets is presented in Section 2. This method is applied to analyse patients with Covid-19 infection, in Section 3 and finally concluded.

2. Proposed TOPSIS method for Plithogenic sets

The procedure called TOPSIS (Technique for Order Preference by Similarity to Ideal Situation) can be utilized to assess various choices against the chosen standards. In the TOPSIS approach, an alternative that is closest to the single valued neutrosophic positive ideal solution (SVNPIS) and farthest from the single valued neutrosophic negative ideal solution (SVNNIS) is picked as optimal. An SVNPIS is made out of the best execution esteems for every other option while the SVNNIS comprises of the most noticeably terrible presentation esteems. A point by point depiction and treatment of TOPSIS is examined by [44,45] and we have adjusted the pertinent strides of TOPSIS using plithogenic sets as introduced beneath. Aggregation of decision makers alternatives and criterion is combined, and the optimal opinion is captured using plithogenic set operations.

Steps for TOPSIS using plithogenic sets:

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1. Let there be n-Decision Makers$(DM_1, DM_2, DM_3, \dots, DM_n)$.
2. Each Decision Maker has 'r' alternatives and 's' criterion. The l-th alternative and m-th component are $z_{lm}^{n} = \left(\alpha_{lm}^{n}, \beta_{lm}^{n}, \gamma_{lm}^{n}\right)$ and $\omega_{m}^{n} = \left(\alpha_{m}^{n}, \beta_{m}^{n}, \gamma_{m}^{n}\right)$ respectively. where $l = 1, 2, \dots, r$ and $m = 1, 2, \dots s$.
3. The Plithogenic neutrosophic ratings are aggregated and given as $z_{lm} = \left(\alpha_{lm}, \beta_{lm}, \gamma_{lm}\right)$ such that

$$\left(\alpha_{l1}, \alpha_{l2}, \alpha_{l3}\right) \wedge_p \left(\beta_{l1}, \beta_{l2}, \beta_{l3}\right) = \left(\left(\alpha_{l1} \wedge_p \beta_{l1}, \frac{1}{2}\left(\alpha_{l2} \vee_F \beta_{l2}\right) + \frac{1}{2}\left(\alpha_{l2} \wedge_F \beta_{l2}\right), \alpha_{l3} \vee_P \beta_{l3}\right), 1 \le l \le r\right)$$

are used for the aggregation of DM's opinion with respect to each criteria.
4. The aggregated Neutrosophic weights of each criterion are calculated as $\omega_m = \left(\alpha_m^{'}, \beta_m^{'}, \gamma_m^{'}\right)$ such that

$$\alpha_m^{'} = \min_n \left\{\alpha_m^{'n}\right\},\ \beta_m^{'} = \frac{1}{N}\sum_{n=1}^{s} \beta_m^{'n},\ \gamma_m^{'} = \max_n \left\{\gamma_m^{'n}\right\}$$

5. The MCDM problem in matrix format is

$$A = \begin{array}{c} \\ x_1 \\ x_2 \\ . \\ . \\ . \\ x_r \end{array} \begin{array}{c} \begin{array}{ccccc} y_1 & y_2 & . & . & . \ y_s \end{array} \\ \begin{pmatrix} z_{11} & z_{12} & . & . & . & z_{1s} \\ z_{21} & z_{22} & . & . & . & z_{2s} \\ . & . & . & & & . \\ . & . & & . & & . \\ . & . & & & . & . \\ z_{r1} & z_{r2} & . & . & . & z_{rs} \end{pmatrix} \end{array}$$

$\omega = \left(\omega_1, \omega_2, \dots, \omega_n\right)$ where for all z_{lm} and ω_m ; $l = 1, 2, \dots, r$ and $m = 1, 2, \dots, s$.

Here $z_{lm} = \left(\alpha_{lm}, \beta_{lm}, \gamma_{lm}\right)$ and $\omega_m = \left(\alpha_m^{'}, \beta_m^{'}, \gamma_m^{'}\right)$ are neutrosophic numbers representing linguistic variables.

6. Thus we have the normalized Neutrosophic decision matrix as $M = \left[d_{lm}\right]_{r \times s}, l = 1, 2, \dots, r; m = 1, 2, \dots, s.$

Where $d_{lm} = \left(\frac{\alpha_{lm}}{\gamma_m^{+}}, \frac{\beta_{lm}}{\gamma_m^{+}}, \frac{\gamma_{lm}}{\gamma_m^{+}}\right)$ and $\gamma_m^{+} = \max_l \gamma_{lm}$ (Benefit criteria)

where $d_{lm} = \left(\frac{\alpha_m^{-}}{\gamma_{lm}}, \frac{\alpha_m^{-}}{\beta_{lm}}, \frac{\alpha_m^{-}}{\alpha_{lm}}\right)$ and $\alpha_m^{-} = \min_l \alpha_{lm}$ (Cost criteria)

The above normalization method preserves the property that the ranges of normalized neutrosophic numbers belongs to $[0,1]$. Either benefit criteria or cost criteria is considered depending on the case study.

7. The weighted normalized neutrosophic decision matrix Nis computed by multiplying the weights ω_m of evaluation model with the normalized neutrosophic decision matrix as $N = \left[\upsilon_{lm}\right]_{r \times s}$ where $\upsilon_{lm} = d_{lm}(.)\,\omega_m = \left(\alpha_m^{''}, \beta_m^{''}, \gamma_m^{''}\right), l = 1, 2, \dots r; m = 1, 2, \dots, s$

8. The SVNPIS and SVNNIS of the electives are defined as follows

$P^{+} = \left\{\upsilon_1^{+}, \upsilon_2^{+}, \dots, \upsilon_n^{+}\right\}$ where $\upsilon_m^{+} = (\gamma, \gamma, \gamma)$ such that $\gamma = \max_l \left\{\gamma_{lm}^{''}\right\}, l = 1, 2, \dots, r; m = 1, 2, \dots, s.$

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$P^{-}=\left\{\upsilon_1^{-},\upsilon_2^{-},...,\upsilon_n^{-}\right\}$ where $\upsilon_m^{-}=(\alpha,\alpha,\alpha)$ such that $\alpha=\min_l\left\{\alpha_{lm}^{''}\right\}, l=1,2,...,r; m=1,2,...,s.$

9. The distance P_l^{+} and P_l^{-} of each weighted alternative $l=1,2,...,r$ from the SVNPIS and SVNNIS is computed as follows $P_l^{+}=\sum_{m=1}^{r}P_\upsilon\left(\upsilon_{lm},\upsilon_m^{+}\right)$ and $P_l^{-}=\sum_{m=1}^{r}P_\upsilon\left(\upsilon_{lm},\upsilon_m^{-}\right)$ where $P_\upsilon\left(i,j\right)$ is the distance between two single valued Plithogenic neutrosophic numbers 'i' and 'j'.i.e., if $i=\left(a_1,b_1,c_1\right)$, $j=\left(a_2,b_2,c_2\right)$ then $P_\upsilon\left(i,j\right)=\sqrt{\frac{1}{3}\left\{\left(a_1-a_2\right)^2+\left(b_1-b_2\right)^2+\left(c_1-c_2\right)^2\right\}}$.

10. The closeness coefficient of CC_l represents the distance of SVNPIS P^{+} and SVNNIS P^{-} simultaneously. The closeness coefficients of each alternative is calculated as $CC_l=\frac{P_l^{-}}{P_l^{+}+P_l^{-}}, l=1,2,...,r$.

The proposed TOPSIS method for plithogenic sets is demonstrated to patients suffering from Covid-19.

3. Numerical illustration for Covid-19

The whole world is facing and trying to cope up using different strategies to handle the novel CORONA virus (Covid-19). It is well known that while people of all age groups are susceptible to the disease, those with co-morbidities are especially vulnerable to it. For applying the proposed work, Covid-19 affected patients with hypertension, diabetic and heart disease.It is very difficult for a physician todiagnose and appropriately treat such patients. To overcome this, plithogenic neutrosphic linguistic scales are defined based on the diseases and the weights are defined based on the decision maker (Doctors). Let the co-morbidities (hypertension, diabetic and heart disease) be the criteria C_1,C_2,C_3. Let us take three doctors opinion and the doctors be the decision-makers $\left(DM_1,DM_2,DM_3\right)$ who will give the opinion or suggestion for hypertension, diabetic and heart disease patient which was measured in neutrosophic scale. Patients with these will also have some other complications, so every patient contradicts with other patients even though, they have a similar type of symptom. Plithogenic concepts are used and the contradiction is recorded. Let the patients be Patient.1, Patient.2, Patient.3, and Patient.4. In Table.1 and Table.2, linguistic variables for describing the intensity of Covid-19 infected patients is presented based on plithogenic number.

Table.1 Linguistic Variable are defined based on the Disease

S.No.	Rating Linguistic variable	Plithogenic Number
1	Nothing(N)	(0.11,0.31,0.36)
2	Very Low(VL)	(0.16,0.26,0.11)
3	Low(L)	(0.41,0.36,0.51)
4	Medium(M)	(0.66,0.61,0.71)
5	High(H)	(0.71,0.66,0.81)
6	Very High(VH)	(0.91,0.86,0.91)
7	Absolute(A)	(0.96,0.91,0.96)

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Table.2 Weights of the criteria are defined by the Decision Maker

S.No.	Linguistic Variables for the Importance Weight of Each Criteria	Plithogenic Number
1	Very Low(VL)	(0.09,0.29,0.34)
2	Low(V)	(0.14,0.24,0.09)
3	Medium Low(ML)	(0.39,0.34,0.49)
4	Medium(M)	(0.64,0.59,0.69)
5	Medium High(MH)	(0.69,0.64,0.79)
6	High(H)	(0.89,0.84,0.89)
7	Very High(VH)	(0.94,0.89,0.94)

The decision makers (doctors) opinion for different patients with weights for each attribute is given in table.3.

Table.3 Linguistic Variables with Weights

	Weight	VH	M	VL	H	ML	VH	MH	V	H
Patients (Alternatives)	Contradiction Degree	DM1			DM2			DM3		
		C_1	C_2	C_3	C_1	C_2	C_3	C_1	C_2	C_3
Patient-1	0	N	H	A	VL	A	N	L	VH	H
Patient-2	0.25	VL	M	L	L	H	M	M	VH	L
Patient-3	0.50	VH	A	H	M	VL	L	N	N	A
Patient-4	0.75	L	VH	VL	M	A	VH	N	H	VL

Using step.3 the plithogenic aggregation is calculated with contradiction degree is shown in table.4. For example, the DM's opinion are aggregated in similar form

$$DM_1 \wedge_p DM_2 = (0.11, 0.31, 0.36) \wedge_p (0.16, 0.26, 0.11)$$

$$= \left(0.11 \wedge_p 0.16, \frac{1}{2}(0.31 \vee_F 0.26) + \frac{1}{2}(0.31 \wedge_F 0.26), 0.36 \vee_P 0.11\right)$$

$$= \left((1-0)\times(0.11\times 0.16)+0, \frac{1}{2}(0.31+0.26), (1-0)\times(0.36+0.11-0.36\times 0.11)+0\right)$$

$$= (0.02, 0.29, 0.43)$$

$$DM_1 \wedge_p DM_2 \wedge_p DM_3 = (0.02, 0.29, 0.43) \wedge_p (0.41, 0.36, 0.51) = (0.01, 0.32, 0.72)$$

Table.4 Plithogenic aggregation results

Alternative	Contradiction Degree	DM1^DM2^DM3		
		C_1	C_2	C_3
Patient-1	0	(0.01,0.32,0.72)	(0.62,0.82,1.00)	(0.07,0.64,1.00)
Patient-2	0.25	(0.27,0.46,0.71)	(0.63,0.75,0.93)	(0.29,0.42,0.75)

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Patient-3	0.50	(0.45,0.52,0.59)	(0.34,0.45,0.45)	(0.76,0.71,0.81)
Patient-4	0.75	(0.55,0.40,0.30)	(0.91,0.77,0.79)	(0.61,0.41,0.12)

Let the weights of the decision maker be their experience. Their experience is aggregated using step.4 and the weights are calculated as shown in Table-5. i.e. if $\omega_1 = \left(\alpha_1^{'}, \beta_1^{'}, \gamma_1^{'}\right)$ then $\alpha_1^{'} = \min\{0.94, 0.89, 0.69\} = 0.69$, $\beta_1^{'} = \frac{1}{3}(0.89 + 0.84 + 0.64) = 0.79$, $\gamma_1^{'} = \max\{0.94, 0.89, 0.79\} = 0.94$.

Table.5 Weighted decision matrix

Weights	(0.69,0.79,0.94)	(0.14,0.39,0.69)	(0.09,0.67,0.94)
Aggregate decision matrix	DM1^DM2^DM3		
Alternatives	C_1	C_2	C_3
Patient-1	(0.01,0.32,0.72)	(0.62,0.82,1.00)	(0.07,0.64,1.00)
Patient-2	(0.27,0.46,0.71)	(0.63,0.75,0.93)	(0.29,0.42,0.75)
Patient-3	(0.45,0.52,0.59)	(0.34,0.45,0.45)	(0.76,0.71,0.81)
Patient-4	(0.55,0.40,0.30)	(0.91,0.77,0.79)	(0.61,0.41,0.12)

In the situation, it is advisable to consider benefit criteria. Thus, the normalized neutrosophic decision matrix is calculated using step.6 as shown in Table-6. In similar form

$$d_{l1} = \left(\frac{\alpha_{l1}}{\gamma_1^+}, \frac{\beta_{l1}}{\gamma_1^+}, \frac{\gamma_{l1}}{\gamma_1^+}\right)$$

where $\gamma_1^+ = \max\{0.72, 0.71, 0.59, 0.30\} = 0.72$

$$d_{11} = \left(\frac{\alpha_{11}}{\gamma_1^+}, \frac{\beta_{11}}{\gamma_1^+}, \frac{\gamma_{11}}{\gamma_1^+}\right) = \left(\frac{0.01}{0.72}, \frac{0.32}{0.72}, \frac{0.72}{0.72}\right) = (0.01, 0.44, 1.00)$$

Table.6 Normalized Decision Matrix

Weights	(0.69,0.79,0.94)	(0.14,0.39,0.69)	(0.09,0.67,0.94)
	DM1^DM2^DM3		
Alternatives	C_1	C_2	C_3
Patient-1	(0.01,0.44,1.00)	(0.62,0.82,1.00)	(1.00,0.64,0.07)
Patient-2	(0.38,0.64,0.99)	(0.63,0.75,0.93)	(0.75,0.42,0.29)
Patient-3	(0.63,0.72,0.82)	(0.34,0.45,0.45)	(0.81,0.71,0.76)
Patient-4	(0.76,0.56,0.42)	(0.91,0.77,0.79)	(0.12,0.41,0.61)

The weighted normalized neutrosophic decision matrix is calculated using step.7 as shown in the Table-7. In similar form

$$\upsilon_{11} = d_{11}(.)\,\omega_1 = (0.01, 0.44, 1.00).(0.69, 0.79, 0.94) = (0.01, 0.35, 0.94)$$

Table.7 Weighted Normalized decision matrix

Alternatives	C_1	C_2	C_3
Patient-1	(0.01,0.35,0.94)	(0.09,0.32,0.69)	(0.09,0.43,0.07)
Patient-2	(0.26,0.50,0.93)	(0.09,0.29,0.64)	(0.07,0.28,0.27)

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Patient-3	(0.43,0.57,0.77)	(0.05,0.18,0.31)	(0.07,0.48,0.71)
Patient-4	(0.53,0.44,0.39)	(0.13,0.30,0.55)	(0.01,0.27,0.57)

The SVNPIS is $\{(0.53,0.57,0.94),(0.13,0.32,0.69),(0.09,0.48,0.71)\}$ and SVNNIS is $\{(0.01,0.35,0.39),(0.05,0.18,0.31),(0.01,0.27,0.07)\}$ are calculated using step.8. The distance between SVNPIS and SVNNIS is measured using step.9 and closeness coefficients are calculated using step.9 and the patients are ranked as shown in the Table.8.

Table.8 Distance Measure of Ideal solution and Closeness Coefficients

Alternatives	Distance of SVNPIS			P_l^+	Distance of SVNNIS			P_l^-	Closeness Coefficient	Rank
	C_1	C_2	C_3		C_1	C_2	C_3			
Patient-1	0.32	0.02	0.38	0.72	0.32	0.24	0.10	0.65	0.47	4
Patient-2	0.16	0.04	0.28	0.48	0.35	0.20	0.12	0.68	0.59	2
Patient-3	0.11	0.24	0.01	0.36	0.35	0.00	0.39	0.74	0.67	1
Patient-4	0.33	0.08	0.15	0.56	0.30	0.16	0.29	0.76	0.58	3

From Table-8, is the most diseased is patient-3 and is severely affected by Covid-19, which indicates the requirement of critical care and treatment, while Patient -3 is less affected when compared with the others. Thus, TOPSIS method for plithogenic sets can be used to identify the severity of Covid-19 patients.

4. Conclusion

In this paper, we considered the multi-standards choice making, an issue when there is a gathering of decision makers. While crisp data is insufficient to show the real circumstances in MCDM, we changed accessible systems in the TOPSIS strategy when decision-makers used linguistic variables. With respect to estimation of reality, plithogenic sets provide a mean for aggregation of multiple decision makers' opinion. The concept of plithogenic sets is extended to TOPSIS method and demonstrated to the framework of Covid-19.

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