COVID-19 Decision-Making Model using Extended Plithogenic Hypersoft Sets with Dual Dominant Attributes

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Abstract

Plithogenic Hypersoft set is the multi argument function with plithogenic universe of discourse and single dominant attribute value. The theory of plithogenic sets deals with the attributes and it is of the form (P, a, V, d, c) characterized by the degree of appurtenance and contradiction. This paper introduces the approach of plithogenic hypersoft sets with two independent dominant attribute values pertaining to each attribute to handle the dual system of decision making. The proposed decision making model is validated with the data of the present COVID -19 pandemic situations. The objective of the model is to rank the patients being identified as asymptotic and affected using Frequency Matrix Multi Attributes Decision making system. Combined plithogenic hypersoft representations of the degree of appurtenance between the patients and the attribute values make the decision-making model more comprehensive and feasible. The developed model can be extended to other decision making environment with various forms of degree of appurtenance.

Keywords: Plithogenic Hypersoft sets, dual Dominant attributes, decision making, pandemic, COVID-19

1.Introduction

Decision-making process is characterized by a sequence of integrated and interconnected activities in arriving at an optimal solution to the decision making problem. The elements of decision-making comprises of alternatives, criteria along with their degree of association. On profound analysis, the deterministic nature of the criterion satisfaction rate by the alternatives do not provide a complete representation of the decision- making problem as it fails to handle uncertainty and impreciseness that exists in reality. The introduction of fuzzy sets by Zadeh [1] plays a significant role in tackling uncertain decision making environment. Fuzzy sets differ from crisp sets in its representation and membership values. The membership values of the crisp set belong to $\{0,1\}$ and the membership values of the fuzzy set belong to $[0,1]$. Fuzzy decision making methods are applied by the researchers to several decision making problems due to the flexibility in representation and resolving of uncertainty. To mention a few, Coroiu [2] applied the strategy of fuzzy decision making in manufacturing systems. Wei et al [3] applied fuzzy decision making tactics in developing new project. Wang et al discussed multi criteria decision making in fuzzy environment.

Soft set theory formulated by Molodstov [4] is yet another domain that predominantly deals with uncertainties and it is widely applied to the field of decision making. The consensus that exists in the objective of fuzzy sets and soft sets has motivated Maji et al [5] to introduce fuzzy soft sets and it has vast applications in various domains of decision-making.

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Qinrong Feng et al [6] discussed fuzzy soft sets in group decision making. Muhammad Naveed [7] used fuzzy soft sets in decision making on finding the optimal technique of weight loss. Zhicai Liu [8] developed fuzzy soft set decision making model for determining the ideal solution. Smarandache [9] generalized soft sets to hypersoft sets and fuzzy hypersoft sets and its application in frequency matrix multi attribute decision making technique was discussed by Sagaya Bavia et al. [10].With the introduction of Intuitionistic sets by Atannsov [11], fuzzy soft sets were extended to intutionistic fuzzy soft sets. The intutionistic sets differ from fuzzy sets in its membership value. The former contains both membership and the non-membership values where the latter deals only with membership values. IFSS and intutionistic fuzzy hypersoft sets has wide applications in several decision making scenarios. Cagman, Naim [12] discussed the application of intuitionistic soft sets. Irfan Deli [13] presented the intuitionistic parameterized soft set theory and its applications. Chunqiao et al [14] generalized IFSS and explained its relation with decision making methods on multi attribute.Rana Muhammad [15] extended the method of TOPSIS with the approach of intuitionistic hyper soft set. Babak [16] , Park et al [17], Chetia et al[18] , Das [19] presented the applications of intutionistic fuzzy soft sets in decision making. Smarandache [20-22] introduced Neutrosophic sets which is of comprehensive in nature. Neutrosophic soft sets is an extension of IFSS and the neutrosophic representations consists of truth values, indeterminate values and falsity values and plays a crucial role in expressing the existential nature of the problem and it is an added advantage. Faruk Karaaslan [23] discussed the applications of neutrosophic soft sets in diverse scenarios. Sudan Jha [24] analyzed the stock trends using neutrosophic soft sets. Muhammad Saqlain et al [25] have defined aggregate operators of neutrosophic hypersoft sets and its applications in decision making. Nidhi et al [26] studied multi criteria group decision making in neutrosophic environment. Muhammad Riaz et al[27]discussed the applications of neutrosophic soft rough topology in decision making. Abhijit et al [28] presented neutrosophic approach in multi attribute decision making. Sarwar et al [29], Deli & Broumi [30], Abdel et al [31-32] studied the intervention of the theory of soft neutrosophy in decision making on various scenario. It is very vivid from the literature that researchers have developed decision making models using both the approaches of soft sets and hypersoft sets with various representations of fuzzy, intuitionistic and neutrosophic sets.

Smarandache [33] has given an excellent generalization of the crisp sets, fuzzy sets, intuitionistic fuzzy sets and neutrosophic sets in the name of Plithogenic sets. The concept of plithogeny is gaining momentum in the field of decision making. A plithogenic set of the form (P,a,V,d,c), where P is a set, a, the set of attribute values, V, the attribute range, d, the degree of appurtenance and c the degree of contradiction. The degree of appurtenance and the degree of contradiction of the attribute values are determined with respect to a dominant attribute value. This paper focusses on Plithogenic sets because of its robust nature and are extensively applied in various domains of decision making. Researchers have extended and discussed several concepts in plithogenic environment. To mention a few, Nivetha and Smarandache introduced the concepts of concentric plithogenic hypergraph [34], plithogenic –n-super hypergraph [35], plithogenic cognitive maps [36], plithogenic- sub cognitive maps [37] and discussed its efficiency in decision making.

Plithogenic sets play a significant role in multi-criteria decision making (MCDM). Abdel-Basset et al formulated MCDM models with the intervention of plithogenic sets to make optimal decisions on green supply chain management [38,39], medical diagnosis , IoT [40]. Decision making models with quality function deployment and plithogenic approach was also constructed for making optimal selection of sustainability metrics of supply chain. Plithogenic sets are used predominantly to handle decision making environment involving several attributes and multi attribute values. The hypersoft sets dealing with the utility of multi attribute function in making decisions were further extended to plithogenic hypersoft sets by Smarandache [41] which was extended to plithogenic fuzzy whole hypersoft set by Shazia et al [42] and it was applied to frequency matrix multi attribute technique of making decisions with new development of operators. Nivetha and Smarandache [43] introduced the notion of combined plithogenic hypersoft sets and applied the same approach to frequency matrix in multi attribute decision making. In combined plithogenic hypersoft sets, the degree of appurtenance is a combination of either crisp/fuzzy/intuitionistic/neutrosophic values. Shazia et al [44] introduced the concept of plithogenic subjective hyper-super- soft matrices to rank the alternatives subjectively at local, global and universal levels. Muhammad Rayees [45] et al developed a new MCDM method based

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on plithogenic hypersoft set with neutrosophic degree of appurtenance. In all of the above decision making models with plithogenic hypersoft sets only one dominant attribute was considered, but in this paper the concept of extended plithogenic hypersoft set is introduced with dual dominant attribute values. The decision making problems with single dominant attribute value helps in handling only one phenomenon, but if dual dominant attribute values are considered, decision making on two different phenomena shall take place simultaneously. The proposed concept is novel and it will certainly enable the decision makers to make decisions based on two distinct aspects as it provides opportunity to lay a special focus on the two entities of dominant attribute values.

The paper is organized as follows: section 2 presents the extended plithogenic hypersoft sets with two dual attribute values; section 3 validates the significance of the extended plithogenic hypersoft sets with application to COVID 19; section 4 discusses the results and the last section concludes the research work.

2. Extended Plithogenic Hypersoft sets

This section presents the need of extending and discussing the extended plithogenic hypersoft sets in decision making by taking the basic preliminaries related to plithogenic hypersoft sets discussed by Smarandache. This section will also discuss extended combined plithogenic hypersoft sets. Let us consider a conventional example of plithogenic hypersoft set with single dominant attribute value.

Let U be the universe of discourse that consists of online teaching tools say $U = \{T_1,T_2,T_3,T_4,T_5\}$ and the set $M =\{T_2,T_4\} \subset U$.

The attributes are a_1 = pricing, a_2 = flexibility, a_3 = Interactive, a_4 = Special Features. The realistic attribute values are A_i (i = 1,2,3,4) corresponding to each attributes a_i are

$A_1 = \{ A_1^1, A_1^2, A_1^3\}$={**low**, medium, high}, $A_2 = \{ A_2^1, A_2^2, A_2^3\}$={low, medium, **high**}, $A_3 = \{ A_3^1, A_3^2, A_3^3\}$= {less, moderate, **high**},

$A_4 = \{ A_4^1, A_4^2, A_4^3\}$={minimum, moderate, **maximum**}

If any of the educational institutions is to make a decision on the practice of the online teaching tools, the following conventional considerations are considered with respect to a single dominant attribute value corresponding to each attribute

Let the function be: $G: A_1^1 \times A_2^3 \times A_3^3 \times A_4^3 \longrightarrow P(U)$

Let's assume: G ({low, high, high, maximum}) = $\{T_2,T_4\}$.

The degree of appurtenance states the satisfaction rate of the attribute value by the elements of M and that helps in decision making between the alternatives T_2,T_4.

In the above example only two online tools fulfill the dominant attribute values of each of the attributes. But in decision making we focus not only the best alternatives but also on the worst alternatives so as to make a comprehensive decision making. Now let us consider a situation where we compare all the alternatives with respect to two dominant attribute values so as to take decisions on choosing and rejecting the alternatives.

The attributes are a_1 = pricing, a_2 = flexibility, a_3 = Interactive, a_4 = Special Features. The realistic additional attribute values are A_i (i = 1,2,3,4) corresponding to each attributes a_i are

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$A_1 = \{ A_1^1, A_1^2, A_1^3, A_1^4\}$={low, medium, high, **free of cost**}, $A_2 = \{ A_2^1, A_2^2, A_2^3, A_2^4\}$= {low, medium, **high,** nil}, $A_3 = \{ A_3^1, A_3^2, A_3^3, A_3^4\}$={less, more, **high**, nil}, $A_4 = \{ A_4^1, A_4^2, A_4^3, A_4^4\}$= { minimum, moderate, **maximum**, nil}

Let us define a function G_1: $A_1^4 \times A_2^3 \times A_3^3 \times A_4^3 \longrightarrow P(U)$, which considers the attribute values pertains to make decisions on the desirable and feasible online teaching tools.

Let us define another function G_2: $A_1^3 \times A_2^1 \times A_3^1 \times A_4^1 \longrightarrow P(U)$, which considers the attribute values pertains to make decisions on the online teaching tools that are infeasible in nature. $A_1 = \{ A_1^1, A_1^2, A_1^3, A_1^4\}$={low, medium, **high**, free of cost}, $A_2 = \{ A_2^1, A_2^2, A_2^3, A_2^4\}$= {**low**, medium, high, nil}, $A_3 = \{ A_3^1, A_3^2, A_3^3, A_3^4\}$={**less**, more, high, nil}, $A_4 = \{ A_4^1, A_4^2, A_4^3, A_4^4\}$= { **minimum**, moderate, maximum, nil}

Each of the alternatives has two degrees of appurtenance corresponding to feasible and infeasible online teaching tools with respect dual dominant attribute values corresponding to each attribute. The distinctive nature of the attribute values enables us to make optimal decision based on ranking of the alternatives related to two different aspects.

G_1 ({free, high, high, maximum}) = { T_1 (1,0.8,0.7,0.1), T_2 (0.1,0.9,0.4,0.5), T_3 (0.3,0.2,0.5,0.8), T_4 (0.4,0.1,0.5,0.9), T_5 (0.2,0.3,0.4,0.7)}

G_2 ({high, nil, nil, nil}) = { T_1 (0,0.2,0.2,0.9), T_2 (0.9,0.1,0.7,0.2), T_3 (0.8,0.9,0.3,0.1), T_4 (0.7,0.9,0.6,0.1), T_5 (0.6,0.7,0.9,0.1)}

The extended plithogenic hypersoft set can be discussed in case of combined plithogenic hypersoft set environment as discussed in [29]

G_1 ({free, high, high, maximum}) = { T_1 (1,0.8,(0.7,0.2),0.1), T_2 (0.1,0.9,0.4,(0.5,0.1,0.2)), T_3 (0.3,0.2,0.5,(0.8,0.1)), T_4 (0.4,(0.1,0.7),0.5,(0.9,0.1)), T_5 ((0.2,0.7),0.3,(0.4,0.7),0.7)}

G_2 ({high, nil, nil, nil}) = {T_1 (0,(0.2,0.7),0.2,0.9),T_2(0.9,0.1,0.7,(0.2,0.1,0.7)), T_3 (0.8,0.9,(0.3,0.6),0.1),T_4(0.7,(0.9,0.1),0.6,0.1),T_5(0.6,(0.7,0.1,0.2),0.9,0.1)}

Thus the plithogenic hypersoft sets that dealt with only one dominant attribute has been extended to plithogenic hypersoft sets with two domination attribute values. This kind of extension plays a significant role in making decisions on both the feasible and infeasible tools of online teaching and also all the alternatives are taken into account. The extended plithogenic hypersoft sets integrated with combined plithogenic hypersoft sets representation is highly pragmatic and will certainly help in making optimal decisions.

3. Application of Extended Plithogenic hypersoft sets in Decision Making

The theoretical development of extended plithogenic hypersoft sets with dual dominant attribute values is validated with a real time data in this section. Presently the entire world is suffering from the consequences of COVID-19. Each nation strengthens its medical emergency to identify the symptomatic and asymptomatic COVID-19 patients to isolate the infected patients to avoid the transmission of the virus. Let U be the set of patients who are to be classified as symptomatic and asymptotic for further treatment. Let the attributes be A_1 = fever, A_2 = body pain, A_3 = Cough, A_4 = Cold, A_5 = Breathing, A_6 = Loss of senses, A_7 = Fatigue

The attribute values are

A_1 = {3-5 days, 1-2 days, no}={A_1^1,A_1^2,A_1^3}

A_2 = {moderate, low, High, nil} = {A_2^1,A_2^2, A_2^3, A_2^4}

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A_3 = { moderate, severe, mild, nil}={A_3^1,A_3^2,A_3^3,A_3^4}

A_4 = {5-7 days, 3-4 days, 1-2 days, no}={A_4^1,A_4^2,A_4^3,A_4^4}

A_5 = {Shortness of breath, normal} = {A_5^1,A_5^2}

A_6 = { short term , long term ,nil} = {A_6^1,A_6^2,A_6^3}

A_7 = { severe, less, energetic} = {A_7^1,A_7^2}

There are two dominant attribute values pertaining to each attribute, say for the attribute fever the two dominant attribute values are A_1^1, A_1^3, where A_1^1 is related to symptomatic and A_1^3 is related to asymptomatic and these two dominant attribute values are independent of each other, similarly each attribute has dual dominant attribute values. Table 3.1 presents the dual dominant values of the attributes.

Attribute	**Dominant Attribute value of symptomatic**	**Dominant Attribute value of asymptomatic**
A_1	A_1^1	A_1^3
A_2	A_2^3	A_2^4
A_3	A_3^2	A_3^4
A_4	A_4^1	A_4^4
A_5	A_5^1	A_5^2
A_6	A_6^2	A_6^3
A_7	A_7^1	A_7^2

Let U = { P_1,P_2,P_3,P_4,P_5}

Let us define a function F_1: $A_1^1 \times A_2^3 \times A_3^2 \times A_4^1 \times A_5^1 \times A_6^2 \times A_7^1 \longrightarrow P(U)$ with fuzzy degree of appurtenance and these attribute values are pertaining to the symptomatic patients based on the reliable data source and eminent experts of the field.

F_1({3-5 days, High, severe, 5-7 days, Shortness of breath , long term, severe}) = {P_1(0.4,0.5,0.4,0.3,0.8,0.5,0.3),P_2(0.8,0.6,0.9,0.5,0.7,0.8,0.9),P_3(0.1,0.1,0.2,0.4,0.2,0.3,0.4),P_4(0.6,0.4,0.7,0.9,0.5,0.7 ,0.6),P_5 (0.1,0.2,0.1,0.1,0.2,0.3,0.1)}.

Let us define a function F_2: $A_1^4 \times A_2^4 \times A_3^4 \times A_4^4 \times A_5^4 \times A_6^4 \times A_7^4 \longrightarrow P(U)$ with fuzzy degree of appurtenance and these attribute values are pertaining to the asymptomatic patients based on the reliable data source and eminent experts of the field.

F_2({no,nil,nil,no,normal,nil,energetic})={P_1(0.6,0.6,0.5,0.6,0.7,0.5,0.7),P_2(0.1,0.2,0.1,0.2,0.3,0.2,0.4),P_3(0.8,0.7,0.6, 0.8,0.6,0.7,0.9),P_4(0.2,0.7,0.2,0.2,0.1,0.3,0.2),P_5(0.7,0.8,0.7,0.6,0.7,0.8,0.7)}

The matrix representation based on the symptomatic attribute values is

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	A_1^1	A_2^3	A_3^2	A_4^1	A_5^1	A_6^2	A_7^1
P_1	0.4	0.5	0.4	0.3	0.8	0.5	0.3
P_2	0.8	0.6	0.9	0.5	0.7	0.8	0.9
P_3	0.1	0.1	0.2	0.4	0.2	0.3	0.4
P_4	0.6	0.4	0.7	0.9	0.5	0.7	0.6
P_5	0.1	0.2	0.1	0.1	0.2	0.3	0.1

The matrix representation based on the asymptomatic attribute values is

	A_1^4	A_2^4	A_3^4	A_4^4	A_5^4	A_6^4	A_7^4
P_1	0.6	0.6	0.5	0.6	0.7	0.5	0.7
P_2	0.1	0.2	0.1	0.2	0.3	0.2	0.4
P_3	0.8	0.7	0.6	0.8	0.6	0.7	0.9
P_4	0.2	0.7	0.2	0.2	0.1	0.3	0.2
P_5	0.7	0.8	0.7	0.6	0.7	0.8	0.7

The ranking approach developed by Shazia Rana et al [42] is used to rank the symptomatic and asymptomatic patients. From the matrix representation based on symptomatic attribute values, the frequency matrix F = (f_{qp}) is constructed after applying maximum operator, minimum operator and average operator to each row of the symptomatic matrix representation.

The frequency matrix representing the ranking of symptomatic patients

	R_1	R_2	R_3	R_4	R_5
P_1	0	1	2	0	0
P_2	3	0	0	0	0
P_3	0	0	1	2	0
P_4	1	2	0	0	0
P_5	0	0	0	2	1

Table 3.2 comprises of the rankings of symptomatic patients with the authenticity of measures of percentage of p^{th} position for q^{th} alternative is calculated using $\frac{\max_q f_{qp}}{\sum_q f_{qp}} \times 100$

Table 3.2 Ranking of Symptomatic Patients

R_1	P_2	75%
R_2	P_4	66.7%
R_3	P_1	66.7%
R_4	P_3	50%

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R_5	P_5	100%

The frequency matrix representing the ranking of asymptomatic patients

$$
\begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \end{array}
\begin{array}{c} \begin{array}{ccccc} R_1 & R_2 & R_3 & R_4 & R_5 \end{array} \\
\begin{pmatrix} 0 & 1 & 2 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 \\ 3 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2 & 1 & 0 \\ 1 & 2 & 0 & 0 & 0 \end{pmatrix} \end{array}
$$

Table 3.3 comprises of the rankings of asymptomatic patients with the authenticity of measures of percentage.

Table 3.3. Ranking of Asymptomatic Patients

R_1	P_3	75%
R_2	P_5	67%
R_3	P_1	40%
R_4	P_4	50%
R_5	P_2	100%

Let us discuss the significance of two dual dominant attributes with combined plithogenic hypersoft sets representation.

Let U = { $P_1,P_2,P_3,P_4,P_5,P_6,P_7$}

Let us define a function F_1: $A_1^1 \times A_2^3 \times A_3^2 \times A_4^1 \times A_5^1 \times A_6^2 \times A_7^1 \longrightarrow P(U)$ with fuzzy degree of appurtenance and these attribute values are pertaining to the symptomatic patients.

F_1({3-5 days, High, severe, 5-7 days, Shortness of breath , long term, severe})= {P_1(0.3,(0.5,0.6),0.5,(0.3,0.6),0.8,(0.7,0.2),0.9),P_2(0.9,(0.6,0.1,0.2),0.9,0.5,0.4,0.7,(0.5,0.3)), P_3(0.2,0.1,(0.2,0.7),0.4,0.4,(0.7,0.2),0.8),P_4((0.6,(0.2,0.3),0.3,0.8,(0.9,0.1),0.7),P_5 ((0.1,0.8),0.1,0.2,(0.1,0.8),(0.7,0.1,0.2),0.5,0.4),P_6(1,1,0.9,0.3,(0.4,0.3),0.7,0.4),P_7(0.7,0.5,0.6,(0.7,0.2),1,0.8,0.3)}

Let us define a function F_2: $A_1^4 \times A_2^4 \times A_3^4 \times A_4^4 \times A_5^4 \times A_6^4 \times A_7^4 \longrightarrow P(U)$ with fuzzy degree of appurtenance and these attribute values are pertaining to the asymptomatic patients.

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F_2({no,nil,nil,no,normal,nil,energetic})={P_1(0.8,0.6,0.8,(0.7,0.2),0.4,0.5,0.3),P_2(0.1,(0.1,0.1,0.8),0.1,0.4,(0.6,0.3),0.4,0.5),P_3(0.8,0.7,0.7,(0.8,0.2),0.2,(0.4,0.3),0.4),P_4(0.2,0.7,0.2,(0.1,0.8),0.7,0.3,0.2),P_5(0.9,0.7,0.7,(0.8,0.1),(0.7,0.2),0.4,0.2),P_6(0,0,0.2,0.8,(0.2,0.4),0.4),P_7(0.2,0.9,0.3,(0.1,0.8),0.7,0.5,0.6)}

The degree of appurtenance is not of same kind as it is in the combined form comprising of crisp, fuzzy, intuitionistic and neutrosophic values; the degree of appurtenance is converted to fuzzy values. The intuitionistic representation of the form (T,F) is converted to fuzzy by using $\frac{T}{T+F}$ [46]. The neutrosophic representation of the form (a,b,c) is converted to fuzzy by using $\frac{1+a-2b-c}{2}$ [47].

The modified matrix representation based on the symptomatic attribute values is

	A_1^1	A_2^3	A_3^2	A_4^1	A_5^1	A_6^2	A_7^1
P_1	0.3	0.45	0.5	0.33	0.8	0.78	0.9
P_2	0.9	0.6	0.9	0.5	0.4	0.7	0.63
P_3	0.2	0.1	0.22	0.4	0.4	0.78	0.8
P_4	0.45	0.3	0.8	0.9	0.8	0.9	0.7
P_5	0.11	0.1	0.2	0.11	0.65	0.5	0.4
P_6	1	1	0.9	0.3	0.57	0.7	0.4
P_7	0.7	0.5	0.6	0.77	1	0.8	0.3

The modified matrix representation based on the asymptomatic attribute values is

	A_1^4	A_2^4	A_3^4	A_4^4	A_5^4	A_6^4	A_7^4
P_1	0.3	0.45	0.5	0.33	0.4	0.5	0.3
P_2	0.9	0.6	0.9	0.5	0.67	0.4	0.5
P_3	0.2	0.1	0.22	0.4	0.2	0.57	0.4
P_4	0.45	0.3	0.8	0.9	0.7	0.3	0.2
P_5	0.11	0.1	0.2	0.11	0.78	0.4	0.2
P_6	1	1	0.9	0.3	0.8	0.34	0.4
P_7	0.7	0.5	0.6	0.77	0.7	0.5	0.6

The frequency matrix representing the ranking of symptomatic patients

	R_1	R_2	R_3	R_4	R_5	R_6	R_7
P_1	1	1	0	0	1	0	0
P_2	2	0	0	1	0	0	0
P_3	0	1	1	0	0	1	0
P_4	1	2	0	0	0	0	0
P_5	0	0	2	0	0	0	1

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P_6	2	1	0	0	0	0	0
P_7	0	2	1	0	0	0	0

Table 3.4 comprises of the rankings of symptomatic patients with the authenticity of measures of percentage.

Table 3.4. Ranking of Symptomatic Patients

R_1	P_6	33%
R_2	P_4	29%
R_3	P_7	25%
R_4	P_2	100%
R_5	P_1	100%
R_6	P_3	100%
R_7	P_5	100%

The frequency matrix representing the ranking of asymptomatic patients

	R_1	R_2	R_3	R_4	R_5	R_6	R7
P_1	0	0	1	0	1	1	0
P_2	1	2	0	0	0	0	0
P_3	0	0	0	0	2	1	0
P_4	1	0	0	1	0	0	1
P_5	0	0	1	1	1	0	0
P_6	0	1	1	1	0	0	0
P7	1	0	1	1	0	0	0

Table 3.5 comprises of the rankings of asymptomatic patients with the authenticity of measures of percentage.

Table 3.5. Ranking of Asymptomatic Patients

R_1	P_7	33%
R_2	P_2	67%
R_3	P_1	25%
R_4	P_6	25%
R_5	P_5	50%
R_6	P_3	50%
R_7	P_4	100%

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4. Discussion

Table 3.2 and 3.3 presents the ranking of symptomatic and asymptomatic patients. The percentage of closer association of a patient P_i (i = 1,2,3,4,5) as symptomatic or asymptomatic helps in classifying the patient as corona infected or not. For instance in table 3.2 the patient P_2 is ranked in first position under symptomatic, but in table 3.3 the same patients occupies fifth rank with 100% of authenticity measure to be asymptomatic. This shows clearly that the patient P2 is symptomatic. In this same fashion each of the patients can be classified as symptomatic or asymptomatic. Thus the position of the patients is determined in both the different cases. The positions of the symptomatic and asymptomatic patients help to classify the patients based on the degree of appurtenance towards the respective attribute values of each attribute. Table 3.4 and 3.5 presents the results using combined plithogenic hypersoft sets representation. The same kind of inferences shall also be made for the results obtained. The decision making based on two dual attributes are highly realistic and it certainly pave way for making comprehensive decisions. The positional values of the patients with respect to the measures of percentage authenticity give us the optimal ranking.

Conclusion

This paper introduces a new approach of extending plithogenic hypersoft set of single dominant attribute value to plithogenic hypersoft sets with two dual dominant attribute values. The proposed approach is discussed in two environments, one with the usual representation of plithogenic hypersoft sets and the other one is the combined plithogenic hypersoft sets. The extended plithogenic hypersoft sets is validated with examples in both the environments. The proposed concept can be validated with degree of appurtenance represented as linguistic variables. This concept can be applied to various domains of decision making. This kind of approach will certainly create a favourable decision making environment. This proposed decision making model can also be discussed under plithogenic hypergraphic as a future direction of this research work.

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