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An Innovative Model for Complex and Uncertain Problems Using Complex Spherical Fuzzy Hypersoft Sets

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ABSTRACT

This article developed the idea of Complex Spherical Fuzzy Hypersoft set (CSpFHSS) through practical application . this research can be applicable to different areas of math and science. This research are creating new model take the best feature from the best model introduced a new and improved way of solving problem. The complex spherical fuzzy hyper Soft sets which need a gradual transition between membership grades, are a subset of spherical fuzzy hypersoft sets. Many areas with complex and un certain problems can benefit from using CSpFHSS these areas included finance, health care, environment, social sciences, image processing, pattern recognition, data mining, expert system and decision making. With the powerful tool of CSpFHSS we can accurately solved complex real world problem simulated and analysis these problems.

Keywords: Decision-Making; Fuzzy Set; Soft Set; Uncertainty; Optimization; Spherical Fuzzy Soft Set.

Introduction

Providing quick and efficient medical solutions is one of the main goals of technological innovation. Accurate therapy becomes challenging in hospitals because of the numerous issues such as lack of doctors , nurses , medical equipment and many other that are prevalent there. Therefore, in order to distribute the limited health care resources, a strategy that thoroughly analyses the problem states must be developed. Because allocated data frequently contains characteristics of fuzziness, ambiguity, and uncertainty, a structure that can handle these concepts is crucial to achieving this. The complex single-valued neutrosophic soft set and the related distance measure were introduced in this article as a remedy for these issues and a means of handling unknowns. An analogous measurement is then presented using the offered distance measure for the intricate single-valued neutrosophic soft. Under the utilization part, a mathematical method based on the complex single-valued function is presented. The outcomes of this mathematical model are then confirmed by patient review once it is

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applied to a real- world medical resource allocation problem. Furthermore, a comparison between the suggested model and current methods is carried out to show how effective it is at increasing allocation accuracy. Numerous researchers have advanced medical issues and their resolution in order to accomplish this. But as time goes on, the world keeps encountering new circumstances that
have a big influence on people's lives. A summary of the main conclusions and possible options for further research round out the report.

Literture review

Fuzzy set theory covers the issues of acquiring sufficient data for good decisions due to ambiguity around social and economic factors and information access. It is commonly used as a helpful approach for situations involving multi-attribute choices.Lotfi Zadeh [1] invented fuzzy sets in 1965 as a technique for interacting with ambiguous and generalised data. They are especially useful when collaborating on difficult-to-quantify data or data without clear category limits.A fuzzy set's partly membership provides each element a number between 0 and 1, indicating its level of membership in the set. The membership function in the set determined how much of all the components the set includes, allowing for a more complex representation of ambiguity. A number of one represents whole membership, while a value of 0 indicates non-membership. They provide an effective tool for storing and making sense of inaccurate and unpredictable data, that leads to more flexible and realistic simulation. Fuzzy logic extends traditional binary logic to deal with fuzzy sets, which are often utilised when working with fuzzy sets to enable reasoning and assessment in situations when it is difficult to define exact rules. Since the introduction of fuzzy set theory by Zadeh in 1965 [1], fuzzy sets have been used to handle uncertain, imprecise, and vague information. A fuzzy set is defined as a collection of ordered pairs, where each element of a set A over a universal set X has a membership value within the interval [O, 1], represented by a membership function. The concept of fuzzy sets was later extended to Intuitionistic Fuzzy Sets (IFS) by Atanassov [2], which introduced both membership and non-membership functions for each element, with the constraint that their sum lies within the unit interval [O,1]. Further developments led to Pythagorean Fuzzy Sets (PyFS) by Yager and Abbasov [3], where the sum of the squares of member ship and non-membership values must lie within [O,1]. These sets, however, are limited to representing data in one dimension and cannot handle information in the complex plane. To overcome this limitation, Complex Fuzzy Sets (CFS) were introduced by Ramot et al. [10], where the membership function is defined as P.,ei(, with f. as the amplitude term (ranging within [O, 1]) and (as the phase term (ranging from O to 211-). Alkouri and Salleh [11] further extended this to Complex lntuitionistic Fuzzy Sets (CIFS), incorporating both membership and non-membership values in the complex plane, constrained by a+b ::=; 1 and irr + ii- ::=; 1. The Complex

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Pythagorean Fuzzy Set (CPyFS), introduced by Akram, M.,and Naz [5], further improved this by requiring that the sum of the squares of membership and non-membership values in the complex plane must be less than or equal to 1. While these advancements effectively manage uncertainty, they lack a parameterized framework for decision-making. To address this, Molodtsov [6] proposed Soft Set Theory, where a soft set (SS) over a universal The relationship from a set of attributes to the universal set's super set is known as a set. This concept was extended to Fuzzy Soft Sets (FSS) by Agman N. and KarataS [21] which combine fuzzy sets with soft sets to improve uncertainty handling in decision-making. Intuitionistic Fuzzy Soft Sets (IFSS), introduced by Maji, PK.(2009). [8], and Pythagorean Fuzzy Soft Sets (PyFSS), introduced by Peng et al. [9], extended FSS by incorporating intuitionistic and Pythagorean conditions, respectively. To extend soft set theory to the com plex plane, Complex Fuzzy Soft Sets (CFSS) were proposed by Thirunavukarasu et al. [12]. CFSS replaced real-valued functions with complex-valued functions, incorporating am plitude and phase terms to provide richer information for solving ambiguous and uncertain problems. Recently, Maji et al. [8] introduced Complex lntuitionistic Fuzzy Soft Sets (CIFSS), combining the properties of CIFS and SS for enhanced decision-making. Building on these foundations, Spherical Fuzzy Soft Sets, proposed by Perveen et al. [16], general ize picture fuzzy sets by ensuring that the square sum of membership, non-membership, and neutral membership values lies within [O,1]. Akram and Shabir [5] introduced Complex Spherical Fuzzy Soft Sets, where the square sum of membership, non-membership, and neutral membership values lies within the unit circle in the complex plane. Finally, Fuzzy Hyper Soft Sets, introduced by Yolcu and Ozturk [22], combine the features of fuzzy sets and hyper-soft sets to create a hybrid structure for managing complex and parameterized uncertainty.

Complex Spherical Fuzzy hypersoft set and its properties

This sections included some basic definitions which leads to the main concept of the article.

Basic definition

Fuzzy Set [1]: Let G be a universal set ,then the fuzzy set on G is given as:

$$\{(\epsilon, U^m(\epsilon))|\epsilon \in G\}$$

Where $U^m : G \to [0, 1]$ and $U^m(\epsilon)$ is known as membership of G.

Pythagorean Fuzzy Set Let G be a universal set ,then the Pythagorean fuzzy set on G is given as:

$$\{(\epsilon, U^m(\epsilon), U^n(\epsilon))|\epsilon \in G\}$$

Where $U^m : G \to [0, 1]$ and $U^n : G \to [0, 1]$ and $U^m(\epsilon)$ is known as membership

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of G and
$U^n(\epsilon)$ is known as non-membership of G.

$0 \leq (U^m(\epsilon))^2 + (U^n(\epsilon))^2 \leq 1$ for all $\epsilon \in G$.

Complex Spherical Fuzzy Soft Set [14]: Assume the universe set be denoted as C. To explain the idea of a complex Spherical Fuzzy Soft Set , we can represent it as follows:

$B = \{\langle c, QB(c), JB(c), OB(c)\rangle : c \in C\}$

where:

$QB(c) : C \rightarrow$ complex plane $JB(c) : C \rightarrow$ complex plane $OB(c) : C \rightarrow$ complex plane

where $QB(c), JB(c), OB(c)$ lies in complex plane. :

$0 < QB^2(c) + JB^2(c) + OB^2(c) < 1.$

where:

$QB(c) = r_{Q(c)}e^{\iota\theta Q}(c)$

$JB(c) = r_{J(c)}e^{\iota\theta J}(c)$

$OB(C) = r_{O(c)}e^{\iota\theta O}(c)$

This formula explain Spherical complex Fuzzy Soft Set, wherein elements in the universe C are characterized based on their degrees of membership that are favorable, neutral, and neg- ative while insuring that the sum of squared membership degree remain bounded with in the interval.

1.1. Complex spherical fuzzy hypersoft set and its properties

Definition 2.1. In spherical fuzzy hyper soft set will cover the values between 0 and 1 but spherical fuzzy soft set will cover all the values lies in complex plane. we can take multi attribute values instead of single value. The definition of CSpFHSS is as follow.

$A = \{e, x_1, \mu(x1), \lambda(x_1), \omega(x_1) : x \in U\}$

and

$\mu(x) = r_\mu e^{\iota\theta\mu}$ $\lambda(x) = r_\lambda e^{\iota\theta\lambda}$ $\omega(x) = r_\omega e^{\iota\theta\omega}$

where

$0 < (r_\mu)^2 + (r_\lambda)^2 + (r_\omega)^2 < 1 \ \forall \ x \in U$

$0 \leq (\theta_\mu)^2 + (\theta_\lambda)^2 + (\theta_\omega)^2 \leq 2\pi$

Numarical example

Concider a person whishes to select a hospital for treatment .A number of three hospital which is a set of discourse $A \subset E$

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$U = \{Z_1, Z_2, Z_3, Z_4\}$

Attribute and their values are
V_1 = Private, Government(Govt), V_2 = facilities , V_3 = Emergency treatment
Then the attribute values set are:

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where
$V_1 = \{v_{11} = \text{private}, v_{22} = \text{Govt}\}$
$V_2 = \{v_{21} = \text{availabe}, v_{22} = \text{notavaiable}\}$ $V_3 = \{v_{31} = \text{avaialable}\}$
$Y = V_1 \times V_2 \times V_3$ $Y = \{y_1, y_2, y_3, y_4\}$

$Y_1 = \{v_{11}, v_{21}, v_{31}\}$ $Y_2 = \{v_{11}, v_{22}, v_{31}\}$ $Y_3 = \{v_{12}, v_{21}, v_{31}\}$ $Y_4 = \{v_{12}, v_{22}, v_{31}\}$

$A = \{(\lambda_{fhss}, Y_1\} = \{(0.03e^{(\iota 2\pi)(0.1)}, 0.01e^{(\iota 2\pi)(0.2)}, 0.02e^{(\iota 2\pi)(0.1)})/Z_1,$
$(0.01e^{(\iota 2\pi)(0.2)}, 0.02e^{(\iota 2\pi)(0.1)}, 0.03e^{(\iota 2\pi)(0.2)})/Z_2,$
$(0.02e^{(\iota 2\pi)(0.1)}, 0.03e^{(\iota 2\pi)(0.2)}, 0.04e^{(\iota 2\pi)(0.1)})/Z_3, (0.01e^{(\iota 2\pi)(0.4)},$
$0.02e^{(\iota 2\pi)(0.3)}, 0.01e^{(\iota 2\pi)(0.1)})/Z_4\}$

$\{\lambda_{fhss}, Y_2\} = \{(0.02e^{(\iota 2\pi)(0.1)}, 0.02e^{(\iota 2\pi)(0.1)}, 0.01e^{(\iota 2\pi)(0.1)})/Z_1,$
$(0.03e^{(\iota 2\pi)(0.1)}, 0.01e^{(\iota 2\pi)(0.2)}, 0.03e^{(\iota 2\pi)(0.2)})/Z_2,$
$(0.03e^{(\iota 2\pi)(0.3)}, 0.03e^{(\iota 2\pi)(0.1)}, 0.03e^{(\iota 2\pi)(0.4)})/Z_3, (0.04e^{(\iota 2\pi)(0.1)},$
$0.03e^{(\iota 2\pi)(0.4)}, 0.03e^{(\iota 2\pi)(0.1)})/Z_4\}$

$\{(\lambda_{fhss}, Y_3\} = \{(0.03e^{(\iota 2\pi)(0.1)}, 0.01e^{(\iota 2\pi)(0.2)}, 0.02e^{(\iota 2\pi)(0.1)})/Z_1,$
$(0.01e^{(\iota 2\pi)(0.2)}, 0.02e^{(\iota 2\pi)(0.1)}, 0.03e^{(\iota 2\pi)(0.2)})/Z_2,$
$(0.02e^{(\iota 2\pi)(0.1)}, 0.03e^{(\iota 2\pi)(0.2)}, 0.04e^{(\iota 2\pi)(0.1)})/Z_3, (0.01e^{(\iota 2\pi)(0.4)},$
$0.02e^{(\iota 2\pi)(0.3)}, 0.01e^{(\iota 2\pi)(0.1)})/Z_4\}$

$\{(\lambda_{fhss}, Y_4\} = \{(0.01e^{(\iota 2\pi)(0.1)}, 0.02e^{(\iota 2\pi)(0.2)}, 0.03e^{(\iota 2\pi)(0.1)})/Z_1,$
$(0.01e^{(\iota 2\pi)(0.3)}, 0.01e^{(\iota 2\pi)(0.1)}, 0.03e^{(\iota 2\pi)(0.3)})/Z_2,$
$(0.03e^{(\iota 2\pi)(0.2)}, 0.02e^{(\iota 2\pi)(0.3)}, 0.03e^{(\iota 2\pi)(0.2)})/Z_3, (0.01e^{(\iota 2\pi)(0.4)},$
$0.02e^{(\iota 2\pi)(0.3)}, 0.01e^{(\iota 2\pi)(0.1)})/Z_4\}$

$V = \{\lambda_{fhss}, Y_1\} = \{(0.02e^{(\iota 2\pi)(0.1)}, 0.02e^{(\iota 2\pi)(0.1)}, 0.01e^{(\iota 2\pi)(0.1)})/Z_1,$
$(0.03e^{(\iota 2\pi)(0.1)}, 0.01e^{(\iota 2\pi)(0.2)}, 0.03e^{(\iota 2\pi)(0.2)})/Z_2,$
$(0.03e^{(\iota 2\pi)(0.3)}, 0.03e^{(\iota 2\pi)(0.1)}, 0.03e^{(\iota 2\pi)(0.4)})/Z_3, (0.04e^{(\iota 2\pi)(0.1)},$

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$0.03e^{(\iota 2\pi)(0.4)}, 0.03e^{(\iota 2\pi)(0.1)})/Z4\}$

$\{(\lambda_{fhss}, Y2\} = \{(0.03e^{(\iota 2\pi)(0.1)}, 0.01e^{(\iota 2\pi)(0.2)}, 0.02e^{(\iota 2\pi)(0.1)})/Z1,$
$(0.01e^{(\iota 2\pi)(0.2)}, 0.02e^{(\iota 2\pi)(0.1)}, 0.03e^{(\iota 2\pi)(0.2)})/Z2,$
$(0.02e^{(\iota 2\pi)(0.1)}, 0.03e^{(\iota 2\pi)(0.2)}, 0.04e^{(\iota 2\pi)(0.1)})/Z3, (0.01e^{(\iota 2\pi)(0.4)},$
$0.02e^{(\iota 2\pi)(0.3)}, 0.01e^{(\iota 2\pi)(0.1)})/Z4\}$

$\{\lambda_{fhss,Y3} \} = \{(0.02e^{(\iota 2\pi)(0.1)}, 0.02e^{(\iota 2\pi)(0.1)}, 0.01e^{(\iota 2\pi)(0.1)})/Z1,$
$(0.03e^{(\iota 2\pi)(0.1)}, 0.01e^{(\iota 2\pi)(0.2)}, 0.03e^{(\iota 2\pi)(0.2)})/Z2,$

$(0.03e^{(\iota 2\pi)(0.3)}, 0.03e^{(\iota 2\pi)(0.1)}, 0.03e^{(\iota 2\pi)(0.4)})/Z3, (0.04e^{(\iota 2\pi)(0.1)},$
$0.03e^{(\iota 2\pi)(0.4)}, 0.03e^{(\iota 2\pi)(0.1)})/Z4\}$

$\{(\lambda_{fhss}, Y4\} = \{(0.03e^{(\iota 2\pi)(0.1)}, 0.01e^{(\iota 2\pi)(0.2)}, 0.02e^{(\iota 2\pi)(0.1)})/Z1,$
$(0.01e^{(\iota 2\pi)(0.2)}, 0.02e^{(\iota 2\pi)(0.1)}, 0.03e^{(\iota 2\pi)(0.2)})/Z2,$
$(0.02e^{(\iota 2\pi)(0.1)}, 0.03e^{(\iota 2\pi)(0.2)}, 0.04e^{(\iota 2\pi)(0.1)})/Z3, (0.01e^{(\iota 2\pi)(0.4)},$
$0.02e^{(\iota 2\pi)(0.3)}, 0.01e^{(\iota 2\pi)(0.1)})/Z4\}$

Then $A \subseteq V$

Extended Union

Let us concider two complex spherical fuzzy hyper soft set .

$R_i = \{(\mu(x)_1, \lambda(x)_1, \omega(x)_1), (\mu(x)_2, \lambda(x)_2, \omega(x)_2), \cdots, (\mu(x)_n, \lambda(x)_n, \omega(x)_n\}$
$R_j = \{(\mu(y)_1, \lambda(y)_1, \omega(y)_1), (\mu(y)_2, \lambda(y)_2, \omega(y)_2), \cdots, (\mu(y)_n, \lambda(y)_n, \omega(y)_n\}$

Then the Extended Union of

$R_1 \cup R_2 = \{\max(\mu(x)_1, \mu(y)_1), \min(\lambda(x)_1, \lambda(y)_1), \min(\omega(x)_1, \omega(y)_1)\},$
$\{\max(\mu(x)_2, \mu(y)_2), \min(\lambda(x)_2, \lambda(y)_2), \min(\omega(x)_2, \omega(y)_2)\},$
. . . . . .
.....
.....
$\{\max(\mu(x)_n, \mu(y)_n), \min(\lambda(x)_n, \lambda(y)_n), \min(\omega(x)_n, \omega(y)_n)\}$

Generally we represent it as

$R_i \cup R_j = \{x_i, < \{\max(\mu(x)_i, \mu(y)_j), \min(\lambda(x)_i, \lambda(y)_j), \min(\omega(x)_i, \omega(y)_j) >\}$

Where:

$\mu(x) = r_\mu e^{\iota\theta\mu}$ $\lambda(x) = r_\lambda e^{\iota\theta\lambda}$ $\omega(x) = r_\omega e^{\iota\theta\omega}$

where

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$0 < (r_\mu)^2 + (r_\lambda)^2 + (r_\omega)^2 < 1 \ \forall \ x \in U$
$0 \leq (\theta_\mu)^2 + (\theta_\lambda)^2 + (\theta_\omega)^2 \leq 2\pi$

Extended intersaction.

Let us concider two complex spherical fuzzy hyper soft set .

$R_i = \{(\mu(x)_1, \lambda(x)_1, \omega(x)_1), (\mu(x)_2, \lambda(x)_2, \omega(x)_2), \cdots, (\mu(x)_n, \lambda(x)_n, \omega(x)_n\}$
$R_j = \{(\mu(y)_1, \lambda(y)_1, \omega(y)_1), (\mu(y)_2, \lambda(y)_2, \omega(y)_2), \cdots, (\mu(y)_n, \lambda(y)_n, \omega(y)_n\}$
Then the Extended intersection of

$R_1 \cap R_2 = \{\min(\mu(x)_1, \mu(y)_1), \min(\lambda(x)_1, \lambda(y)_1), \max(\omega(x)_1, \omega(y)_1)\},$
$\{\min(\mu(x)_2, \mu(y)_2), \min(\lambda(x)_2, \lambda(y)_2), \max(\omega(x)_2, \omega(y)_2)\},$
.....
.....
.....
$\{\min(\mu(x)_n, \mu(y)_n), \min(\lambda(x)_n, \lambda(y)_n), \max(\omega(x)_n, \omega(y)_n)\}$
Generally we represent it as

$R_i \cap R_j = \{x_i, < \{\min(\mu(x)_i, \mu(y)_j), \min(\lambda(x)_i, \lambda(y)_j), \max(\omega(x)_i, \omega(y)_j) >\}$
Where:

$\mu(x) = r_\mu e^{\iota\theta\mu}$ $\lambda(x) = r_\lambda e^{\iota\theta\lambda}$ $\omega(x) = r_\omega e^{\iota\theta\omega}$
where

$$0 < (r_\mu)^2 + (r_\lambda)^2 + (r_\omega)^2 < 1 \ \forall \ x \in U$$
$$0 \leq (\theta_\mu)^2 + (\theta_\lambda)^2 + (\theta_\omega)^2 \leq 2\pi$$

Ristricted Union:

Let us concider two complex spherical fuzzy hyper soft set .
$R_i = \{(\mu(x)_1, \lambda(x)_1, \omega(x)_1), (\mu(x)_2, \lambda(x)_2, \omega(x)_2), \cdots, (\mu(x)_n, \lambda(x)_n, \omega(x)_n\}$
$R_j = \{(\mu(y)_1, \lambda(y)_1, \omega(y)_1), (\mu(y)_2, \lambda(y)_2, \omega(y)_2), \cdots, (\mu(y)_n, \lambda(y)_n, \omega(y)_n\}$
Then the ristricted Union of two sets.
$R_i \cup R_j = \{x_i, < \{\max(\mu(x)_i, \mu(y)_j), \max(\lambda(x)_i, \lambda(y)_j), \min(\omega(x)_i, \omega(y)_j) >\}$

Ristricted intersection:

Let us concider two complex spherical fuzzy hyper soft set .
$R_i = \{(\mu(x)_1, \lambda(x)_1, \omega(x)_1), (\mu(x)_2, \lambda(x)_2, \omega(x)_2), \cdots, (\mu(x)_n, \lambda(x)_n, \omega(x)_n\}$
$R_j = \{(\mu(y)_1, \lambda(y)_1, \omega(y)_1), (\mu(y)_2, \lambda(y)_2, \omega(y)_2), \cdots, (\mu(y)_n, \lambda(y)_n, \omega(y)_n\}$

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Then the Ristricted intersection of two sets:
$R_i \cap R_j = \{x_i, < \{\max(\mu(x)_i, \mu(y)_j), \max(\lambda(x)_i, \lambda(y)_j), \min(\omega(x)_i, \omega(y)_j) >\}$

Where:

$$\mu(x) = r_\mu e^{\iota\theta\mu} \; \lambda(x) = r_\lambda e^{\iota\theta\lambda} \; \omega(x) = r_\omega e^{\iota\theta\omega}$$

$$0 < (r_\mu)^2 + (r_\lambda)^2 + (r_\omega)^2 < 1 \; \forall \; x \in U$$
$$0 \leq (\theta_\mu)^2 + (\theta_\lambda)^2 + (\theta_\omega)^2 \leq 2\pi$$

where

Compliment of two sets : Let us consider a set A
$A = \{\mu(x_1), \lambda(x_1), w(x_1) : x \in U\}$
Then compliment of A is defined as.

$A^c = \{\lambda(x_1), \mu(x_1), w(x_1) : x \in U\}$
De morgan law :
Let us consider that there are two sets A and B Then prove that they satisfy the condition of De Morgan Law:

$(A \cap B)^c = A^c \cup B^c$
$(A \cup B)^c = A^c \cap B^c$

Here we use ristricted union and intersection to prove Demorgan law:

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Then in general:
$A = \{(P_1, N_1, I_1), (P_2, N_2, I_2), \cdots, (P_n, N_n, I_n)\}$
$B = \{(P_a, N_a, I_a), (P_b, N_b, I_b), \cdots, (P_z, N_z, I_z)\}$

$(A \cup B)^{\wedge} = \{\max(P_n, P_z), \max(N_n, N_z), \min(I_n, I_z)\}$
$(A \cup B)^{c} = \{\max(N_n, N_z), \max(P_n, P_z), \min(I_n, I_z)\} \cdots 1$
$A^{c} = \{(N_1, P_1, I_1), (N_1, P_1, I_2), \cdots, (N_n, P_n, R_n)\}$
$B^{c} = \{(N_a, P_a, R_a), (N_b, P_b, R_b), \cdots, (N_z, P_z, R_z)\}$
$A^{c} \cap B^{c} = \{\max(N_n, N_z), \max(P_n, P_z), \min(I_n, I_z)\} \cdots 2$
Where P, N, and I are the membership non membership and neutral function of Complex spherical fuzzy hyper soft set: hence from 1 and 2 prove.
similarly we prove 2nd demorgan law:
Operation on Complex sperical fuzzy hyper softset : Suppose two CSpFHSs:

$R_i = \{\mu(x_i), \lambda(x_i), \omega(x_i)\}$
$R_j = \{\mu(x_j), \lambda(x_j), \omega(x_j)\}$

Where:

$$\mu(x) = r_\mu e^{\iota\theta\mu}\ \lambda(x) = r_\lambda e^{\iota\theta\lambda}\ \omega(x) = r_\omega e^{\iota\theta\omega}$$

$$0 < (r_\mu)^2 + (r_\lambda)^2 + (r_\omega)^2 < 1\ \forall\ x \in U$$
$$0 \leq (\theta_\mu)^2 + (\theta_\lambda)^2 + (\theta_\omega)^2 \leq 2\pi\ \alpha \geq 0$$

where

the operation on CSpFHSs can be defined as follows.

$$R_j = \sqrt{q}\langle [r_{\mu i} + r_{\mu j})^2 + (r_{\lambda i} + r_{\lambda j})^2 - (r_{\omega i} + r_{\omega j})^2] + [(\theta_{\mu i} + \theta_{\mu j})^2 + (\theta_{\lambda i} + \theta_{\lambda j})^2 - (\theta_{\omega i} + \theta_{\omega j})^2]\rangle$$

$$R_i \times R_j = \sqrt{q}\langle [r_{\mu i} \times r_{\mu j})^2 + (r_{\lambda i} \times r_{\lambda j})^2 - (r_{\omega i} \times r_{\omega j})^2] + [(\theta_{\mu i} \times \theta_{\mu j})^2 + (\theta_{\lambda i} \times \theta_{\lambda j})^2 - (\theta_{\omega i} \times \theta_{\omega j})^2]\rangle$$

R_i + $\alpha(R_j) = \sqrt{q}\langle r_{\mu j} e^{\iota\theta\mu j}, (r_\lambda)^{\alpha} e^{\iota\theta\lambda j}\ \alpha, (r_{\omega j})^{\alpha} e^{\iota\theta\omega j}\ \alpha\ (R_i)^{\alpha} = \sqrt{q}\langle (r_\mu)^{\alpha} e^{\iota\theta\mu i\alpha},$

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$(r_\lambda)\alpha e^{\iota\theta\lambda i}$ α, $(r_\omega)e^{\iota\theta\omega i}$

Theorem1.Assuming three CSpFHSs numbers are:

Where:
$R_i = \{\mu(x_i), \lambda(x_i), \omega(x_i)\}$
$R_j = \{\mu(x_j), \lambda(x_j), \omega(x_j)\}$
$R_k = \{\mu(x_k), \lambda(x_k), \omega(x_k)\}$

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$$\mu(x) = r_\mu e^{\iota\theta\mu}$$

$$\lambda(x) = r_\lambda e^{\iota\theta\lambda} \quad \omega(x) = r_\omega e^{\iota\theta\omega}$$

$$0 < (r_\mu)^2 + (r_\lambda)^2 + (r_\omega)^2 < 1 \ \forall \ x \in U$$

where $0 \leq (\theta_\mu)^2 + (\theta_\lambda)^2 + (\theta_\omega)^2 \leq 2\pi$

$$\alpha_i \geq 0$$

$$\alpha_j \geq 0$$

and $\alpha_k \geq 0$

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then the following identities are:

Commutative property w.r.t addition :

$R_i + R_j = R_j + R_i$

Commutative property w.r.t multiplication :

$R_i \times R_j = R_j \times R_i$

Associative property w.r.t addition :

$(R_i + R_j) + R_k = R_j + (R_i + R_k)$

Associative property w.r.t multiplication :

$(R_i \times R_j) \times R_k = R_j \times (R_i \times R_k)$

Leftdistributiveproperty :

$(\alpha R_i + \alpha R_j) = \alpha(R_i + R_j)$

Right distributive property :

$(\alpha_i R_i + \alpha_j R_i) = (\alpha_i + \alpha_j)R_i$

Right distributive property :

$(\alpha_i R_j + \alpha_j R_j) = (\alpha_i + \alpha_j)R_j$

Left distributive property :

$((R_i)^{\alpha i} + (R_i)^{\alpha j}) = (R_i)^{(\alpha i + \alpha j)}$

proof 1 :

$R_i = \{\mu(x_i), \lambda(x_i), \omega(x_i)\}$

$R_j = \{\mu(x_j), \lambda(x_j), \omega(x_j)\}$

$R_k = \{\mu(x_k), \lambda(x_k), \omega(x_k)\}$

$\alpha_i \geq 0$

To show that. Hence proove.

Proof 2 :

L.H.S =

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$$R_i + R_j = \{\mu(x_j), \lambda(x_j), \omega(x_j)\} + \{\mu(x_i), \lambda(x_i), \omega(x_i)\} = R_j + R_i$$

$$R_i + R_j = \{\mu(x_i), \lambda(x_i), \omega(x_i)\} + \{\mu(x_j), \lambda(x_j), \omega(x_j)\}$$

$$R_i = \{\mu(x_i), \lambda(x_i), \omega(x_i)\}$$
$$R_j = \{\mu(x_j), \lambda(x_j), \omega(x_j)\}$$
$$R_k = \{\mu(x_k), \lambda(x_k), \omega(x_k)\} \; \alpha_i \geq 0$$

To show that.

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L.H.S =
$R_i \times R_j = R_j \times R_i$

$R_i \times R_j$
$= \{\mu(x_i), \lambda(x_i), \omega(x_i)\} \times \{\mu(x_j), \lambda(x_j), \omega(x_j)\}$
$= \{\mu(x_j), \lambda(x_j), \omega(x_j)\} \times \{\mu(x_i), \lambda(x_i), \omega(x_i)\}$
$= R_j \times R_i$
The proof of 3 and 4 are straight forward as of 1 and 2:
Proof 5 :

$R_i = \{\mu(x_i), \lambda(x_i), \omega(x_i)\}$
$R_j = \{\mu(x_j), \lambda(x_j), \omega(x_j)\}$
$R_k = \{\mu(x_k), \lambda(x_k), \omega(x_k)\}$ $\alpha_i \geq 0$

To show that.

$$(\alpha R_i + \alpha R_j) = \alpha(R_i + R_j)$$

L.H.S =

Hence proved.
Proof 6 : To prove: Hence Proved:

L.H.S

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$(\alpha R_i + \alpha R_j) \quad \alpha_{i+j}\lambda(x_i), \alpha_{i+j}\omega(x_i)\}$
$= \quad \alpha\{\mu(x_i), = \alpha_{i+j}\{\mu(x_i), \lambda(x_i), \omega(x_i)\}$
$\lambda(x_i), \quad \omega(x_i)\} = (\alpha_i + \alpha_j)R_i$
$+ \quad \alpha\{\mu(x_j), R.H.S$
$\lambda(x_j), \omega(x_j)\}$
$= \quad \alpha\mu(x_i) \quad +$
$\alpha\mu(x_j),$
$\alpha\lambda(x_i) \quad +$
$\alpha\lambda(x_j), \alpha\omega(x_j$
$= \quad \alpha\langle\mu(x_{i+j}),$
$\lambda(x_{i+j}),$
$\omega(x_{i+j})\rangle$
$\alpha(R_i + R_j)$

$(\alpha_i R_i \quad +$
$\alpha_j R_i) = (\alpha_i +$
$\alpha_j)R_i$
$\alpha_i \geq 0$
$\alpha_j \geq 0$

$(\alpha_i R_i + \alpha_j R_i)$
$= \quad \alpha_i\{\mu(x_i),$
$\lambda(x_i), \quad \omega(x_i)\}$
$+ \quad \alpha_j\{\mu(x_i),$
$\lambda(x_i), \omega(x_i)\}$
$= \quad \{\alpha_i\mu(x_i),$
$\alpha_i\lambda(x_i),$
$\alpha_i\omega(x_i)\} \quad +$
$\{\alpha_j\mu(x_i),$
$\alpha_j\lambda(x_i),$
$\alpha_j\omega(x_i)\}$
$= \{\alpha_i\mu(x_i) +$
$\alpha_j\mu(x_i),$
$\alpha_i\lambda(x_i) \quad +$
$\alpha_j\lambda(x_i),$
$\alpha_i\omega(x_i) \quad +$
$\alpha_j\omega(x_i)\}$
$= \{\alpha_{i+j}\mu(x_i),$

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The proof of 7 is straight forward as proof 6:

Proof 8 : To prove:

$((R_i)^{\alpha i} + (R_i)^{\alpha j}) = (R_i)^{(\alpha i + \alpha j)}$

$\alpha_i \geq 0$

$\alpha_j \geq 0$ $((R_i)^{\alpha i} + (R_i)^{\alpha j})$

$= \{\mu(x_i), \lambda(x_i), \omega(x_i)\}^{\alpha i} + \{\mu(x_i), \lambda(x_i), \omega(x_i)\}^{\alpha j}$

$= \{\mu(x_i)^{\alpha i}\}, \{\lambda(x_i)^{\alpha i}\}, \{\omega(x_i)^{\alpha i}\} + \{\mu(x_i)^{\alpha j}\}, \{\lambda(x_i)^{\alpha j}\}, \{\omega(x_i)^{\alpha j}\}$

$= \{\mu(x_i)^{\alpha i} + \mu(x_i)^{\alpha j}\}, \{\lambda(x_i)^{\alpha i} + \lambda(x_i)^{\alpha j}\}, \{\omega(x_i)^{\alpha i} + \omega(x_i)^{\alpha j}\}$

$= \{\mu(x_i)^{\alpha i + j}\}, \{\lambda(x_i)^{\alpha i + j}\}, \{\omega(x_i)^{\alpha i + j}\}$

$= \{\mu(x_i), \lambda(x_i), \omega(x_i)\}^{\alpha i + j}$

$= (R_i)^{(\alpha_i + \alpha_j)}$

R.H.S.

Hence proved.

Technique for solving decision-making issues related to the CSphFHSS

Here we will provide a technique for solving decision making issues related to the complex spherical fuzzy hypersoft sets.

Suppose we have

$V = \{v_1, v_2, v_3, \cdots, v_n\}$

be the section of n choices we have limited numbers of m criteria for example.

$L = \{l_1, l_2, l_3, \cdots, l_m\}$

At the bottom of the Complex Spherical Fuzzy Hypersoft set we will collect the detail regarding the format of

$P = \{\mu, \lambda, \omega\}$ The criteria to the quantitative aspect of P is $0 \leq \mu^2 + \lambda^2 + \omega^2 \leq 1$

Step 1 Data collecting:

Collect the data from decision makers and organized the data as a matrics.

$H = [R_{mn}]$

$$H = \begin{bmatrix} R_{11} & R_{12} \ldots & R_{1m} \\ R_{21} & R_{22} \ldots & R_{2m} \\ R_{n1} & R_{n2} \ldots & R_{nm} \end{bmatrix}$$

Step 2 :

Normalization:

Convert the matrix through Normalization' e.g

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$$H = [R_{ij}]$$

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H = R_{ij}, (benifit measure; $(R_{ij})^c$, cost measure.

Where $(R_{ij})^c$ is the compliment of (R_{ij}).For any Complex Spherical Fuzzy Hypersoft set
$P = (\mu, \lambda, \omega)$ its compliment is determined as
$P^c = (\lambda, \mu, \omega)$. **Step 3** : Aggregation'
Aggregate the CSpFHSS
R_{ij}
(fori = 1, 2, 3, . . . , m)
for all alternative
S_i(fori = 1, 2, 3, . . . , n)
By using CSpFHSAA or CSpFHSGA operator that have been recomended Mathematically.
Step 4 :
Score Value.
Recognize the value of the score.Sc(R_i) for all CSpFHSS
R_i(fori = 1, 2, 3, . . . , m).
Step 5 :
Sorting and ordering.
Arrange the alternatives
V_i(fori = 1, 2, 3, . . . , m)
to determine the most favorable value Sc(R_i).

Case study

To explain numarically we have an example about allocation of selection of limited health care resourses. Let us consider a health care system with multiple hospitals containing var- ious departments. Such as cardialogy, oncology and pediatrics Each equiped with different resources. The resources to be allocated included doctors, nurses, hospitals, beds and medical equipment the primary goal is to allocate these resources efficiently to meet the need of differ- ent patient group While considering the complex relationship between resources department and patient requirement.A heart patient want to take a decision for heart bypass surgery.The contact with his friends who are doing jobs in medical fields. They note the following standard are used to rank best hospitals and doctors as well.
Heart specialist surgeon.(M_1) Operation Fee.(M_2)
Surgical facilities.(M_3) Emergency Staff.(M_4)
Then we select one of the four best related hospitals. However he is undecided about which one is the best hospitals.
Cheema heart centre.(N_1) Doctors hospital Lahore (N_2) Ever care hospital Lahore(N_3)

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Novo'care international hospital(N_4)
Clearly the interplay between hospital is an Multi attribute deciion mking (MADM) problem that consist five alternative
{(m_1, m_2,, m_3.m_4}
four hospitals
{(n_1, n_2,, n_3.n_4}
and specialist d, we use the development approach to identify the optional layout .

Step 1 :

—	M_1	$\overline{M_2}$	M_3	
N_1	$(0.1e^{0.2\iota 2\pi}, 0.2e^{0.2\iota 2\pi}, 0.3e^{0.2\iota 2\pi})$	$(0.3e^{0.2\iota 2\pi}, 0.4e^{0.2\iota 2\pi}, 0.5e^{0.2\iota 2\pi})$	$(0.2e^{0.2\iota 2\pi}, 0.3e^{0.2\iota 2\pi}, 0.4e^{0.2\iota 2\pi})$	$(0.4e^{0.2\iota 2\pi},$
N_2	$(0.2e^{0.3\iota 2\pi}, 0.3e^{0.3\iota 2\pi}, 0.4e^{0.3\iota 2\pi})$	$(0.8e^{0.3\iota 2\pi}, 0.9e^{0.3\iota 2\pi}, 1e^{0.3\iota 2\pi})$	$(0.1e^{0.3\iota 2\pi}, 0.2e^{0.3\iota 2\pi}, 0.3e^{0.3\iota 2\pi})$	$(0.3e^{0.3\iota 2\pi},$
N_3	$(0.2e^{0.4\iota 2\pi}, 0.4e^{0.4\iota 2\pi}, 0.6e^{0.4\iota 2\pi})$	$(0.6e^{0.4\iota 2\pi}, 0.2e^{0.4\iota 2\pi}, 0.4e^{0.4\iota 2\pi})$	$(0.1e^{0.4\iota 2\pi}, 0.3e^{0.4\iota 2\pi}, 0.5e^{0.4\iota 2\pi})$	$(0.2e^{0.4\iota 2\pi},$
N_4	$(0.1e^{0.5\iota 2\pi}, 0.2e^{0.5\iota 2\pi}, 0.4e^{0.5\iota 2\pi})$	$(0.2e^{0.5\iota 2\pi}, 0.5e^{0.5\iota 2\pi}, 0.6e^{0.5\iota 2\pi})$	$(0.1e^{0.5\iota 2\pi}, 0.3e^{0.5\iota 2\pi}, 0.5e^{0.5\iota 2\pi})$	$(0.2e^{0.5\iota 2\pi},$

Step 2 :Standardised data N_3 based on the suggested method.

—

—	M_1	M_2	M_3	
N_1	$(0.1e^{0.2\iota 2\pi}, 0.2e^{0.2\iota 2\pi}, 0.3e^{0.2\iota 2\pi})$	$(0.3e^{0.2\iota 2\pi}, 0.4e^{0.2\iota 2\pi}, 0.5e^{0.2\iota 2\pi})$	$(0.2e^{0.2\iota 2\pi}, 0.3e^{0.2\iota 2\pi}, 0.4e^{0.2\iota 2\pi})$	$(0.4e^{0.2\iota 2\pi},$
N_2	$(0.2e^{0.3\iota 2\pi}, 0.3e^{0.3\iota 2\pi}, 0.4e^{0.3\iota 2\pi})$	$(0.8e^{0.3\iota 2\pi}, 0.9e^{0.3\iota 2\pi}, 1e^{0.3\iota 2\pi})$	$(0.1e^{0.3\iota 2\pi}, 0.2e^{0.3\iota 2\pi}, 0.3e^{0.3\iota 2\pi})$	$(0.3e^{0.3\iota 2\pi},$
N_3	$(0.2e^{0.4\iota 2\pi}, 0.4e^{0.4\iota 2\pi}, 0.6e^{0.4\iota 2\pi})$	$(0.2e^{0.4\iota 2\pi}, 0.6e^{0.4\iota 2\pi}, 0.4e^{0.4\iota 2\pi})$	$(0.1e^{0.4\iota 2\pi}, 0.3e^{0.4\iota 2\pi}, 0.5e^{0.4\iota 2\pi})$	$(0.2e^{0.4\iota 2\pi},$
N_4	$(0.1e^{0.5\iota 2\pi}, 0.2e^{0.5\iota 2\pi}, 0.4e^{0.5\iota 2\pi})$	$(0.2e^{0.5\iota 2\pi}, 0.5e^{0.5\iota 2\pi}, 0.6e^{0.5\iota 2\pi})$	$(0.1e^{0.5\iota 2\pi}, 0.3e^{0.5\iota 2\pi}, 0.5e^{0.5\iota 2\pi})$	$(0.2e^{0.5\iota 2\pi},$

Step 3 : In this stage we apply aggregate operator CSpEHSAA and CSpEHSGA
Arthematic aggregate
$N_1 = (0.2e^{0.2\iota 2\pi}, 0.3e^{0.2\iota 2\pi}, 0.4e^{0.2\iota 2\pi})$ $N_2 = (0.3e^{0.3\iota 2\pi}, 0.4e^{0.3\iota 2\pi}, 0.5e^{0.3\iota 2\pi})$ $N_3 = (0.1e^{0.4\iota 2\pi}, 0.4e^{0.4\iota 2\pi}, 0.4e^{0.4\iota 2\pi})$ $N_4 = (0.1e^{0.5\iota 2\pi}, 0.3e^{0.5\iota 2\pi}, 0.5e^{0.5\iota 2\pi})$
Geomatric aggregate.
$N_1 = (0.2213e^{0.2\iota 2\pi}, 0.3310e^{0.2\iota 2\pi}, 0.4356e^{0.2\iota 2\pi})$ $N_2 = (0.2632e^{0.3\iota 2\pi}, 0.3834e^{0.3\iota 2\pi}, 0.4949e^{0.3\iota 2\pi})$ $N_3 = (0.1682e^{0.4\iota 2\pi}, 0.4356e^{0.4\iota 2\pi}, 0.5384e^{0.4\iota 2\pi})$
$N_4 = (0.1414e^{0.5\iota 2\pi}, 0.3309e^{0.5\iota 2\pi}, 0.5180e^{0.5\iota 2\pi})$

Step 4 :.Score value.
Arthmatic aggreagate Score value:
$Sc(N_1) = 0.040$
$Sc(N_2) = 0.091$
$Sc(N_3) = 0.049$
$Sc(N_4) = -0.050$
Geomatric aggreagate Score value:
$Sc(N_1) = 0.040$
$Sc(N_2) = 0.091$
$Sc(N_3) = 0.049$
$Sc(N_4) = -0.050$
Step 5 :
Ultimately, we assign we assign a ranking to each option based on their respective score value:

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CSpFHSAA :
$N_2 > N_3 > N_1 > N_4$

CSpFHSGA :
$N_2 > N_3 > N_1 > N_4$

As aresult the aggregate operator display the final rank.Doctors h Hospital Lahore is rated as having the best hospital then all of other hospitals By CSpFHSAA.In contrast, CSpFHSGA Shows that, in comparison to the other Hospitals.

Conclusion

In conclusion Utilizing CSpFHSS has demonstrated outcomes in handling complicated De- cision making situation pattern recognition, image, processing, medical dignosis and expert system are just a few steps where the CSpFHSS gives accurate result of the given situation in the domain of CSpFHSS. CSpFHSS improving the foundation of an idea or theory investiga- tion of hybrid model using machine learning method and improve algorithm to large data are the next goal to CSpFHSS research. By using special math tools like information entropy and probability will help improve CSpFHSS. Our uncertainity modeling working with expert in existing fields like Bioinformatic, Enviormental studies, internet of things will help us to find new ways to apply our research.We also creat easy to use software tools to make it assessible to everyone.

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