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A New Similarity Measure of Pythagorean Fuzzy Set with Pythagorean Right Triangle Base according to The Centroid Point

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ABSTRACT: The aim of this paper is to extend the centroid point to survey the similarity measure between PFS in the case of transforms the Pythagorean right triangle. Method is according to Pythagorean fuzzy set (PFS) has a robust utility ability than an intuitionistic fuzzy set(IFS)to modify uncertainty in real-world problems. That launching a novel new similarity measures$S_L^{PC}$to numerical experiments and compare the candidate ranking based on the centroid point to measure the similarity between the PFS, which transforms the Pythagorean right triangle. Resultsverify the similarity measure S_L^{PC} gets a higher priority of the candidate ranking and ordering number 1.Conclusion proved the new similarity measureS_L^{PC} is usefulness and effectiveness.

KEYWORDS :the centroid point, Pythagorean fuzzy set, PFS, Intuitionistic fuzzy set, IFS.

I.INTRODUCTION

A similarity measure is an instrument for surveythe degree of similarity between two things. many researchers discuss applicated in anyapplied ina wide variety of fields. Zadeh (1965) present a fuzzy set to solving uncertainly problem for real-life, and applied in all different scope of decision making.Atanassov (1986)definedintuitionistic fuzzy set (IFS)and applied extensionreal-life at 1994ab,1995,1999,separately.Gauand Buehrer (1993)wereposed vague sets and Bustince and Burillo (1996) dished out that the vague sets were IFSs. They have been inclusive applied by Szmidt and Kacprzyk(1996)in decision-making problems.that Yager (2013) raised the pythagorean fuzzy sets (PFSs) is new method for treat with the membership grade are pairs(μ, v) fulfill the status $\mu^2 + v^2 \leq 1$. PFSs has stronger utility than the intuitionistic fuzzy sets (IFSs) to modify ambiguity problems.

Yager(2013)raised Pythagorean fuzzy set (PFS) feature usedthe sum of membership and non- membership to one case fulfill criteriaof results may be greater than 1, but sometimes its square sum is less than or equal 1. Thereby, Yager (2013,2014)expansion Pythagorean fuzzy set (PFS)distinguishing feature by a membership and non-membership, that represent the status that the square sum of membership is less than or equal to 1. Yager (2014) suppliedone instanceillustrate status: decision-maker hepreferscase is $\frac{\sqrt{3}}{2}$ and heprefersnon-membership is $\frac{1}{2}$.perhaps results sum of two values is greater than 1,it is inappropriatefor IFS, but it is appropriate for PFS since $(\frac{\sqrt{3}}{2})^2 + (\frac{1}{2})^2 \leq 1$.Obviously, PFS better to modify the ambiguity problems in the actual case.

Recently, Shyi-MingChen (2016) proposed a concept of the centroid point to measure the similarity between two things, which inspired me to interesting in learning to discuss similarity measure of the centroid point extension two PFSs.based on

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transformPythagorean right triangle. moreover Yager (2013) has been verified the pythagorean fuzzy sets (PFSs) haverobust utility than the intuitionistic fuzzy sets (IFSs) to modify ambiguity problems.

In this propramemployed the numerical experiment was robust verification support this S_L^{PC}modelwas usefulness and effectiveness.therefore,proposed $S_L^{PC}$is new similarity measure.

Contents introduced as following,the first section is an introduction, brief introduced fuzzy logic simple background , the second section is preliminaries, introduced the basic concepts on PFSand existing the similarity measure, the third section is employing a new measure of similarity S_L^{PC}based on PFSs with Pythagorean right triangle for the centroid point. The fourth section is a numerical experiment. the last one is the conclusion.

II.PRELIMINARIES

Here start tointroducedprevious many researchers discuss theories and concepts in PFS, and their methods.briefly recall the fundamental doctrine related to Pythagorean Fuzzy Set (PFS), as follows:

II.1 THE BASIC CONCEPTS ON PFS

The Pythagorean theorem is derived from the plane geometry of Euclidean geometry.

The five axioms (public) of Euclidean plane geometry are:

You can draw a straight line from onepoint to another.

Any line segment can extend infinitely into a straight line.

Given an arbitrary line segment, you can use one of its endpoints as the center of the circle, which is used as a radius.

All right angles are equal.

If both lines intersect the third line and the sum of the inner angles on the same side is less than two right angles, the two lines must intersect on this side.

The fifth axiom is called parallel axiom (parallel public), and the proposition is as follows:

"Through a point that is no longer on the line, and there is only one line that does not intersect the line."

Manjil P Saikia (2015) Pythagorean theorem is a well-known result in triangular geometry. The square of the hypotenuse is equal to the sum of the squares of the other sides.

Therefore, if c denotes a right-angled bevel triangle, a and b indicate the other two sides, then the theorem says $c^2 = a^2 + b^2$.The triplet (a, b, c) that satisfies the theorem is called a Pythagorean triad.

Definition 1 Yager (2014)

$$\mathrm{p} = \{(x, u_p(x), u_p(x) | x \in X\}.$$

Definition 2Zhang and Xu(2014)

$s(x) = \mu^2 - v^2$.

Where $(x) \in [-1,1]$.

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Definition 3 Zhang and Xu (2014)

$$a(x) = \mu^2 - v^2$$

Where $a(x) \in [0,1]$

For any two PFSs x_1, x_2.

If $s(x_1) > s(x_2)$, then $x_1 \succ x_2$;

If $s(x_1) = s(x_2)$, then

If $a(x_1) > a(x_2)$, then $x_1 \succ x_2$;

If $a(x_1) = a(x_2)$, then $x_1 \backsim x_2$;

Definition 4 Zhang and Xu(2014),Peng and Yang(2016)

(1)$A^c = \{(x, v_A(x), \mu_A(x))|x \in X\}$;

(2)$A \subseteq B$ iff $\forall\, x \in X,\ \mu_A(x) \leq v_B(x)$ and $v_A(x) \geq v_B(x)$;

(3)$A = B$ iff $\forall\, x \in X \mu_A(x) = \mu_B(x)$ and $v_A(x) = v_B(x)$;

(4)$\emptyset_A = \{(x, 1,0)|x \in X\}$;

(5)$\emptyset_A = \{(x, 0,1)|x \in X\}$;

(6)$A \cap B = \{(x, \mu_A(x) \wedge \mu_B(x), v_A(x) \vee v_B(x)|x \in X\}$;

(7)$A \cup B = \{(x, \mu_A(x) \vee \mu_B(x), v_A(x) \wedge v_B(x)|x \in X\}$;

(8)$A \oplus B = \left\{(x, \sqrt{\mu_A^2(x) + \mu_B^2(x) - \mu_A^2(x)}\right\}$

(9)$A \otimes B = \left\{(x, \mu_A(x)\mu_B(x), \sqrt{v_A^2(x) + v_B^2(x) - v_A^2(x)v_B^2(x)|x \in X}\right\}$;

Definition5 Peng,Yuangand Yang (2017)

($D1$) $0 \leq D(A,B) \leq 1$;

($D2$)$D(A,B) = D(B,A)$;

($D3$)$D(A,B) = 0$ if and only if $A = B$;

($D4$)$D(A,A^c) = 1$if and only if Ais a crisp set;

($D5$) If $A \subseteq B \subseteq 0$, then $D(A,B) \leq D(A,0)$and $(B,0) \leq D(A,0)$.

Definition 6Peng,Yuangand Yang(2017)

($S1$)$0 \leq S(A,B) \leq 1$;

($S2$)$S(A,B) = S(B,A)$;

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$(S3) S(A,B) = 1$if and only if A= B;

$(S4) S(A,B) = 0$if and only if Ais a crisp set;

$(S5)$If $A \subseteq B \subseteq 0$then $S(A,0) \leq S(A,B)$and $(A,0) \leq S(B,0)$.

Brief introduced some of the already exists Similarity Measuresfor PFSs

(1)Peng, Harish Garg 's similarity measureS_{PH1} (2019)

$$S_{PH1}(M,N) = 1 - \sqrt[p]{\frac{1}{2nt_k^p}\sum_{i=1}^{n}\{|(t_k-1)\left(u_N^2(x_i)\right) - \left(v_M^2(x_i) - v_N^2(x_i)\right)|^p + |(t_k-k)\left(u_N^2(x_i)\right) - \left(v_M^2(x_i) - v_N^2(x_i)\right)|^p\}}$$

Peng's similarity measure S_P(2018)

$$S_P(M,N) = 1 - D(M,N) =$$
$$1 - \sqrt[p]{\frac{1}{2n(t+1)^p}\sum_{i=1}^{n}(|(t+1-a)((\mu_M^2(x_i) - \mu_N^2(x_i) - a\left((v_N^2(x_i) - v_N^2(x_i)\right)|^p + |(t+1-b)((v_M^2(x_i) - v_N^2(x_i) - b\left((\mu_N^2(x_i) - \mu_N^2(x_i)\right)|^p)},$$

Wei and Wei's similarity measureS_W(2018)

$$S_W(M,N) = \frac{1}{n}\sum_{i=1}^{n}\frac{\mu_M^2(x_i)\mu_M^2(x_i) + v_N^2(x_i)v_N^2(x_i)}{\sqrt{\mu_M^4(x_i) + v_M^4(x_i)}\sqrt{\mu_N^4(x_i) + v_N^4(x_i)}}$$

Peng et al.'s similarity measure$S_{p1\sim3}$(2017)

$$S_{p1}(M,N) = 1 - \frac{\sum_{i=1}^{n}|\mu_M^2(x_i) - v_M^2(x_i) - (v_N^2(x_i) - v_N^2(x_i))|}{2n},$$

$$S_{p2}(M,N) = \frac{1}{n}\sum_{i=1}^{n}\frac{(\mu_M^2(x_i) \wedge \mu_N^2(x_i)) + (v_M^2(x_i) \wedge v_N^2(x_i))}{(\mu_M^2(x_i) \vee \mu_N^2(x_i)) + (v_M^2(x_i) \vee v_N^2(x_i))},$$

$$S_{p3}(M,N) = \frac{1}{n}\sum_{i=1}^{n}\frac{(\mu_M^2(x_i) \wedge \mu_N^2(x_i)) + (1 - v_M^2(x_i) \wedge (1 - v_N^2(x_i))}{(\mu_M^2(x_i) \vee \mu_N^2(x_i)) + (1 + v_M^2(x_i) \vee (1 + v_N^2(x_i))}.$$

Zhang's similarity measureS_Z(2016)

$$S_Z(M,N)$$
$$= \frac{1}{n}\sum_{i=1}^{n}\frac{|\mu_M^2(x_i) - v_N^2(x_i)| + |v_M^2(x_i) - \mu_N^2(x_i)| + |\pi_M^2(x_i) - \pi_N^2(x_i)|}{|\mu_M^2(x_i) - \mu_N^2(x_i)| + |v_M^2(x_i) - v_N^2(x_i)| + |\pi_M^2(x_i) - \pi_N^2(x_i)| + |\mu_M^2(x_i) - v_N^2(x_i)| + |v_M^2(x_i) - \mu_N^2(x_i)| + |\pi_M^2(x_i) - \pi_N^2(x_i)|}$$

III.A NEW MEASURE OF SIMILARITY DUE TO PFSs FOR THE CENTROID POINT

The concept of new similarity measure was constructed due to the pythagoreanfuzzy sets (PFSs) theorem and the centroid point theorem, shown as following:

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$$S_L^{PC}(A_{x_i}, B_{x_i}) = 1 - \frac{\left|2\left(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)\right) - \left(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)\right)\right|}{2} \times \left(1 - \pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i)\right) - \frac{\left|2\left(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)\right) - \left(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)\right)\right|}{2} \times (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i))$$

Let $\tilde{A} = \{(x_i, \mu_{\tilde{A}}(x_i), v_{\tilde{A}}(x_i))|1 \leq i \leq n\}$be Pythagorean fuzzyset X , where $X = \{x_1, x_2, \dots x_n\}$.

Let $(\mu_{\tilde{A}}(x_i), v_{\tilde{A}}(x_i))$imply the Pythagorean fuzzy value of functionx_ia part of the Pythagorean fuzzy set $\tilde{A}$, where $1 \leq i \leq n$.Initial, presentconversion the Pythagorean fuzzy value $(\mu_{\tilde{A}}(x_i), v_{\tilde{A}}(x_i))$and a fuzzy number$A_{x_i}$,which$1 \leq i \leq n$. Let A_{x_i}be the transformed the Pythagorean fuzzy number, $X = [0,1]$

Through from the pythagorean fuzzy value $(\mu_{\tilde{A}}(x_i), v_{\tilde{A}}(x_i))$with three points $T_{A_{x_i}}^{PFS} = (\mu_{\tilde{A}}(x_i), v_{\tilde{A}}(x_i) + \pi_{\tilde{A}}(x_i))$, $U_{A_{x_i}}^{PFS} = (\mu_{\tilde{A}}(x_i), v_{\tilde{A}}(x_i))$and $V_{A_{x_i}}^{PFS} = (\mu_{\tilde{A}}(x_i) + \pi_{\tilde{A}}(x_i), v_{\tilde{A}}(x_i))$.as shown in Figure 1 . where the distance $\overline{T_{A_{x_i}}^{PFS} U_{A_{x_i}}^{PFS}}$between points $T_{A_{x_i}}^{PFS}$and $U_{A_{x_i}}^{PFS}$on Y-axis is equal to $(v_{\tilde{A}}(x_i) + \pi_{\tilde{A}}(x_i)) - v_{\tilde{A}}(x_i) = \pi_{\tilde{A}}(x_i)$, the distance $\overline{U_{A_{x_i}}^{PFS} V_{A_{x_i}}^{PFS}}$between points $U_{A_{x_i}}$and $V_{A_{x_i}}$on X - axis is equal to $(\mu_{\tilde{A}}(x_i) + \pi_{\tilde{A}}(x_i)) - \mu_{\tilde{A}}(x_i) = \pi_{\tilde{A}}(x_i)$, and the centroid point $C_{A_{x_i}}^{PFS}$of the conversionthe Pythagorean fuzzy number A_{x_i}. Figure 1 shows the following:

$$C_{A_{x_i}}^{PFS} = ((\mu_{\tilde{A}}(x_i) + \tfrac{\sqrt{3}}{2}(\pi_{\tilde{A}}(x_i)), v_{\tilde{A}}(x_i) + \tfrac{1}{2}\pi_{\tilde{A}}(x_i)))$$

Because $\pi_{\tilde{A}}(x_i) = 1 - \mu_{\tilde{A}}(x_i) - v_{\tilde{A}}(x_i)$, we can get

$$C_{A_{x_i}}^{PFS} = (\mu_{\tilde{A}}(x_i) + \tfrac{\sqrt{3}}{2}\pi_{\tilde{A}}(x_i)), v_{\tilde{A}}(x_i) + \tfrac{1}{2}\pi_{\tilde{A}}(x_i))$$

$$=(\mu_{\tilde{A}}(x_i) + \tfrac{\sqrt{3}}{2}\ (1 - \mu_{\tilde{A}}(x_i) - v_{\tilde{A}}(x_i)), v_{\tilde{A}}(x_i) + \tfrac{1}{2}(1 - \mu_{\tilde{A}}(x_i) - v_{\tilde{A}}(x_i))$$

$$=2(\mu_{\tilde{A}}(x_i) + \tfrac{\sqrt{3}}{2}(1 - \mu_{\tilde{A}}(x_i) - v_{\tilde{A}}(x_i)), (2\left(v_{\tilde{A}}(x_i) + \tfrac{1}{2}(1 - \mu_{\tilde{A}}(x_i) - v_{\tilde{A}}(x_i)\right))$$

$$=(\frac{2\ (\mu_{\tilde{A}}(x_i) + \sqrt{3}\left(1 - \mu_{\tilde{A}}(x_i) - v_{\tilde{A}}(x_i)\right)}{2}, \frac{2\left(v_{\tilde{A}}(x_i) + (1 - \mu_{\tilde{A}}(x_i) - v_{\tilde{A}}(x_i)\right)}{2})$$

$$=(\frac{\sqrt{3} - (2 + \sqrt{3})\mu_{\tilde{A}}(x_i) - \sqrt{3}v_{\tilde{A}}(x_i)}{2}, \frac{1 - \mu_{\tilde{A}}(x_i) + v_{\tilde{A}}(x_i)}{2})$$

Also, we can get

$$C_{B_{x_i}}^{PFS} = ((\mu_{\tilde{B}}(x_i) + \tfrac{\sqrt{3}}{2}(\pi_{\tilde{B}}(x_i)), v_{\tilde{B}}(x_i) + \tfrac{1}{2}\pi_{\tilde{B}}(x_i)))$$

Because $\pi_{\tilde{B}}(x_i) = 1 - \mu_{\tilde{B}}(x_i) - v_{\tilde{B}}(x_i)$, we can get

$$C_{B_{x_i}}^{PFS} = (\mu_{\tilde{B}}(x_i) + \tfrac{\sqrt{3}}{2}\pi_{\tilde{B}}(x_i)), v_{\tilde{B}}(x_i) + \tfrac{1}{2}\pi_{\tilde{B}}(x_i))$$

$$=(\mu_{\tilde{B}}(x_i) + \tfrac{\sqrt{3}}{2}\ (1 - \mu_{\tilde{B}}(x_i) - v_{\tilde{B}}(x_i)), v_{\tilde{B}}(x_i) + \tfrac{1}{2}(1 - \mu_{\tilde{B}}(x_i) - v_{\tilde{B}}(x_i))$$

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$=2\left(\mu_{\tilde{B}}(x_i)+\frac{\sqrt{3}}{2}(1-\mu_{\tilde{B}}(x_i)-v_{\tilde{B}}(x_i)\right),\left(2\left(v_{\tilde{B}}(x_i)+\frac{1}{2}(1-\mu_{\tilde{B}}(x_i)-v_{\tilde{B}}(x_i)\right)\right)$

$=\left(\frac{2\left(\mu_{\tilde{B}}(x_i)+\sqrt{3}\left(1-\mu_{\tilde{B}}(x_i)-v_{\tilde{B}}(x_i)\right)\right)}{2},\frac{2\left(v_{\tilde{B}}(x_i)+(1-\mu_{\tilde{B}}(x_i)-v_{\tilde{B}}(x_i)\right)}{2}\right)$

$=\left(\frac{\sqrt{3}-(2+\sqrt{3})\mu_{\tilde{B}}(x_i)-\sqrt{3}v_{\tilde{B}}(x_i)}{2},\frac{1-\mu_{\tilde{B}}(x_i)+v_{\tilde{B}}(x_i)}{2}\right)$

From Fig.1, we can see that $\overline{T^{PFS}_{A_{x_i}}U^{PFS}_{A_{x_i}}}=\overline{U^{PFS}_{A_{x_i}}V^{PFS}_{A_{x_i}}}=\pi_A(x_i)$ where $\overline{T^{PFS}_{A_{x_i}}U^{PFS}_{A_{x_i}}}$ denotes the distance between the point $T^{PFS}_{A_{x_i}}=\left(\mu_{\tilde{A}}(x_i),v_{\tilde{A}}(x_i)+\pi_{\tilde{A}}(x_i)\right)$ and the point $U^{PFS}_{A_{x_i}}=\left(\mu_{\tilde{A}}(x_i),v_{\tilde{A}}(x_i)\right)$ on the Y-axis . $\overline{U^{PFS}_{A_{x_i}}V^{PFS}_{A_{x_i}}}$denotes the similarity measure between the point $U^{PFS}_{A_{x_i}}=\left(\mu_{\tilde{A}}(x_i),v_{\tilde{A}}(x_i)\right)$and $V^{PFS}_{A_{x_i}}=\left(\mu_{\tilde{A}}(x_i)+\pi_{\tilde{A}}(x_i),v_{\tilde{A}}(x_i)\right)$,on the X-axis and $\pi_{\tilde{A}}(x_i)$imply the degree of indeterminacy of functionx_ia part of the Pythagorean fuzzy set $\tilde{A}$, where$\pi_{\tilde{A}}(x_i)=1-\mu_{\tilde{A}}(x_i)-v_{\tilde{A}}(x_i),\pi_{\tilde{A}}(x_i)\in[0,1]$ and $1\le i\le n$.

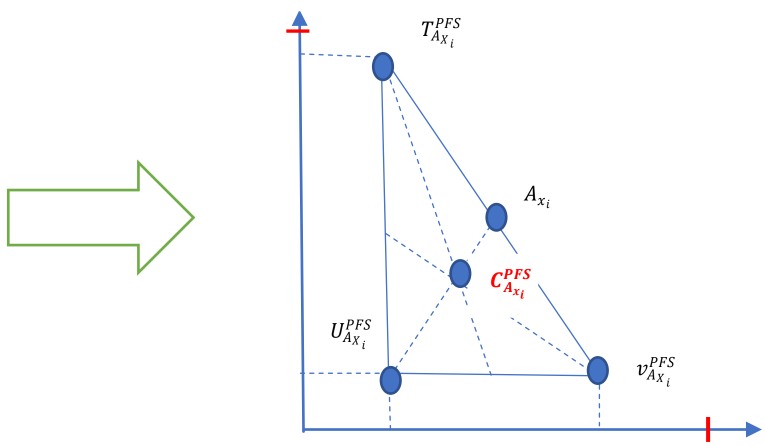

Fig 1: A New Similarity Measure of PFSs due to The Centroid Point

Let $A_{x_i}$and B_{x_i}be two the Pythagorean fuzzy numbers conversion from the Pythagorean fuzzy value $\left(\mu_{\tilde{A}}(x_i),v_{\tilde{A}}(x_i)\right)$and $\left(\mu_{\tilde{B}}(x_i),v_{\tilde{B}}(x_i)\right)$of function$x_i$a part of the Pythagorean fuzzy sets $\tilde{A}$and $\tilde{B}$,separately, as shown in Figure 2.the centroid points $C_{A_{x_i}}$and $C_{B_{x_i}}$of the conversionthe Pythagorean fuzzy number $A_{x_i}$and B_{x_i}.Figure 2 shows in the following:

$$C_{A_{x_i}}=\left(\frac{\sqrt{3}-(2+\sqrt{3})\mu_{\tilde{A}}(x_i)-\sqrt{3}v_{\tilde{A}}(x_i)}{2},\frac{1-\mu_{\tilde{A}}(x_i)+v_{\tilde{A}}(x_i)}{2}\right)$$

$$C_{B_{x_i}}=\left(\frac{\sqrt{3}-(2+\sqrt{3})\mu_{\tilde{B}}(x_i)-\sqrt{3}v_{\tilde{B}}(x_i)}{2},\frac{1-\mu_{\tilde{B}}(x_i)+v_{\tilde{B}}(x_i)}{2}\right)$$

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According to Figure 2,the degree of similarity measure S(A_{x_i},B_{x_i}) between the Pythagorean fuzzy value $(\mu_{\tilde{A}}(x_i), v_{\tilde{A}}(x_i))$ and $(\mu_{\tilde{B}}(x_i), v_{\tilde{B}}(x_i))$ is calculated as follows:

$$s(A_{x_i}, B_{x_i}) = 1 - \frac{\left|2\left(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)\right) - \left(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)\right)\right|}{2} \times \left(1 - \pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i)\right) - \frac{\left|2\left(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)\right) - \left(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)\right)\right|}{2} \times \left(\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i)\right)$$

$S_L^{PC}(A_{x_i}, B_{x_i}) = 1 - \frac{\left|\frac{\sqrt{3}}{2}\left(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)\right) - \left(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)\right)\right|}{2} \times \left(1 - \left(\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i)\right)\right) - \left|\frac{\sqrt{3}}{2}\left(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)\right) - \left(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)\right)\right| \times \left(\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i)\right).$

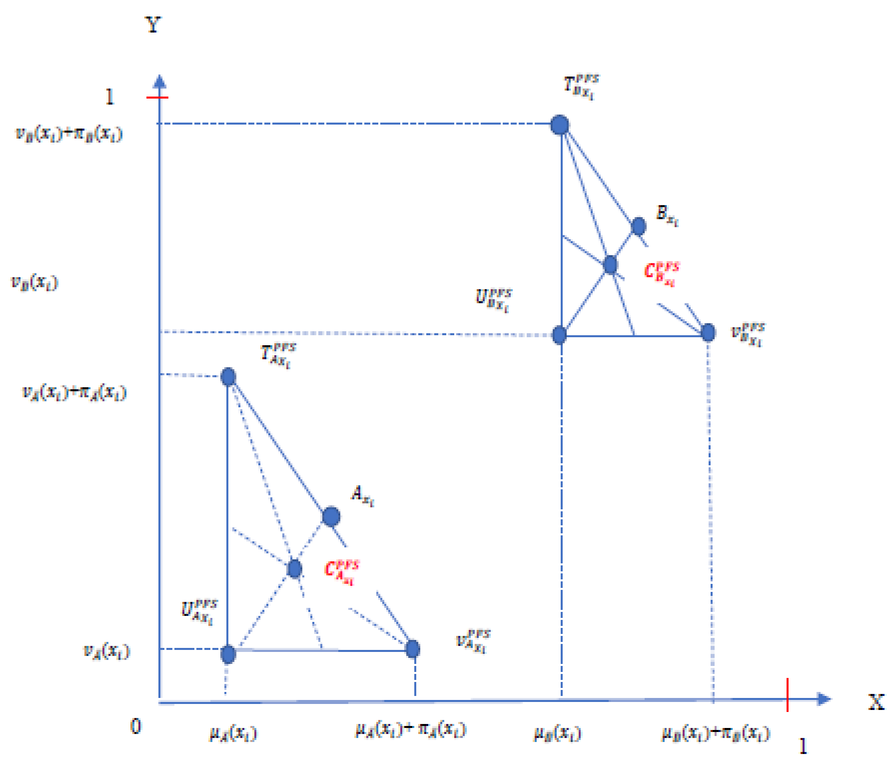

Fig 2: The transformed the Pythagorean fuzzy number A_{x_i} and B_{x_i} of the Pythagorean fuzzy values $(\mu_{\tilde{A}}(x_i), v_{\tilde{A}}(x_i))$ and $(\mu_{\tilde{B}}(x_i), v_{\tilde{B}}(x_i))$, respectively.

LetA_{x_i}, $B_{x_i}$and C_{x_i}be three transformed Pythagorean fuzzy numbers of the Pythagorean fuzzy value $(\mu_{\tilde{A}}(x_i), v_{\tilde{A}}(x_i))$, $(\mu_{\tilde{B}}(x_i), v_{\tilde{B}}(x_i))$and $(\mu_{\tilde{c}}(x_i), v_c(x_i))$of function$x_i$a part of the Pythagorean fuzzy sets $\tilde{A}$, $\tilde{B}$and $\tilde{C}$, separately, where $1 \le i \le n$.Their properties are represented as following.

Here raised a new similarity measure according to Peng and Yuang and Yang (2017), definition 6, illustrated as proof as below properties,separately:

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Property 3.1 0≤ $S(M,N) \leq 1$

Proof:

Assume that $\mu_{\tilde{A}}(x_i) = \mu_{\tilde{B}}(x_i) = 1$and assume that $v_{\tilde{A}}(x_i) = v_{\tilde{B}}(x_i) = 0$, then $\pi_{\tilde{A}}(x_i) = 1 - \mu_{\tilde{A}}(x_i) - v_{\tilde{A}}(x_i) = 1 - 1 - 0 = 0$and $\pi_{\tilde{B}}(x_i) = 1 - \mu_{\tilde{B}}(x_i) - v_{\tilde{B}}(x_i) = 1 - 1 - 0 = 0$. Based on Eq.

$$S_L^{PC}(A_{x_i}, B_{x_i}) = 1 - \frac{|\sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)) - (v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))|}{2} \times \left(1 - (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i))\right) - \frac{|\sqrt{3}(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)) - (\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i))|}{2} \times (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i))$$

We can get

$$S_L^{PC}(A_{x_i}, B_{x_i}) = 1 - \frac{|\sqrt{3}(1-0) - (0-1)|}{2} \times \left(1 - (0-0)\right) - \frac{|\sqrt{3}(0-1) - (1-0)|}{2} \times (0-0)$$

= 0

Assume that $\mu_{\tilde{A}}(x_i) = \mu_{\tilde{B}}(x_i) = 1$and assume that $v_{\tilde{A}}(x_i) = v_{\tilde{B}}(x_i) = 0$, then based on eq.,

$$S_L^{PC}(A_{x_i}, B_{x_i}) = 1 - \frac{|\sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)) - (v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))|}{2} \times \left(1 - (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i))\right) - \frac{|\sqrt{3}(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)) - (\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i))|}{2} \times (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i))$$

We can get

$$S_L^{PC}(A_{x_i}, B_{x_i}) = 1 - |\sqrt{3}(1-1) - (0-0)| \times \left(1 - (0-0)\right) - |\sqrt{3}(0-0) - (1-1)| \times (0-0)$$

$$= 1.$$

Property 3.2 $S(M,N) = S(N,M)$;

Proof:

Because $1 - \frac{|\sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)) - (v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))|}{2} = 1 - \frac{|\sqrt{3}(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)) - (\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i))|}{2}$.Where fromEq.

$$S_L^{PC}(A_{x_i}, B_{x_i}) = 1 - \frac{|\sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)) - (v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))|}{2} \times \left(1 - (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i))\right) - \frac{|\sqrt{3}(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)) - (\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i))|}{2} \times (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i))$$

$$= \frac{\left|\sqrt{3}(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)) - (\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i))\right|}{2} \times (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i)) - \frac{\left|1 - \sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)) - (v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))\right|}{2} \times (1 - (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i)))$$

$$= S_L^{PC}(B_{x_i}, A_{x_i})$$

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Consequently, $S_L^{PC}(A_{x_i}, B_{x_i}) = S_L^{PC}(B_{x_i}, A_{x_i})$is proved.

Property 3.3$S(M,N) = 1$ if and only if $M = N$;

Proof:

If $S_L^{PC}(A_{x_i}, B_{x_i}) = 1$, then based on Eq

$S_L^{PC}(A_{x_i}, B_{x_i}) = 1 - \frac{|\sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)) - (v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))|}{2} \times \left(1 - (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i))\right) - \frac{|\sqrt{3}(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)) - (\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i))|}{2} \times (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i))$=1

Then, we can get

$\frac{|\sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)) - (v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))|}{2} \times \left(1 - (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i))\right) + \frac{|\sqrt{3}(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)) - (\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i))|}{2} \times (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i))$=1

Then, we can get

$\frac{|\sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)) - (v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))| + |\sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)) - (v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))|}{2} \times 1$=1

Therefore, we can get

$\frac{\sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i))}{2} = \frac{\sqrt{3}(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))}{2}$if $\frac{(\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i))}{2} \times \frac{|\sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)) - (v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))|}{2} - \frac{|\sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)) - (v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))|}{2}$= 0

Then we can get that

$\frac{\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i)}{2} = 0$ or $\frac{|\sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)) - (v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))|}{2} - \frac{|\sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)) - (v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))|}{2} = 0$

The proof is proved.

Property 3.4 $S(M,N) = 0$ if and only if M is a crisp set. (Omitted)

Property 3.5If $M \subseteq N \subseteq 0$ then $S(M,0) \leq S(M,N)$ and $(M,0) \leq S(N,0)$.

Proof:

$$S_L^{PC}(A_{x_i}, B_{x_i}) = 1 - \frac{|\sqrt{3}(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)) - (v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i))|}{2} \times \left(1 - (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i))\right) - \frac{|\sqrt{3}(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)) - (\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i))|}{2} \times (\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i))$$

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$$=1-\left(\frac{\left|\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\right|}{2}\right)(1)-\left(\frac{\left|\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\right|}{2}\right)\left(\pi_{\tilde{A}}(x_i)\right)-\left(\frac{\left|\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\right|}{2}\right)\left(\pi_{\tilde{B}}(x_i)\right)-\left(\frac{\left|\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)-\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\right|}{2}\right)\left(\pi_{\tilde{A}}(x_i)\right)-\left(\frac{\left|\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)-\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\right|}{2}\right)\left(\pi_{\tilde{B}}(x_i)\right)$$

$$=1-\left(\frac{\left|\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\right|}{2}\right)-\left(\frac{\left|\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)\right|}{2}\right)-\left(\frac{\left|\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)\right|}{2}\right)-\left(\frac{\left|\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)-\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)\right|}{2}\right)-\left(\frac{\left|\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)-\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)\right|}{2}\right)$$

$$=1-\left(\left|\frac{\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)}{2}-\frac{\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}-\frac{\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)}{2}-\frac{\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}-\frac{\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)}{2}-\frac{\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)}{2}\right|\right)$$

$$=1-\left(\left|\frac{\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)}{2}-\frac{\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}-\frac{\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)}{2}-\frac{\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}-\frac{\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}\right|\right)-(\left|\frac{\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)}{2}-\frac{\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)}{2}\right|)$$

$$=1-\left(\left|\frac{(\sqrt{3}-1)(\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{(\sqrt{3}-1)(\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right))}{2}\right|\right)-(|\frac{(\sqrt{3}-1)(\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right))}{2}|)-(|\frac{(\sqrt{3}-1)(\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right))}{2}|)-(\left|\frac{(\sqrt{3}-1)\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)}{2}\right|)$$

$$=1-(|\frac{\sqrt{3}-1}{2}(\,|(\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)|-\left|\left(\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)\right)\right|-\left|\left(\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)\right)\right|-\left|\left(\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)\right)\right|-\left|\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)\left(\pi_{\tilde{B}}(x_i)\right)\right||$$

$$=1-|\frac{\sqrt{3}-1}{2}(\,|\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\right)|)|$$

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Because $\mu_{\tilde{A}}(x_i) \le \mu_{\tilde{C}}(x_i)$ and $v_{\tilde{A}}(x_i) \ge v_{\tilde{C}}(x_i)$, we can see that $\frac{\sqrt{3}}{2}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right) \le 0$ and $\frac{\sqrt{3}}{2}\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)-\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right) \ge 0$. Thus, based on Eq. $P_c S(A_{x_i}, C_{x_i})$, we can get

$$S_L^{PC}(A_{x_i}, C_{x_i}) = 1 - \left|\frac{\sqrt{3}}{2}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\right| \times \left(1-\left(\pi_{\tilde{A}}(x_i)-\pi_{\tilde{C}}(x_i)\right)\right) - \left|\frac{\sqrt{3}}{2}\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right) - \left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\right| \times \left(\pi_{\tilde{A}}(x_i)-\pi_{\tilde{C}}(x_i)\right)$$

$$=1-\left(\frac{\left|\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\right|}{2}\right)(1)-\left(\frac{\left|\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\right|}{2}\right)\left(\pi_{\tilde{A}}(x_i)\right)-\left(\frac{\left|\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\right|}{2}\right)\left(\pi_{\tilde{C}}(x_i)\right)-\left(\frac{\left|\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)-\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\right|}{2}\right)\left(\pi_{\tilde{A}}(x_i)\right)-\left(\frac{\left|\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)-\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\right|}{2}\right)\left(\pi_{\tilde{C}}(x_i)\right)$$

$$=1-\left(\frac{\left|\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\right|}{2}\right)-\left(\frac{\left|\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)\right|}{2}\right)-\left(\frac{\left|\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{C}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{C}}(x_i)\right)\right|}{2}\right)-\left(\frac{\left|\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)-\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)\right|}{2}\right)-\left(\frac{\left|\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{C}}(x_i)\right)-\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{C}}(x_i)\right)\right|}{2}\right)$$

$$=1-\left(\left|\frac{\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)}{2}-\frac{\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}-\frac{\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{C}}(x_i)\right)}{2}-\frac{\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{C}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}-\frac{\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{C}}(x_i)\right)}{2}-\frac{\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{C}}(x_i)\right)}{2}\right|\right)$$

$$=1-\left(\left|\frac{\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)}{2}-\frac{\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}-\frac{\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{C}}(x_i)\right)}{2}-\frac{\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{C}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}-\frac{\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{\sqrt{3}\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{C}}(x_i)\right)}{2}-\frac{\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{C}}(x_i)\right)}{2}\right|\right)$$

$$=1-\left(\left|\frac{(\sqrt{3}-1)(\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)-\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)}{2}\right|\right)-\left(\left|\frac{(\sqrt{3}-1)(\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right))}{2}\right|\right)-\left(\left|\frac{(\sqrt{3}-1)(\left(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{C}}(x_i)\right))}{2}\right|\right)-\left(\left|\frac{(\sqrt{3}-1)(\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{A}}(x_i)\right))}{2}\right|\right)-\left(\left|\frac{(\sqrt{3}-1)\left(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i)\right)\left(\pi_{\tilde{C}}(x_i)\right)}{2}\right|\right)$$

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$=1\text{-}(|\frac{\sqrt{3}-1}{2}(\,|((\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i))-(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i))|-\left|\left((\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{A}}(x_i))\right)\right|-$
$\left|\left((\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))\right)\right|-\left|\left((v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{A}}(x_i))\right)\right|-|(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))||$

$=1\text{-}|\frac{\sqrt{3}-1}{2}(\,|(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i))-(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i))|)|$

Moreover , because $\mu_{\tilde{B}}(x_i)\leq\mu_{\tilde{C}}(x_i)$ and $v_{\tilde{B}}(x_i)\geq v_{\tilde{C}}(x_i)$. we can see that $\frac{\sqrt{3}}{2}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))-(v_{\tilde{B}}(x_i)-$ vCxi≤0. and 32 vBxi− vCxi−μBxi−μCxi≥0. Thus, based on Eq. PcSBxi,Cxi, we can get

$$S_L^{PC}(B_{x_i},C_{x_i})=1-|\frac{\sqrt{3}}{2}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))-(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))|\times\left(1-(\pi_{\tilde{B}}(x_i)-\pi_{\tilde{C}}(x_i))\right)-|\frac{\sqrt{3}}{2}(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))-(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))|\times(\pi_{\tilde{B}}(x_i)-\pi_{\tilde{C}}(x_i))$$

$$=1-\left(\frac{\left|\sqrt{3}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))-(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))\right|}{2}\right)(1)-\left(\frac{\left|\sqrt{3}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))-(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))\right|}{2}\right)(\pi_{\tilde{A}}(x_i))-\left(\frac{\left|\sqrt{3}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))-(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))\right|}{2}\right)(\pi_{\tilde{C}}(x_i))-\left(\frac{\left|\sqrt{3}(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))-(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))\right|}{2}\right)(\pi_{\tilde{A}}(x_i))-\left(\frac{\left|\sqrt{3}(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))-(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i))\right|}{2}\right)(\pi_{\tilde{C}}(x_i))$$

$$=1-\left(\frac{\left|\sqrt{3}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))-(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))\right|}{2}\right)-\left(\frac{\left|\sqrt{3}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i))-(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i))\right|}{2}\right)-\left(\frac{\left|\sqrt{3}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))-(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))\right|}{2}\right)-\left(\frac{\left|\sqrt{3}(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i))-(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i))\right|}{2}\right)-\left(\frac{\left|\sqrt{3}(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))-(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))\right|}{2}\right)$$

$$=1-\left(\left|\frac{\sqrt{3}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))}{2}-\frac{(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))}{2}\right|\right)-\left(\left|\frac{\sqrt{3}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i))}{2}-\frac{(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i))}{2}\right|\right)-\left(\left|\frac{\sqrt{3}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))}{2}-\frac{(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))}{2}\right|\right)-\left(\left|\frac{\sqrt{3}(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i))}{2}-\frac{(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i))}{2}\right|\right)-\left(\left|\frac{\sqrt{3}(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))}{2}-\frac{(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))}{2}\right|\right)3$$

$$=1-\left(\left|\frac{\sqrt{3}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))}{2}-\frac{(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))}{2}\right|\right)-\left(\left|\frac{\sqrt{3}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i))}{2}-\frac{(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i))}{2}\right|\right)-\left(\left|\frac{\sqrt{3}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))}{2}-\frac{(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))}{2}\right|\right)-\left(\left|\frac{\sqrt{3}(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i))}{2}-\frac{(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i))}{2}\right|\right)-(\left|\frac{\sqrt{3}(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))}{2}-\frac{(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))}{2}\right|)$$

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$=1-\left(\left|\frac{(\sqrt{3}-1)((\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))-(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))}{2}\right|\right)-$
$\left(\left|\frac{(\sqrt{3}-1)((\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i)))}{2}\right|\right)-(|\frac{(\sqrt{3}-1)((\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i)))}{2}|)-(|\frac{(\sqrt{3}-1)((v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i)))}{2}|)-$
$(\left|\frac{(\sqrt{3}-1)(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))}{2}\right|)$

$=1-(|\frac{\sqrt{3}-1}{2}(\ |((\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))-(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))|-\left|((\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i)))\right|-$
$\left|((\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i)))\right|-\left|((v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{B}}(x_i)))\right|-|(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))(\pi_{\tilde{C}}(x_i))||$

$=1-|\frac{\sqrt{3}-1}{2}(\ |(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))-(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))|)|$

Then, we can get

(i)$S_L^{PC}(A_{x_i},B_{x_i})-S_L^{PC}(A_{x_i},C_{x_i})$

$=1-|\frac{\sqrt{3}-1}{2}(\ |(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i))-(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i))|)|-1-|\frac{\sqrt{3}-1}{2}(\ |(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i))-(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i))|)|$

$=|\frac{\sqrt{3}-1}{2}(v_{\tilde{B}}(x_i)+v_{\tilde{C}}(x_i)-\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))|$

(ii)$S_L^{PC}(B_{x_i},C_{x_i})-S_L^{PC}(A_{x_i},C_{x_i})$

$=1-|\frac{\sqrt{3}-1}{2}(\ |(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{C}}(x_i))-(v_{\tilde{B}}(x_i)-v_{\tilde{C}}(x_i))|)|-1-|\frac{\sqrt{3}-1}{2}(\ |(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{C}}(x_i))-(v_{\tilde{A}}(x_i)-v_{\tilde{C}}(x_i))|)|$

$=|\frac{\sqrt{3}-1}{2}(\mu_{\tilde{B}}(x_i)-\mu_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)-v_{\tilde{A}}(x_i))|$

Because $\mu_{\tilde{A}}(x_i)\le\mu_{\tilde{B}}(x_i)\le\mu_{\tilde{C}}(x_i)$ and $v_{\tilde{A}}(x_i)\ge v_{\tilde{B}}(x_i)\ge v_{\tilde{C}}(x_i)$. We can get $\mu_{\tilde{B}}(x_i)-\mu_{\tilde{A}}(x_i)\ \ge 0$ and $v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i)\ge 0$. Because $0\le\pi_{\tilde{A}}(x_i)\le 1$and $0\le\pi_{\tilde{B}}(x_i)\le 1$. we can get $0\le\pi_{\tilde{B}}(x_i)+\pi_{\tilde{A}}(x_i)\le 2$. Thus , we can get $1-|\frac{\sqrt{3}-1}{2}(\ |(\mu_{\tilde{A}}(x_i)-\mu_{\tilde{B}}(x_i))-(v_{\tilde{A}}(x_i)-v_{\tilde{B}}(x_i))|)|\ge 0$. Therefore , we can get $S_L^{PC}(B_{x_i},C_{x_i})-S_L^{PC}(A_{x_i},C_{x_i})\ge 0$ That is,$S_L^{PC}(A_{x_i},C_{x_i})\le S_L^{PC}(B_{x_i},C_{x_i})$.From (i) and (ii), we can state that if $\tilde{A}\sqsubseteq\tilde{B}\sqsubseteq\tilde{C}$, then $S_L^{PC}(A_{x_i},C_{x_i})\le S_L^{PC}(A_{x_i},B_{x_i})AndS_L^{PC}(A_{x_i},C_{x_i})\le S_L^{PC}(B_{x_i},C_{x_i})$.

Let X be PFSs , where X ={$x_1,x_2\ ...\ x_n$}, and let $\tilde{A}=\{(x_i,\mu_{\tilde{A}}(x_i),v_{\tilde{A}}(x_i))|1\le i\le n\}$and $\tilde{B}=\{(x_i,\mu_{\tilde{B}}(x_i),v_{\tilde{B}}(x_i))|1\le i\le n\}$,be two PFSs X, where $(\mu_{\tilde{A}}(x_i),v_{\tilde{A}}(x_i))$and $(\mu_{\tilde{B}}(x_i),v_{\tilde{B}}(x_i))$ are the Pythagorean fuzzy values of functionx_ia part of the Pythagorean fuzzy sets $\tilde{A}$and $\tilde{B}$is shown as follows:

$S_L^{PC}(\tilde{A},\tilde{B})$=$w_1\times S_L^{PC}(A_{x_1},B_{x_1})+w_2\times S_L^{PC}(A_{x_2},B_{x_2})+\cdots+w_n\times S_L^{PC}(A_{x_n},B_{x_n})=\sum_{i=1}^{n}(w_i\times S_L^{PC}(A_{x_i},B_{x_i}))$

Where $S_L^{PC}(\tilde{A},\tilde{B})\in\left(\frac{\sqrt{3}}{2}\right)^2+\left(\frac{1}{2}\right)^2\le 1$. $w_i$is the weight of function,$\sum_{i=1}^{n}w_i=1$, $A_{x_i}$and $B_{x_i}$are the corresponding conversion PFN of the Pythagorean fuzzy values $(\mu_{\tilde{A}}(x_i),v_{\tilde{A}}(x_i))$and $(\mu_{\tilde{B}}(x_i),v_{\tilde{B}}(x_i))$of function$x_i$a part of PFSs$\tilde{A}$and $\tilde{B}$, separately, $S_L^{PC}(A_{x_1},B_{x_1})$is the degree of similarity measure between the Pythagorean fuzzy values $(\mu_{\tilde{A}}(x_i),v_{\tilde{A}}(x_i))$and $(\mu_{\tilde{B}}(x_i),v_{\tilde{B}}(x_i))$Through by the raised similarity measure of the pythagorean fuzzy values describe$S_L^{PC}(A_{x_1},B_{x_1})$and

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$1 \leq i \leq n$. The larger the value of $S_L^{PC}(\tilde{A},\tilde{B})$, upper the degree of similarity measure between the Pythagorean fuzzy sets $\tilde{A}$and $\tilde{B}$.where $S_L^{PC}(\tilde{A},\tilde{B}) \in \left(\frac{\sqrt{3}}{2}\right)^2 + (\frac{1}{2})^2 \leq 1$.

IV.COMPARISON NEW SIMILARITY MEASURE S_L^{PC} WITH ALREADY EXISTS SIMILARITY MEASURES FOR PFS

In this work,proposed new similarity measure S_L^{PC}comparison with ones selected some similarity measures based onPFS form the already exists similarity measures, as Table 1.and as followsS_L^{PC}:

$$S_L^{PC}(A_{x_i},B_{x_i}) = 1 - \frac{\left|2\left(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)\right) - \left(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)\right)\right|}{2} \times \left(1 - \pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i)\right) - \frac{\left|2\left(v_{\tilde{A}}(x_i) - v_{\tilde{B}}(x_i)\right) - \left(\mu_{\tilde{A}}(x_i) - \mu_{\tilde{B}}(x_i)\right)\right|}{2} \times \left(\pi_{\tilde{A}}(x_i) - \pi_{\tilde{B}}(x_i)\right)$$

IV.1 Numerical experiments

The numerical experiments are tested new similarity measure $\boldsymbol{S_L^{PC}}$with already existssimilarity for PFS , in this paper, choose six cases and methods of S_P(2018),$S_{PH1}(2019)$, $S_{PH2}(2019)$,S_w(2018) ,$S_{P1}(2017)$, $S_{P2}(2017)$, $S_{P3}(2017)$$S_Z$(2016) practical calculated,respectively.as Table 1 to3, shown in the following:

Table 1: The comparison outcome of the new similarity measure $S_L^{PC}$with some of the already existssimilarity measures for PFSs adopted from Peng and Harish Garg (2019)

	Case1	Case2	Case3	Case4	Case5	Case6
M	$\{(x,0.5,0.5)\}$	$\{(x,0.6,0.4)\}$	$\{(x,0,0.87)\}$	$\{(x,0.6,0.27)\}$	$\{(x,0.125,0.075)\}$	$\{(x,0.5,0.45)\}$
N	$\{(x,0,0)\}$	$\{(x,0,0)\}$	$\{(x,0.28,0.55)\}$	$\{(x,0.28,0.55)\}$	$\{(x,0.175,0.025)\}$	$\{(x,0.55,0.4)\}$
S_P (2018)	0.9167	0.9	0.7336	0.7444	0.99	0.9525
S_{PH1} (2019)	0.9167	0.9	0.7336	0.7444	0.99	0.9525
S_W (2018)	N/A	N/A	0.968	0.438	0.9476	0.9812
S_{P1} (2017)	1	0.9	0.7336	0.7444	0.99	0.9525
S_{P2} (2017)	0	0	0.3621	0.2284	0.4483	0.8119
S_{P3} (2017)	0.6	0.6176	0.3133	0.6028	0.9806	0.9168

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S_Z (2016)	0.5	0.5	0.5989	0.1696	0.625	0.6557
S_L^{PC}	1	0.9	N/A	0.6919	0.75	1

Case1~case6 adopted from Peng and Harish Garg (2019).

See Table 1, obviously showing the similarity measure S_L^{PC}(Proposed) is comparison with decided candidatesS_P(2018),$S_{PH1}(2019)$, $S_{PH2}(2019)$,S_w(2018),$S_{P1}(2017)$, $S_{P2}(2017)$, $S_{P3}(2017)$, S_Z(2016) ranking results as follows Table 2:

Table 2: The ranking and candidates

case	Case 1 to Case 6 comparison ranking	The best Candidates
1	$S_L^{PC} = S_{P1} \succ S_{PH1} \succ \text{Sp} \succ S_{P3} \succ S_Z \succ S_{P2} \succ S_w$	$S_L^{PC} = S_{P1}$
2	$S_L^{PC} = S_P = S_{PH1} = S_{P1} \succ S_{P3} \succ S_Z \succ S_{P2} \succ S_w$	S_L^{PC}
3	$S_w \succ S_P = S_{PH1} = S_{P1} \succ S_Z \succ S_{P2} \succ S_{P3} \succ S_L^{PC}$	S_w
4	$S_P = S_{PH1} = S_{P1} \succ S_L^{PC} \succ S_{P3} \succ S_w \succ S_{P2} \succ S_z$	$S_{P=S_{PH1}=S_{P1}}$
5	$S_P = S_{PH1} = S_{P1} \succ S_{P3} \succ S_w \succ S_L^{PC} \succ S_z \succ S_{P2}$	$S_{P=S_{PH1}=S_{P1}}$
6	$S_L^{PC} \succ S_w \succ S_P = S_{PH1} = S_{P1} \succ S_{P3} \succ S_{P2} \succ S_Z$	S_L^{PC}

It was got five candidates from Table 2, according to taking the ordering from the weights of the candidates shown in table 3.

Table 3: Comparison of ordering the weight candidates

The best Candidates	The total weights of case calculated	Order
S_L^{PC}	Case 1(1) + case 2 (0.9)+case 6 (1) = 2.9	1
S_P	Case 4 (0.7444) + case 5 (0.99) = 1.7344	3
S_{P1}	Case1(1)+case 4(0.7444) + case 5(0.99)= 2.7344	2
S_w	Case 3 (0.968) =0.968	5
S_{PH1}	Case 5 (0.99) =0.99	4

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V.CONCLUSION

The result was S_L^{PC}compared with some of the existing similarity measures of PFSS_W, S_P,S_{PH1},S_{P1}, S_{P2}, S_{P3}, S_Z,shown as Tables 1 to 3 to illustrate the candidates ordering outcomes were. Obviously,S_L^{PC} priority order is first, which means this research method is usefulness and effectiveness.

REFERENCES

[1] Animesh Biswas, Biswajit Sarkar (2019). Interval-valued Pythagorean fuzzy TODIM approach hrough point operator-based similarity measures for multicriteria group decision making.Kyber nets. vol.48 :3 ,496-519.
[2] Alexander R. Pruss.(2006) .The principle of sufficient reason: a reassessment. Cambridge University Press. 2006: 11.ISBN0-521-85959-X.
[3] Decui Liang, Zeshui Xu (2017). The New extension of TOPSIS method for multiple criteria decision making with hesitant Pythagorean fuzzy sets. Applied Soft Computing 60 (2017) 167-179.
[4] Eric W. Weisstein.(2003).The parallel postulate is equivalent to the Equidistance postulate.Playfair axiom,Proclus axiom. theTriangle postulate and the Pythagorean theorem. CRC concise encyclopedia of mathematics.2nd.: 2147 ISBN 1-58488-347-2 .
[5] Garg, H., and Kumar, K. (2018). An advanced study on the similarity measures of intuitionistic fuzzy sets based on the set pair analysis theory and their application in decision making. Soft Computing. https://doi.org/10.10 07/s0 050 0- 018- 3202- 1.
[6] Guiwu Wei, Yu Wei (2018). Similarity measures of Pythagorean fuzzy sets based on the cosine function and their applications. Int J Intell Syst .2018:33:634-652.
[7] Guiwu Wei, Yu Wei (2018). Similarity measures of Pythagorean fuzzy sets based on the cosine function and their applications. Int J Intell Syst. 2018; 33: 634–652.
[8] Harish Garg (2017). A new Improved Score Function of An Interval-value Pythagorean Fuzzy Set Based TOPSIS Method. International Journal for Uncertainty Quantification,7(5):463-474(2017)
[9] Hoang Nguyen (2016). A novel similarity/dissimilarity measure for intuitionistic fuzzy sets and its application in pattern recognition. Expert Systems with Applications 45 (2016) 97–107.
[10] Liang DC, Xu ZS (2017). The new extension of TOPSIS method for multiple criteria decision making with hesitant Pythagorean fuzzy sets. Appl Soft Comput 60:167–179.
[11] Liang DC, Xu ZS, Liu D, Wu Y (2018). Method for three-way decisions using ideal TOPSIS solutions at Pythagorean fuzzy information. Inf Sci 435:282–295.
[12] Liu Y, Qin Y, Han Y (2018). Multiple criteria decision making with probabilities in interval-valued pythagorean fuzzy setting. Int J Fuzzy Syst 20:558–571.
[13] Manjil P Saikia (2016). The Pythagoras Theorem. Asia Pacific Mathematics Newsletter. September 2015, Volume 5 No 2.
[14] Peng (2018).Newsimilarity measure and distance measure for Pythagorean fuzzy Set,Complex& intelligent Systems. https//doi.org/10.1007/s40747-018-0084-x.
[15] Peng (2018).New Operations for Interval-value Pythagorean Fuzzy Set.https://www.researchgate.net/publication/32315/323157686.
[16] Peng (2016).Fundamental Properties of Pythagorean Fuzzy Aggregation Operations.https://www.researchgate.net/publication/310758917.
[17] Peng, Dai J (2017). Approaches to Pythagorean Fuzzy stochastic multi-criteria decision making based on prospect theory and regret theory with new distance measure and score function. Int J Intell Syst 32:1187–1214.
[18] Peng (2018). New similarity measure and distance measure for Pythagorean fuzzy set. Complex & Intelligent Systems. https://doi.org/10.1007/s40747-018-0084-x .
[19] Peng.,Huiyong Yuan, Yong Yang (2017). Pythagorean Fuzzy Information Measuresand Their Applications. Int J Intell Syst. 32: 991–1029.
[20] Peng., Harish Garg (2019). Multiparametric similarity measures on Pythagorean fuzzy sets with applications to pattern recognition. Applied Intelligence. Advance online publication. doi : 10.1007/s10489-019-01445-0.
[21] Qian,Jiang,Xin Jin, Shin-Jye Lee, Shaowen Yao(2019). A new similarity/distance measure between intuitionistic fuzzy sets based on the transformed isosceles triangles and its applications to pattern recognition. Expert Systems with Applications.116,239-453.
[22] S.M. Chen,S.H. Cheng, T.C. Lan (2016). A novel similarity measure between intuitionistic fuzzy sets based on the centroid points of transformed fuzzy numbers with applications to pattern recognition, Information Science,Vol.20, 15-40.
[23] S. M. Chen, S. H.Cheng and C. H.Chiou (2016a). Fuzzy multiattribute group decision making based on intuitionistic fuzzy sets and evidential reasoning methodology. Information Fusion, 27, 215–227.
[24] S. M. Chen, S. H.Cheng and T. C. Lan (2016b). A novel similarity measure between intuitionistic fuzzy sets based on the centroid points of transformed fuzzy numbers with applications to pattern recognition. Information Sciences, 343, 15–40 .
[25] SumeraNaz, Samina Ashraf and Muhammad Akam (2018). A Novel Approach to Decision – Making with Pythagorean Fuzzy Information, Mathematics,6,95;doi: 10,3390/math6060095.
[26] Stephen W. Hawking (2005).God Created the Integers,cited work. ,ISBN0-7624-1922-9.
[27] Xiaolu Zhang (2016). A Novel Approach Based on Similarity Measure for Pythagorean Fuzzy Multiple Criteria Group Decision Making. Int J Intell Syst. 31: 593–611.