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(An Autonomous Institution, Affiliated to Anna University, Chennai)

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Department of Mathematics

Organizes

International Webinar on

"Neutrosophic Sets"

Day 2:

Title: The recent advances of Neutrosophic theory

(4th August 2020, Tuesday, 1:30 p.m. to 2.30 p.m. IST)

Prof. Said Broumi

Laboratory of Information Processing,
Faculty of Science Ben M'Sik,
University Hassan II, Casablanca, Morocco

Objectives of this session

- Notions of neutrosophic set, neutrosophic logic with examples.
- Neutrosophic theory indexed in the most known scientific Databases
- Geomertic representation of Neutrosophic Cube
- Extensions of neutrosophic set
- Applications
- Neutrosophic tools
- etc

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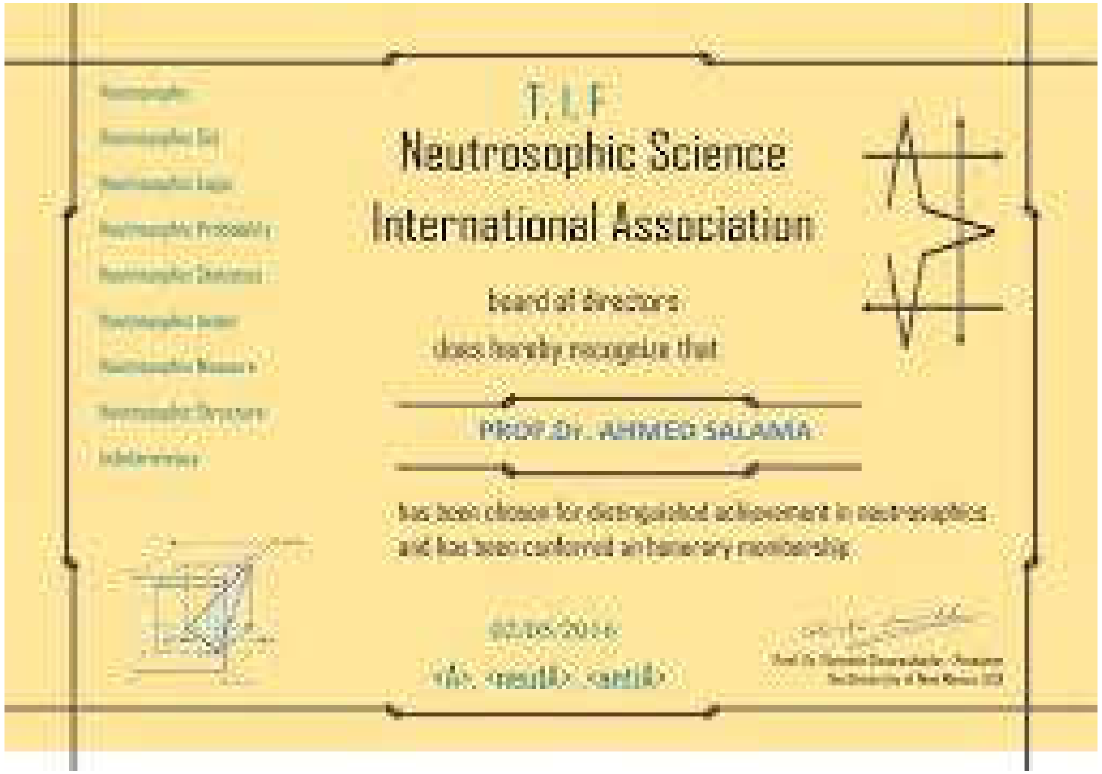

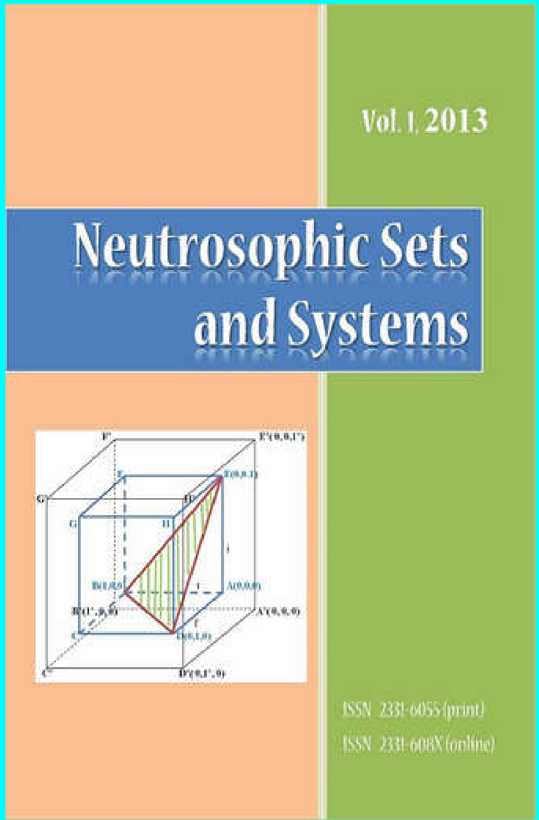

Neutrosophic Sets and Systems

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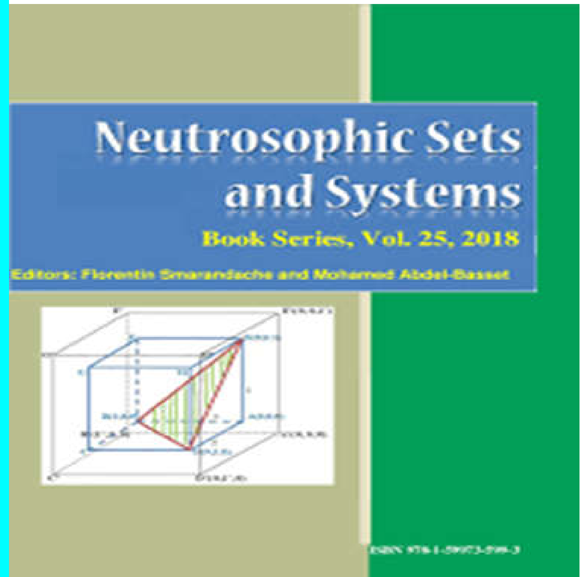

Download Neutrosophic ToolBoxes:

Said Broumi (2019). Neutrosophic Logic Toolbox Package_ Neutrosophic Matrices. MATLAB Central File Exchange.

Haitham A. El-Ghareeb (2019), Novel Open Source Python Neutrosophic Package.

Maikel Leyva Vazquez (2018, using Jupyter). Neutrosophic Computation and and Linear Equations & Neutrosofia: Nuevos avances en el tratamiento de la incertidumbre.

Google Scholar

Publicaciones principales

Categorías > Engineering & Computer Science > **Fuzzy Systems**

	Publicación	Índice h5	Mediana h5
1.	Applied Soft Computing	96	123
2.	IEEE Transactions on Fuzzy Systems	87	117
3.	Knowledge-Based Systems	85	121
4.	Soft Computing	60	86
5.	Journal of Intelligent & Fuzzy Systems	50	79
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8.	International Journal of Approximate Reasoning	37	51
9.	Granular Computing	34	57
10.	Neutrosophic Sets and Systems	28	38
11.	International Journal of Information Technology & Decision Making	24	44

Florentin Smarandache 00:00 (il y a 3 minutes)

À Mohamed, moi, Saeid, 952518336@qq.com, A.A.A., Mumtaz, aslam_ravian, Le, hoda, Darjan, Ahmed

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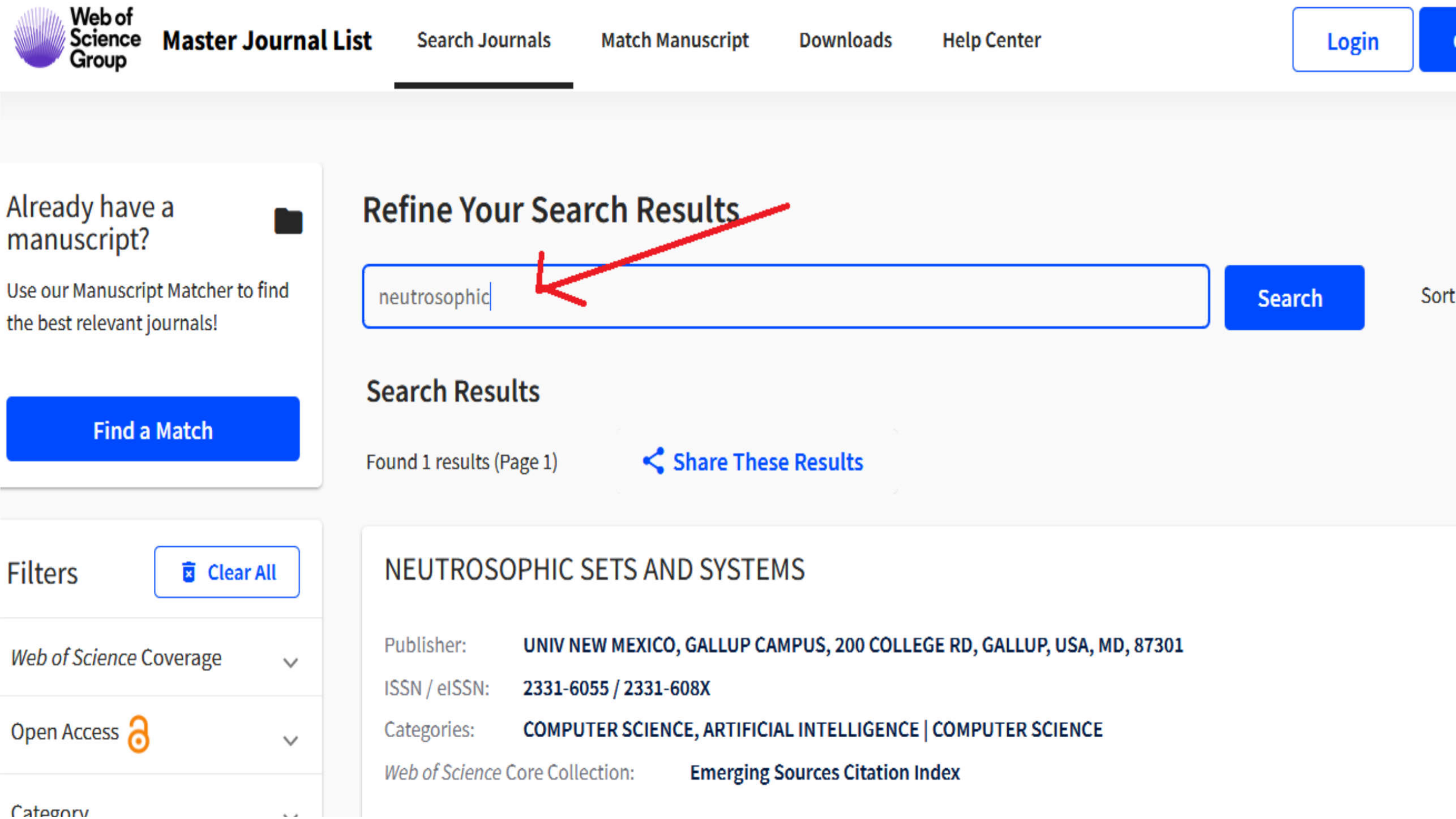
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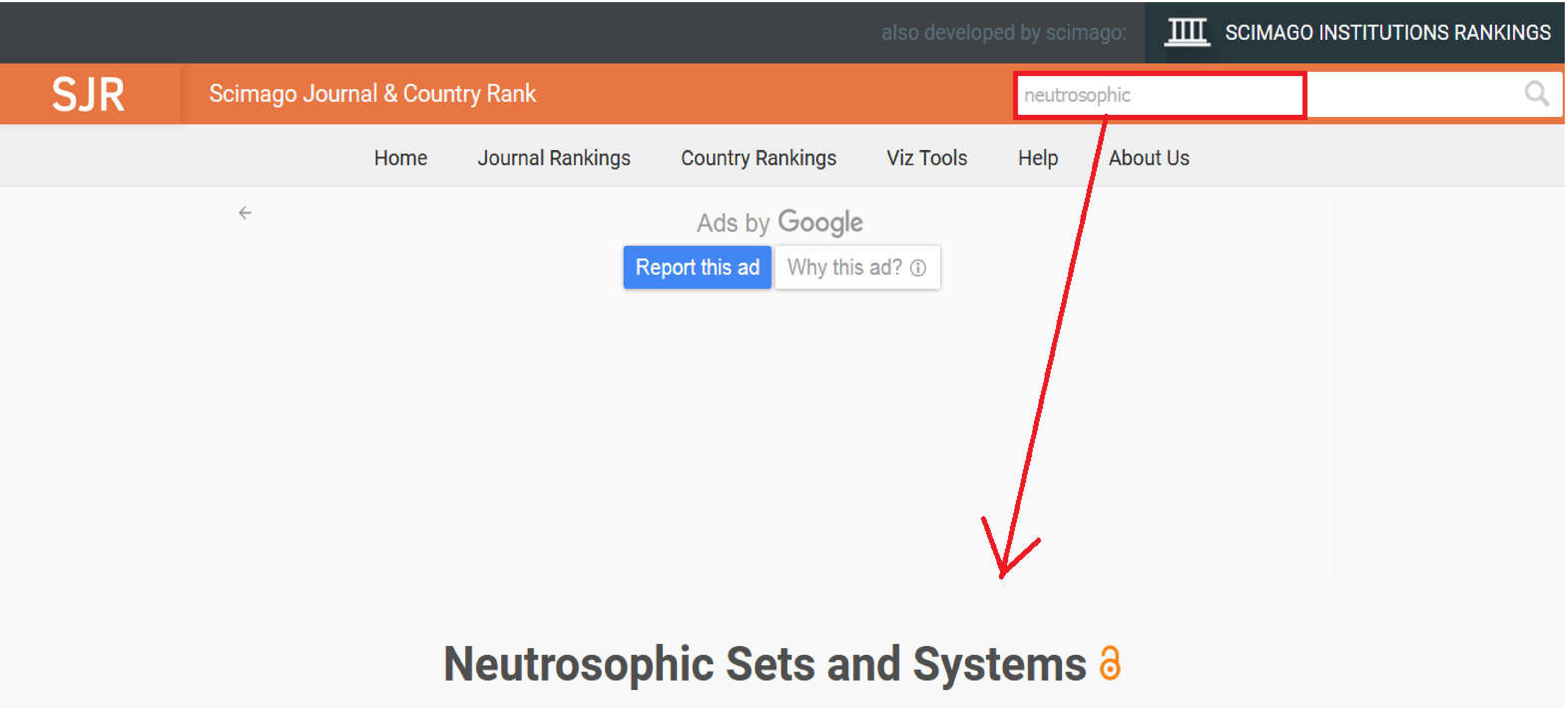
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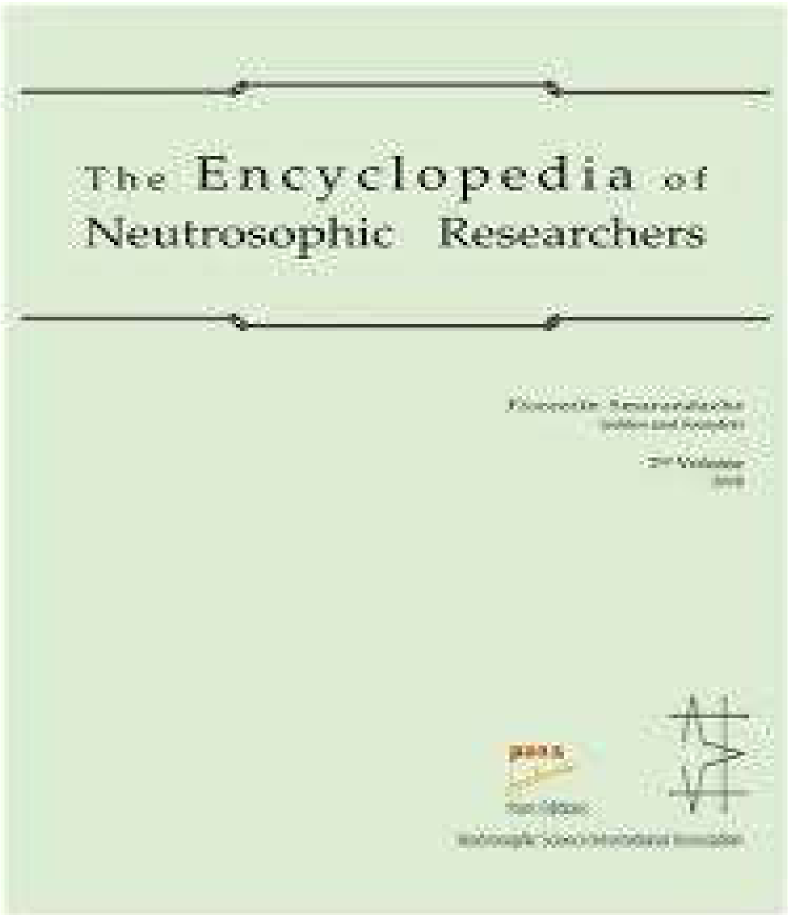

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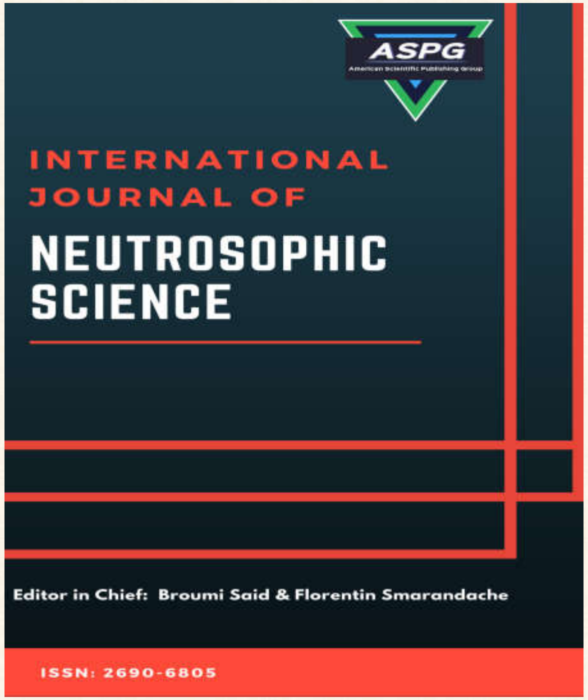

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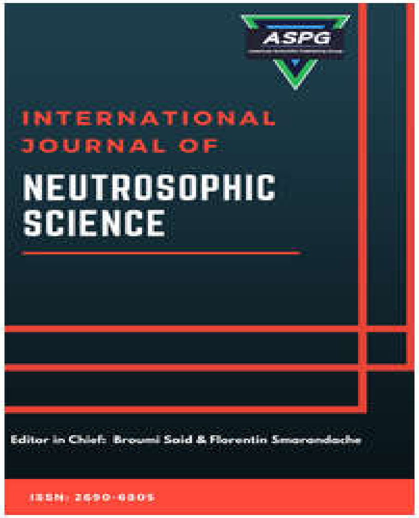

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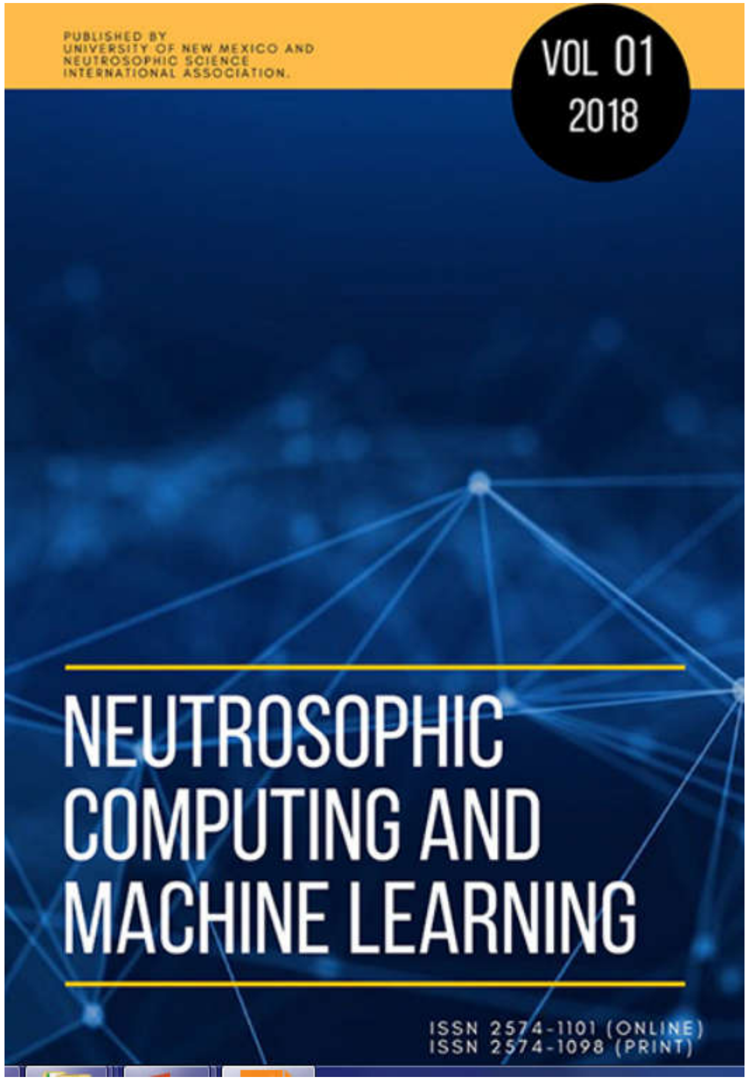

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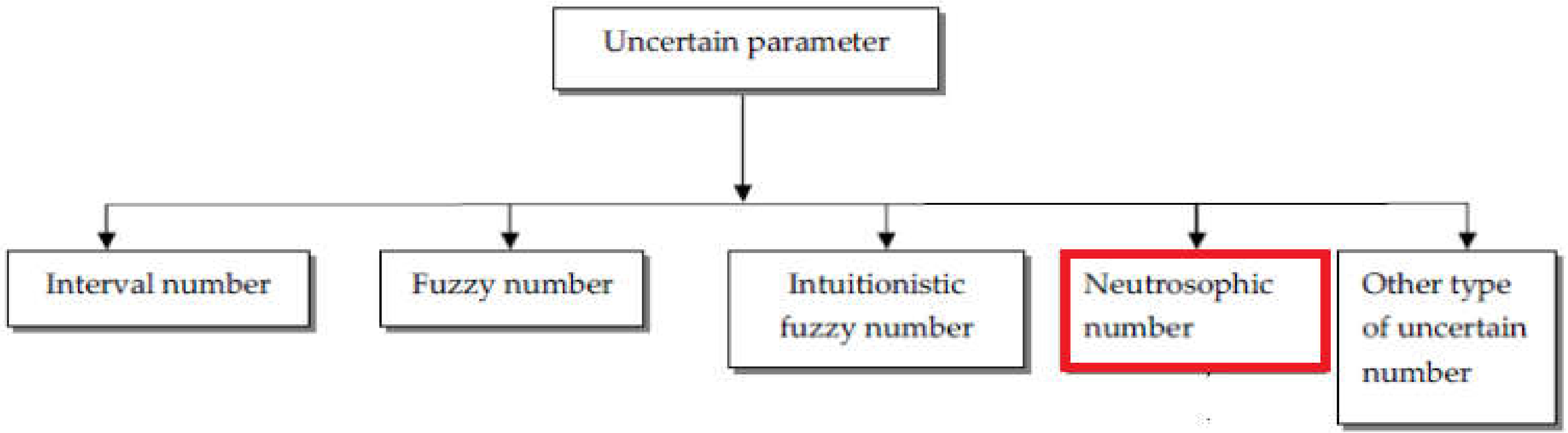
Conferences organized in china on neutrosophic in2019



Some basic differences between some uncertain parameters:

If we take Interval number [1] then we can see,

1,The information belongs to a certain interval

2. There is no concept of membership function

If we take Fuzzy number , then we can see,

1. The concept of belongingness of the elements comes
2. The use of membership function is present

If we take Intuitionistic fuzzy number , then we can see,

1. The concept of belongingness and non-belongingness of the elementscomes
2. The use of membership and non-membership function is present

If we take Neutrosophic number , then we can see,

1. The concept of truthiness, falsity, and indeterminacy of the elements comes
2. The use of membership function for truthiness, falsity, and indeterminacy is present

Limit of the Boolean logic

to measure the proposition P = "In 2021 there will be a terrorist attack"? Because in Boolean logic he has to say either P = 0 or P = 1 [only God can say this!].

There are things that are neither black nor white, but also gray...

	Type of Logic	Founder
1	Fuzzy logic (T)	L. Zadeh (1965)
2	Intuitionistic fuzzy logic (T,F)	K.Atanassov (1983)
3	Neutrosophic logic (T,I,F)	F. Smarandache (1995)

L. Zadeh (1965)

Fuzzy logic and fuzzy sets (T)

Zadeh's FS is characterized by one part: Truth
Fuzzy logic handles the concepts of partial truth, that is, the truth with values betwen « completely true or 1 » and « completely false or 0 »

Fuzzy sets: represent the membership without expressing the corresponding degree of non membership so it provides an imperfect expression of uncertain information. The degree of nonmembership in fuzzy sets is the complement of membership for fuzzy sets, Therefore the nonmembership is not independent.

A fuzzy set cannot express the information about **rejection**.

A fuzzy set is defined as $A = \{(x, T(x))\}$, where
$0 \leq T \leq 1$; T is A function in [0, 1].

[4] L. Zadeh, "Fuzzy logic and approximate reasoning," Synthese, vol. 30, no. 3-4, 1975, pp. 407–428

K.Atanassov (1983)

Intuitionistic fuzzy logic and
Intuitionistic fuzzy sets (T,F)

Intuitionstic fuzzy sets is an extension of **fuzzy sets** which describes vaguness and impresion by a range of membership values.
intuitionistic fuzzy set give a degree of membership and a degree of non-membership of an element in a given set
Atanassov introduced the intuitionistic fuzzy set (IFS) to **bring in non-membership.**

Intuitionistic fuzzy sets, as well as vague sets, are suitable in simulating the impreciseness of human understanding in decision making by representing degree of membership and nonmembership, but it also cannot express indeterminacy degree which is the ignorance value between truth and false.

An **Intuitionistic fuzzy sets is defined as A = {(x, T(x), F(x))}, where**

$0 \leq T + F \leq 1$; T, F are functions in [0, 1].

[2] K. Atanassov, "Intuitionistic fuzzy sets: theory and applications", Physica, New York, 1999.

Florentin Smarandache

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University of New Mexico, 705 Gurley Ave., Gallup, New Mexico 87301, USA

FOUNDER OF NEUTROSOPHIC LOGIC(SET)

- In 1995, he generalized framework for unification of many existing logics, such as fuzzy logic, paraconsistent logic, intuitionistic logic, etc. The main idea of NL is to characterize each logical statement in a 3D Neutrosophic Space, where each dimension of the space represents respectively
- **1) the truth (T)**
- **2) the falsehood (F) and**
- **3)the indeterminacy (I)**

of the statement under consideration, where T, I, F are standard or non-standard real subsets of $]^{-}0, 1^{+}[$ with not necessarily any connection between them.

Definition: Neutrosophic set

Let X be a non empty set, then the set A = {(x, μ_A(x), σ_A(x), π_A(x)) : x ∈ X} is called a neutrosophic set on X, where −0 ≤ μ_A(x)+ σ_A(x), +π_A(x)≤ 3 + for all x ∈ X, μ_A(x), σ_A(x) *and* π_A(x)∈] −0, 1 +[are the degree of membership the degree of indeterminacy and the degree of non membership of each x ∈ X to the set A respectively.

Definition:

The following statements are true for neutrosophic sets A and B on X:

(i). μ_A(x) ≤ μ_B(x), σ_A(x) ≥ σ_B(x) and π_A(x) ≥ π_B(x) for all x ∈ X if and only if A ⊆ B.

(ii) A ⊆ B and B ⊆ A if and only if A = B.

(iii) A ∩ B = {(x, min{ μ_A(x), μ_B(x)},min{σ_A(x) , $\sigma_B(x)$},max{π_A(x) , π_B(x) }) : x ∈ X}.

(iv) A ∪ B = {(x,max{ μ_A(x), μ_B(x)},max{σ_A(x) , σ_B(x)},min{π_A(x) , π_B(x)}) : x ∈ X}

(v) A^C = {(x, $\pi_A(x)$, $1-\sigma_A(x)$, μ_A(x)): x ∈ X}

F. Smarandache (1995)

Neutrosophic logic and neutrosophic sets(T,I,F)

Fig. 1. An example of indeterminacy. What is tossed, 1, 3 or 5?

Smarandache's NS is characterized by three parts: truth, indeterminacy, and falsity. Truth, indeterminacy and falsity membership values behave independently and deal with the problems of having uncertain, indeterminant and imprecise data

[1] F. Smarandache, "Neutrosophy. Neutrosophic Probability, Set, and Logic," ProQuest Information & Learning, Ann Arbor, Michigan, USA, 105 p., 1995

Florentine and Wang et al. [*] gave a new concept of single valued neutrosophic set (SVNS) and defined the set of theoretic operators in an instance of NS called SVNS

A single valued neutrosophic set is defined as A = {(x, T(x), I(x), F(x))}, where

$0 \leq T + I + F \leq 3$; T, I, F are functions in [0, 1].

[*] H. Wang, F. Smarandache, Y. Zhang and R.Sunderraman, "Single Valued Neutrosophic Sets," Multispace and Multisrtucture 4, 2010, pp.410-413.

Indeterminacy

- Indeterminacy is present everywhere in real life. If a die is tossed on a irregular surface then there is no clear face to see. Indeterminacy occurs due to defects in creation of physical space or defective making of physical items involved in the events. Indeterminacy occurs when we are not sure of any event. Neutrosophic logic will help us to consider this indeterminacy.

Fig. 1. An example of indeterminacy. What is tossed, 1, 3 or 5?

Indeterminacy

- **Indeterminacy exists almost everywhere in the whole world:**
- **if weather reports say that the probability of rain tomorrow is 70 % then it does not mean that the probability of not raining is 30% because there are some hidden weather factor like jet stream, weather fronts etc that the reporter are not aware of. So there is some ambiguity that leads to indeterminacy.**
- **Different doctors have different views on the same diagnosis of patient's disease so, indeterminacy exists there,**

- In classical set theory, the membership of elements in a set is assessed in binary terms 0 and 1; according to a bivalent condition-an element either belongs or does not belong to the set.
- As an extension, fuzzy set theory permits the gradual assessment of the membership of elements in a set. A fuzzy set A in X is characterised by a membership function which is associated with each element in X, a real number in the interval [0,1].
- Lotfi A Zadeh [1] introduced a theory whose objects fuzzy sets-are sets with imprecise boundaries which allow us to represent vague concepts and contexts in natural language.
- Fuzzy set theory is limited to modelling a situation involving uncertainty.
- As an extension of fuzzy set concept, the theory of intuitionistic fuzzy sets introduced whose elements have degree of membership and non membership.
- Intuitionistic fuzzy sets have been introduced by Krassimir Atanassov [2] as an extension of Lotfi Zadeh's notion of fuzzy set.
- Let us have a fixed universe X and A is a subset of X .The intuitionistic fuzzy set can be defined as where . for membership μ and ν for non membership, which belongs to the real unit interval [0,1] and sum belongs to the same interval.

Neutrosophic logic /set

As an alternative to the existing logics, Smarandache proposed the neutrosophic Logic to represent a mathematical model of

- **uncertainty** **vagueness,**
- **ambiguity,** **imprecision,** **undefined,**
- **unknown,** **incompleteness,** **inconsistency,**
- **redundancy,** **Contradiction,**

where the concept of neutrosophy is a new branch of philosophy introduced by Smarandache.

F. Smarandache. A Unifying Field in Logics: Neutrosophic Logic. Neutrosophy, Neutrosophic Set, Neutrosophic Probability", American Research Press, Rehoboth, NM, 1999.

Neutrosophy

- Neutrosophy is a new branch of philosophy introduced by Florentin Smarandache, which is studying the origin, nature and scope of neutralities as well as their interactions with different additional spectral (i.e. notions or ideas located between the two extremes, supporting neither nor).
- Etymologically, neutro-sophy [French neuter < Latin neuter, neutral and Greek sophia, skill/wisdom] means knowledge of neutral thought and started in 1995.

- The fundamental theory of neutrosophy is:

Every idea <A> tends to be neutralized, diminished, balanced by <nonA> ideas (not only <antiA> as Hegel asserted) -as a state of equilibrium: <nonA> = what is not <A>,

<antiA> = the opposite of <A>,

and <neutA> = what is neither <A> nor <antiA>.

Neutrosophy consider a proposition, theory, event, concept, or entity, “A” in relation to its opposite, “AntiA” and which is not “A”, “Non –A”, and that which is neither “A” nor “Anti-A”, denoted by “Neut-A”.

Neutrosophy is the basis of, neutrosophic set, neutrosophic logic, neutrosophic probability and neutrosophic statistic.

- the neutrosophic triplet (<A>, <neutA>, <antiA>) works when it makes sense in our real world, when it does exist in our everyday life -- not always.
- For example, if <A> = small, then <antiA> = big, and <neutA> = medium; it works.
- But if <A> = table, then it is not possible to say "anti-table" or "neut-table"!

- In a classical way ”A”,”neutA”, and”antiA” are disjoint two by two. Nevertheless, since in many cases the borders between notions are vague and imprecise, it is possible that ”A”, ”neutA”, and ”antiA” have common parts two by two, or even all three of them as well.
- A neutrosophic set is defined as A = {(x, T(x), I(x), F(x))},

Where $0 \leq T + I + F \leq 3$; T, I, F are functions in [0, 1].

Example : In a soccer game there are three chances: to win (<A>), to have a tie game (<neutA>), or to loose (<antiA>).

The Neutrosophy's Triplet is (<A>, <neutroA>, <antiA>),

where <A> may be an item (concept, idea, proposition, theory, structure, algebra, etc.),

<antiA> the opposite of <A>,

while <neutroA> {also the notation <neutA> was employed before} the neutral between these opposites.

Based on the above triplet the following Neutrosophic Principle one has: a law of composition defined on a given set may be true (T) for some set elements, indeterminate (I) for other set's elements, and false (F) for the remainder of the set's elements.

- Neutrosophy is a new branch of philosophy and logic introduced by Florentin Smarandache in 1995 which studies the origin and features of neutralities in nature.
- Each proposition in Neutrosophic logic is approximated to have the percentage of truth (T), the percentage of indeterminacy (I) and the percentage of falsity (F).
- So this Neutorsophic logic is called generalization of classical logic, conventional fuzzy logic, intuitionistic fuzzy logic and interval valued fuzzy logic.
- This mathematical tool is used to handle problems like imprecise, indeterminate and inconsistent data.
- The use of neutrosophic theory becomes inevitable when a situation involving indeterminacy is to be modelled

Neutrosophic Set

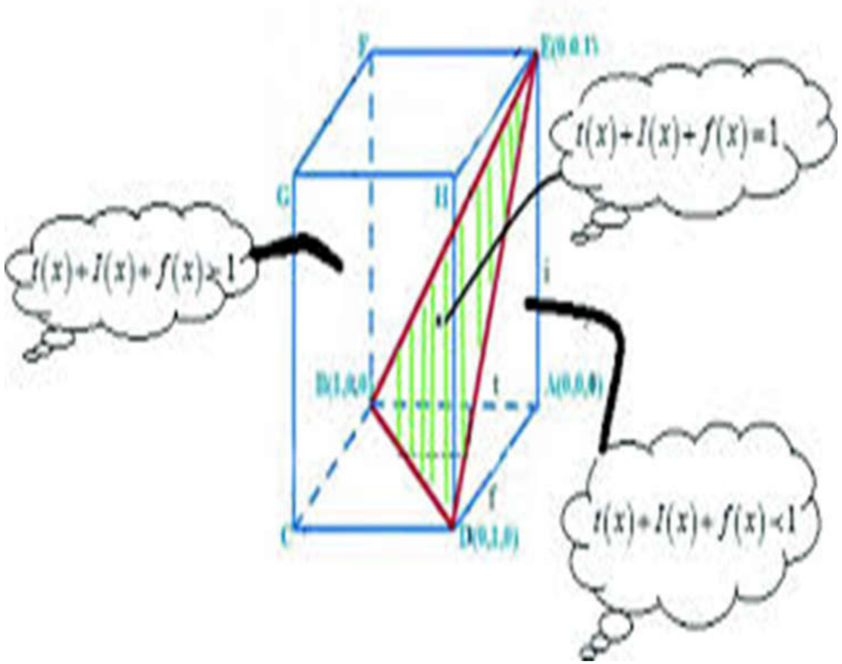
- **Let *X be a space of points (objects), with a generic element in X denoted by x. A neutrosophic set A in X is* characterized by a truth membership function *TA, an indeterminacy-membership function IA and a falsity membership* function *FA. TA(x), IA(x) and FA(x) are real standard or non-standard subsets.***
- **To maintain consistency with the classical and fuzzy logics and with probability, there is the special case where $t + i + f = 1$.**
- **But to refer to intuitionistic logic, which means incomplete information on a variable, proposition or event one has $t + i + f < 1$.**
- **Analogically, referring to paraconsistent logic, which means contradictory sources of information about a same logical variable, proposition, or event one has $t + i + f > 1$.**

Neutrosophic logic

- It was created by Florentin Smarandache (1998) and is an extension/combination of the fuzzy logic, intuitionistic logic, paraconsistent logic. In neutrosophic logic, in an easy way, every logical variable x is described by an ordered triple.x= (t, i, f)

where t is the degree of truth, f is the degree of false and i is the level of indeterminacy. T, I, and F are called *neutrosophic components, representing the truth, indeterminacy, and falsehood values* respectively referring to neutrosophy, neutrosophic logic, neutrosophic components, neutrosophic set.

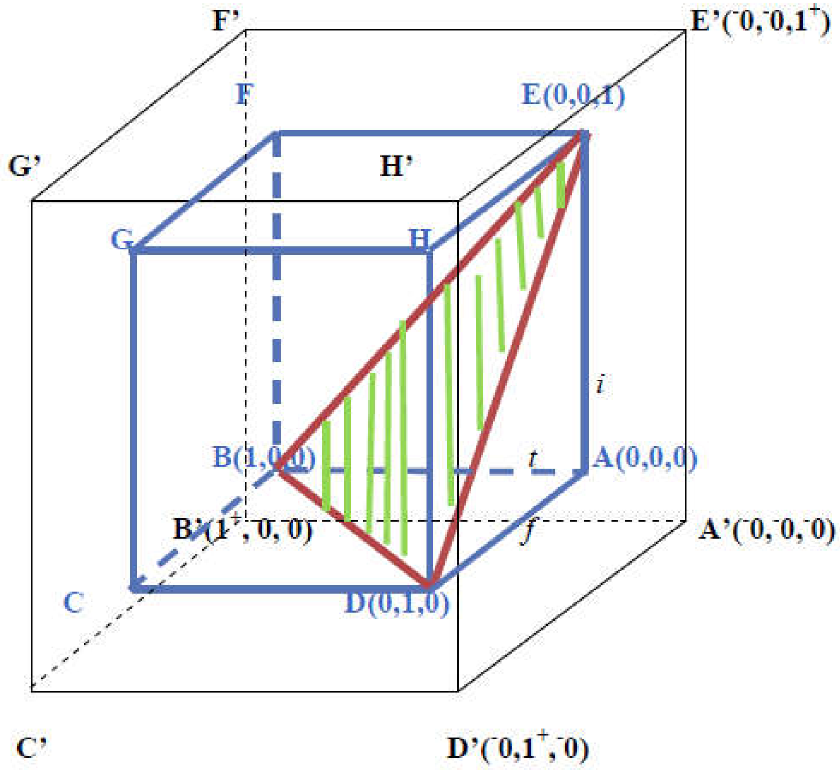
Every element of the NS's features has not only a certain degree of truth(T), but also a falsity degree (F) and indeterminacy degree(I). This concept is generated from many others such as crisp set, intuitionistic fuzzy set, fuzzy set, interval-valued fuzzy set, interval-valued intuitionistic fuzzy set, etc.



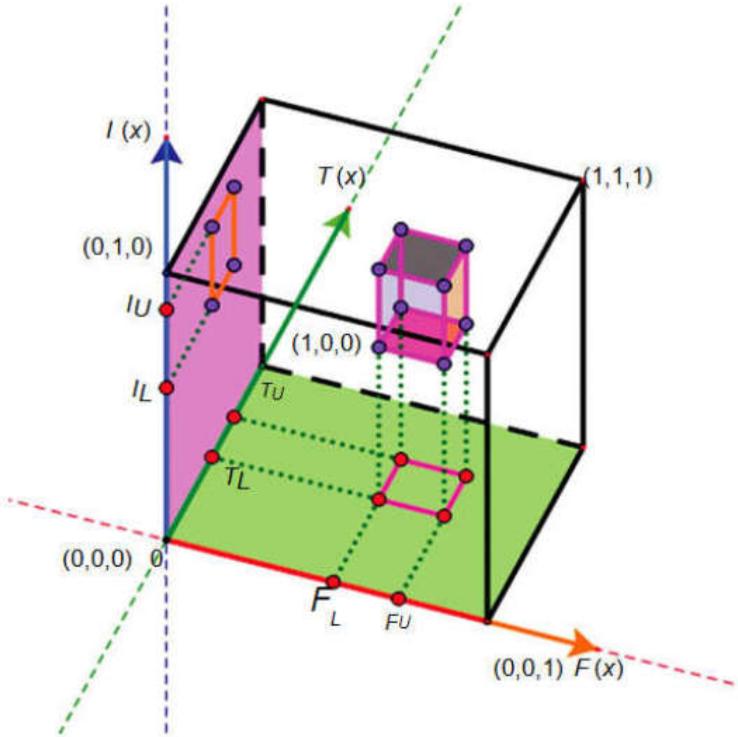
GEOMERTIC REPRESENTATION OF NEUTROSOPHIC CUBE

-The focal objective of neutrosophic logic is to characterize each logical statements in a 3D-neutrosophic space, where each dimension of space represents respectively the truth(T) , falsehood(F) and indeterminacies (I) of the statements under consideration

-in an easy way, every logical variable x is described by an ordered triple. x= (t, i, f)



GEOMERTIC REPRESENTATION OF INTERVAL VALUED NEUTROSOPHIC NUMBERS



$[T_L, T_U] x [I_L, I_U] x [F_L, F_U]$

Difference between Neutrosophic Set and Intuitionistic Fuzzy Set

Neutrosophic set (NS) is a generalization of Fuzzy set, especially intuitionistic fuzzy set (IFS). Hence, the differences between NS and IFS was studied deeply because one's has known their relation and differences in the first explanation. The difference between NS and IFS summarized in Table 1

TABLE 1. The difference between Neutrosophic Set and Intuitionistic Fuzzy Set.

Neutrosophic Set	Intuitionistic Fuzzy Set
1. In NS there is no restriction on T, I, F: thus NL can characterize the incomplete information (sum < 1), paraconsistent information (sum > 1).	IFS the sum of components (or their superior limits) = 1
2. NS can distinguish, between absolute membership [NS(absolute membership)=1^+] and relative membership[NS(relative membership)=1]	IFS cannot; absolute membership is membership in all possible worlds, relative membership is membership in at least one world.
3. In NS components can be nonstandard	IFS, they don't
4. NS operators can be defined with respect to T,I,F.	IFS operators are defined with respect to T and F only.
5. I can split in NS in more subcomponents (examples in Belnap's four-valued logic (1977) indeterminacy is split into uncertainty and contradiction.)	IFS cannot
6. NS, like dialetheism (some contradiction are true), can deal with paradoxes, NS (paradox element) = (1,I,1)	IFS cannot

Generalization and comment

Because the neutrosophic set is related to intuitionistic fuzzy set, paraconsistent set and fuzzy set, the generalization will focus on these type of sets. Hence, NS generalizes:

1. the *intuitionistic set*, which supports incomplete set theories (for $0 < n < 1$, $0 =< t, i, f <= 1$) and incomplete known elements belonging to a set;
2. the *fuzzy set* (for $n = 1$ and $i = 0$, and $0 =< t, i, f <= 1$);
3. the *classical set* (for $n = 1$ and $i = 0$, with t, f either 0 or 1);
4. the *paraconsistent set* (for $n > 1$, with all $t,i,f < 1^+$);
5. the *faillibilist set* ($i > 0$);
6. the *dialetheist set*, a set M has at least one of its elements also belongs to its complement C(M); thus, the intersection of some disjoint sets is not empty;
7. the *paradoxist set* ($t=f=1$);
8. the *pseudoparadoxist set* ($0 < i < 1$, $t=1$ and $f > 0$ or $t > 0$ and $f = 1$);
9. the *tautological set* ($i,f < 0$).

Smarandache comment's that; compared to other types of sets, in the neutrosophic set each element has three components which are subsets (not numbers as in fuzzy set) and considers a subset, similarly to intuitionistic fuzzy set, of "indeterminacy" - due to unexpected parameters hidden in some sets, and let the superior limits of the components to even boil over 1 (overloaded) and the inferior limits of the components to even freeze under 0 (underdried).

Difference between Neutrosophic Logic and Intuitionistic Fuzzy Logic

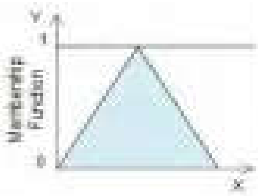
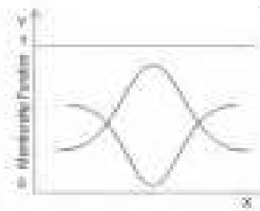
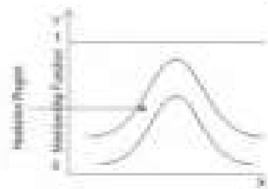
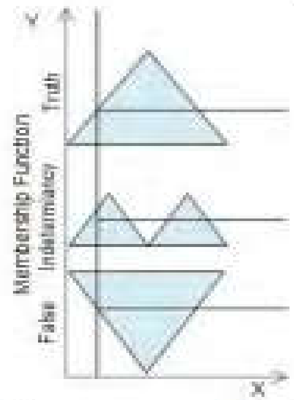
The differences between neutrosophic logic (NL) and intuitionistic fuzzy set (IFS) was summarized in Table 2 NL is attempting to unify many logics in a single field. NL is a generalization of fuzzy logic, especially IFL. Therefore, the difference between them was the importance part in studying NL.

TABLE 2. The difference between Neutrosophic Logic and Intuitionistic Fuzzy Logic.

Neutrosophic Logic	Intuitionistic Fuzzy Logic
1. In NL there is no restriction on T, I, F: thus NL can characterize the incomplete information (sum < 1), paraconsistent information (sum > 1).	IFL the sum of components (or their superior limits) = 1
2. NL can distinguish, in philosophy, between absolute truth [NL(absolute truth)=1^+] and relative truth[NL(relative truth)=1]; absolute truth is truth in all possible worlds (Leibniz), relative truth is truth in at least one world	IFL cannot
3. In NL components can be nonstandard.	IFL they don't
4. NL, like dialetheism [some contradictions are true], can deal with paradoxes, NL (paradox) = (1, I, 1).	IFL cannot

Multivalued logic

Table 1. *Multivalued Logic Membership Function*

	Fuzzy set	Intuitionistic Fuzzy	Vague	Neutrosophic
Membership Function	Degree of belonging	Degree of membership function and non-membership function	Degree of membership function and non-membership function	Degree of membership function, indeterminacy and non-membership function
	 Fig 1. Type1 fuzzy membership function [1]	 Figure 2. Intuitionistic Fuzzy Set [24]	 Figure 3. Vague Set [24]	 Figure 4. Neutrosophic Set [11]

The Neutrosophic Logic: Indetermiancy?

- It is known, The neutrosophic Logic is the only logic that can deal with the paradoxes, since a paradox P is a proposition that is true (its truth degree T = 1) and false (its false degree F = 1) in the same time, and as a consequence the paradox is also completely indeterminate (its indeterminate degree I = 1). Therefore, the neutrosophic truth-values of the paradox is P(1, 1, 1), where 1+1+1 = 3 > 1. No other logics allow the sum of its components to go over 1. *Self-Referential Paradoxes* have the same neutrosophic representation: T =1, F = 1, and I = 1.

ADVANTAGES OF NEUTROSOPHIC LOGIC

- The advantage of using neutrosophic logic is that this logic distinguishes between relative truth, that is a truth in one or a few worlds only, noted by 1, and absolute truth, that is a truth in all possible worlds, noted by 1+. And similarly, neutrosophic logic distinguishes between relative falsehood, noted by 0, and absolute falsehood, noted by –0.
- In neutrosophic logic the sum of components is not necessarily 1 as in classical and fuzzy logic, but any number between –0 and 3+, and this allows the neutrosophic logic to be able to deal with paradoxes, propositions which are true and false in the same time: thus NL(paradox)=(1, I, 1); fuzzy logic cannot do this because in fuzzy logic the sum of components should be 1.
- When the sum of components $t + i + f = 1$ (classical and fuzzy logic);
- When the sum of components is $t + i + f < 1$ (intuitionistic logic);
- When the sum of components is $t + i + f >= 1$ (paraconsistent logic).

Neutrosophic examples

- We may say for example (0.9, 0.05, 0.05) meaning that 90% of 5 km we are sure about, while 5% of 5 km it is indeterminate, and 5% of 5 km unsure,
- in neutrosophic triplet: proved, unprovable (indeterminate), disproved,
- **in an application Form there are three option : Yes- No/ N.A For gendre M/F/other**
- , ***Neutrosophic logic has its chance to simulate human thinking and to be utilized for real environment executions***

- Let's say there is a soccer game between India and Pakistan. If I ask you who will win, you may say, since you're subjective and patriot, that India will win, let's say with a chance of 70%; but if I ask somebody from Pakistan, he would say that Pakistan will win, let's say with 60% chance. But asking a neutral expert, he may say that there is 40% chance of tie game.
- All sources are independent, meaning they do not communicate with each other and they do not know the response of each other.
- Summing we get $0.7 + 0.6 + 0.4 > 1$.

IDETERMINACY(I)

(T, I,F)=(0,1,0)

LET'S FLIP THE COIN ON THE SURFACE OF A SEA, THEN THE COIN FALLS INTO THE SEA AND WE DO NOT KNOWN ANYTHINGS ABOUT IT, THUS INDTERMINACY =1

Other example

- An example of neutrosophic logic is as following; the argument "Tomorrow it will be sunny" does not mean a constant-valued components structure; this argument may be 60% true, 40% indeterminate and 35% false at a time, neutrosophicaly represented by (0,6, 0,4, 0,35) ; but at in a second time may change at 55% true, 40% indeterminate, and 45 % false according to new indications, provenances,neutrosophicaly represented by (0,55,0,40,0,45) , etc.

Neutrosophic example: voting process

For another example, suppose there are 10 voters during a voting process. Five vote “aye”, two vote “blackball” and three are undecided. For neutrosophic notation, it can be expressed as $x(0.5,0.3,0.2)$.

Using fuzzy it is not possible to separate the voting process in favour or against. Using Vague notation we can separate the votes in favour or votes in against but with constraint $tv + fv \leq 1$. Neutrosophic Notation has no restrictions on the boundary. In Neutrosophic Set, indeterminacy is quantified explicitly and true-membership, indeterminacy-membership and false-membership are independent. This assumption is very important in many applications

EXAMPLE OF NS

- For (0,1,0), which means totally indeterminate: Two points, diametrically opposed, on the margins of a marsh have to be connected by a route; it may be a total indeterminacy not knowing in what way to build the route.

- For (0,1,1), with total indeterminacy and total falsehood. The two points, diametrically opposed, on the margins of a marsh having to be connected by a route; the route construction company starts the project and builds the route on the wrong trajectory that the route sinks into the marsh.
- two nodes as the two marsh, and the line as the route.

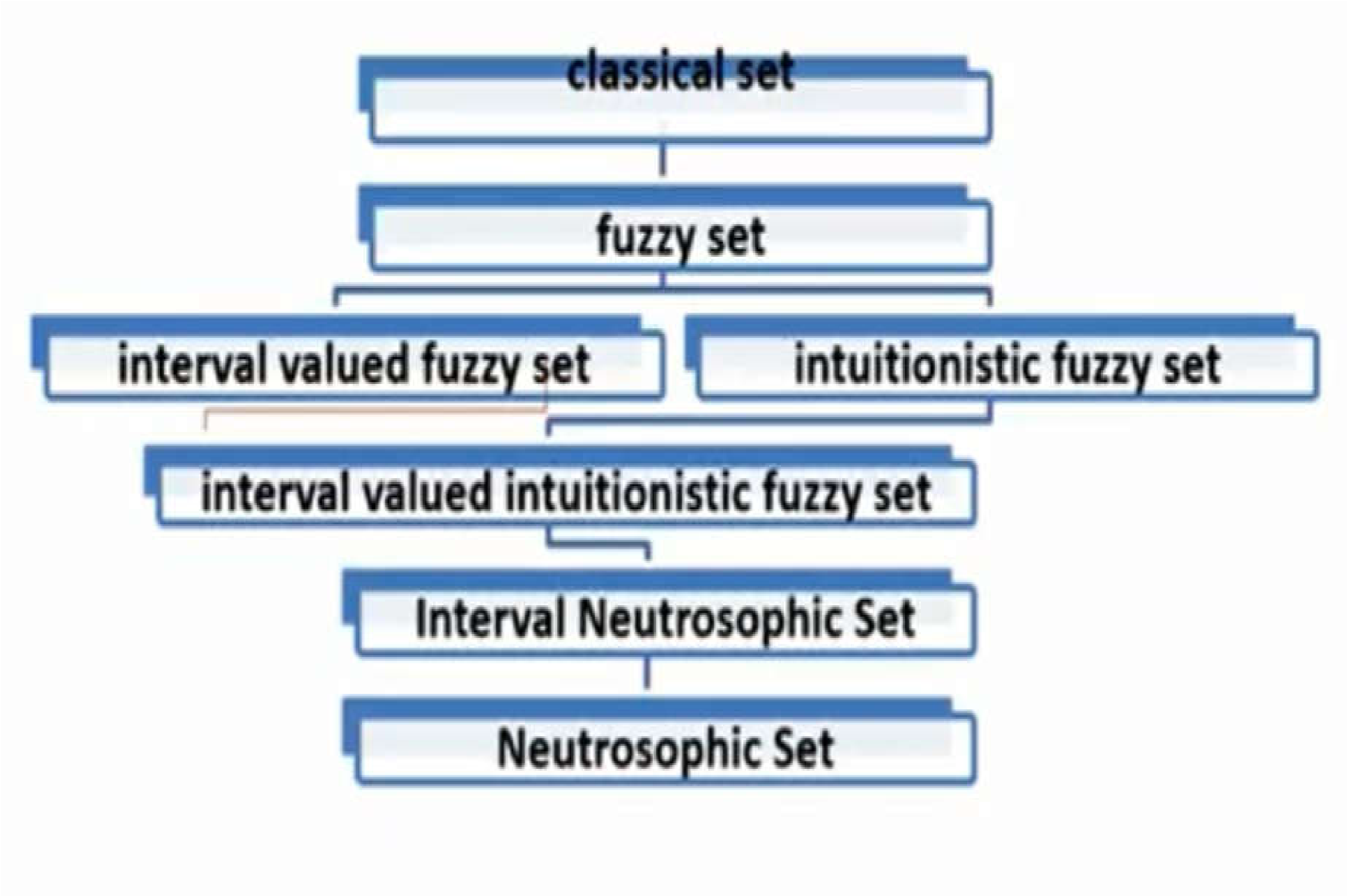
EXAMPLE TO UNDERSTAND THE INDETERMINACY AND NEUTROSOPHIC LOGIC

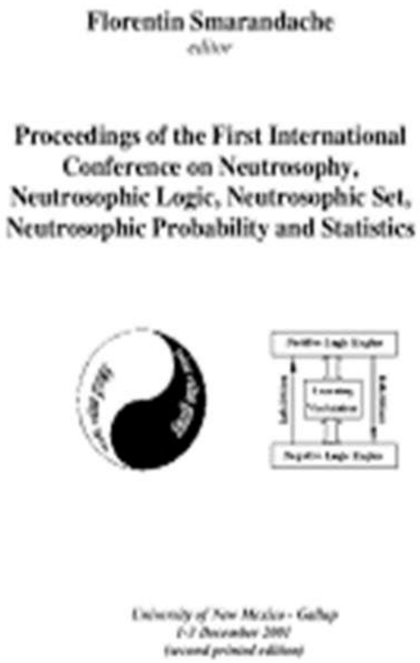
- In a given mobile phone suppose 100 calls came at end of the day.
- 1. 60 calls were received truly among them 50 numbers are saved and 10 were unsaved in mobile.
  - 60 calls will be the truth membership i.e. 0.6.
- 2. 30 calls were not-received by mobile holder. Among them 20 calls which are saved in mobile contacts were not received due to driving, meeting, or phone left in home, car or bag and 10 were not received due to uncertain numbers.
  - 30 not received will be the Indeterminacy membership i.e. 0.3.
- 3. 10 calls were those number which was rejected calls intentionally by mobile holder due to behavior of those saved numbers, not useful calls, marketing numbers or other cases for that he/she do not want to pick or may be blocked numbers
  - 10 rejected will be the false i.e. 0.1 membership value.

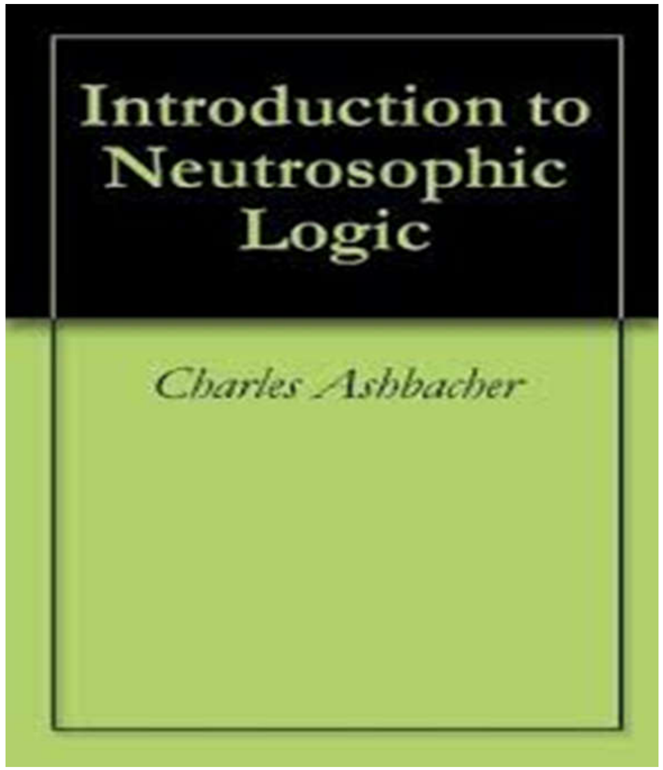
NEUTROSOPHIC EXAMPLES............

- Suppose there are few places in a city and roads connect the places. Hence the places and roads together form a network. But the problem is to find a way that a salesman can visit all the planes once with the lowest travelling cost. Now the travelling cost is directly proportional to the road distance travel by salesman. But all the roads are not in the same smooth conditions in practical. So the real travelling distance with cost may be effected the bad weather, road jam and non-pucca roads. Hence the travelling distance between the places should be taken as neutrosophic. If (T , I, F) be membership value of the road distance between two places, then T indicates distance on good, well-constructed road; I indicates distance on bad (marsh, muddied) road and F indicates distance above the water, where the bridge is not built yet...(i.e. the distance where the road does not exist yet, but it may be build under the form of a bridge to be constructed).

The relationship among neutrosophic sets and other sets







Book on neutrosphic logic with JAVA application

ACADEMIC PRESS

Neutrosophic Set in Medical Image Analysis

2019, Pages 3-29

1 - Introduction to neutrosophy and neutrosophic environment

Florentin Smarandache *, Said Broumi [†], Prem Kumar Singh [‡], Chun-fang Liu [§], V. Venkateswara Rao [¶], Hai-Long Yang [‖], Ion Patrascu [#], Azeddine Elhassouny **

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Abstract

Neutrosophic connectives

- Like other non-classical logic, several definitions for the logical connectives are used
- we will concentrate on the simplest case, where the neutrosophic components are real values instead of intervals or subsets of the unit interval.

Neutrosophic basic connectives: Negation

(N1) $v(\neg p) = (1 - t, 1 - i, 1 - f)$

(N2) $v(\neg p) = (f, i, t)$

(N3) $v(\neg p) = (f, 1 - i, t)$

Conjunction-disjunction-implication

- Conjunction

$$(C1)\quad v(p_1 \wedge p_2) = (t_1 \cdot t_2, i_1 \cdot i_2, f_1 \cdot f_2)$$

$$(C2)\quad v(p_1 \wedge p_2) = (min(t_1, t_2), min(i_1, i_2), max(f_1, f_2))$$

$$(C3)\quad v(p_1 \wedge p_2) = (min(t_1, t_2), max(i_1, i_2), max(f_1, f_2))$$

- Disjunction

$$(D1)\quad v(p_1 \vee p_2) = (max(t_1, t_2), max(i_1, i_2), min(f_1, f_2))$$

$$(D2)\quad v(p_1 \vee p_2) = (max(t_1, t_2), min(i_1, i_2), min(f_1, f_2))$$

- Implication

$$(I1)\quad v(p_1 \rightarrow p_2) = v(\neg p_1 \vee p_2)$$

$$(I2)\quad v(p_1 \rightarrow p_2) = (min(1, 1 - t_1 + t_2), max(0, i_2 - i_1), max(0, f_2 - f_1))$$

Diffrent types of neutrosophic numbers

- Single valued neutrosophic numbers
- Interval valued neutrosophic numbers
- Bipolar neutrosophic numbers
- Trapezoidal fuzzy neutrosophic numbers
- Triangular fuzzy neutrosophic numbers
- Single valued triangular fuzzy numbers
- Single valued trapezoidal fuzzy numbers
- Hesitant Single valued neutrosophic numbers
- Refinned neutrosophic numbers. etc

Neutrosophic numbers

- Numerical neutrosophic components: (T, I, F)
- Literal neutroosphic componets : x=a+Ib

The formula neutrosophically works in the following way:

- x = a+bI is a neutrosophic number whose determinate part is "a" and indeterminate part is "bI", where I = indeterminacy;

NNs can effectively describe incomplete or indeterminate information because they consist of a determinate part and indeterminate part.

Neutrosophic Complex Numbers based on literal component (I)

- Neutrosophic Real Number
- Neutrosophic Complex Number

F.Smarandache, "Introduction to Neutrosophic statistics", Sitech-Education Publisher, PP:34-44, 2014

Neutrosophic Real Number

Suppose that w is a neutrosophic number, then it takes the following standard form: $w = a + bI$ where a , b are real coefficients, and I represent indeterminacy, such $0.\mathrm{I} = 0$ and $\mathrm{I}^n = \mathrm{I}$, for all positive integers n.

Neutrosophic Complex Number

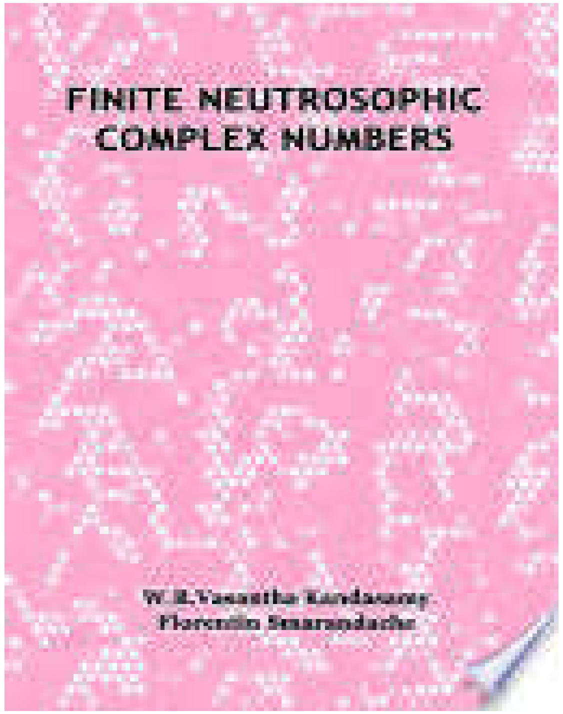
Suppose that z is a neutrosophic complex number, then it takes the following standard form: $z = a + cI + bi + diI$

where a , b, c, d are real coefficients, and I indeterminacy, such that $i^2 = -1 \Rightarrow i = \sqrt{-1}$.

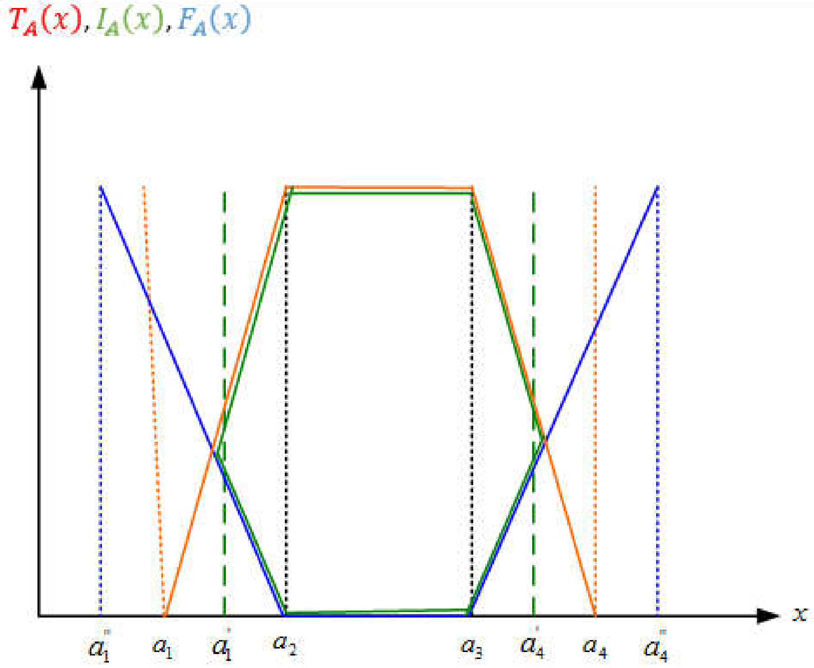
Note: we can say that any real number can be considered a neutrosophic number.

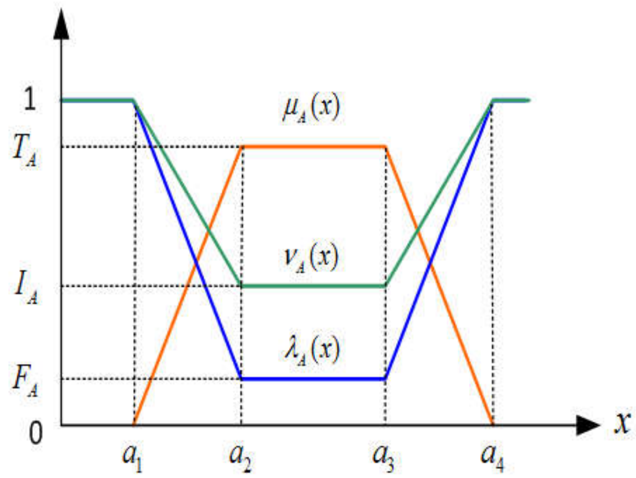
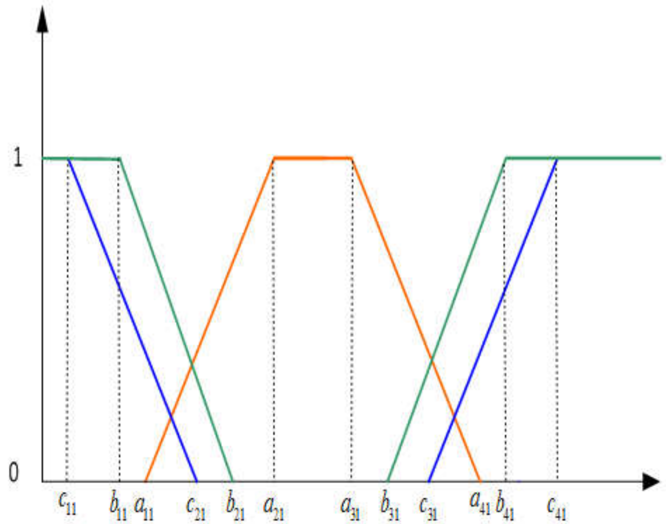
For example: $2 = 2 + 0.I$, $or: 2 = 2 + 0.I + 0.i + 0.i.I$

F.Smarandache, "Introduction to Neutrosophic statistics", Sitech-Education Publisher, PP:34-44, 2014

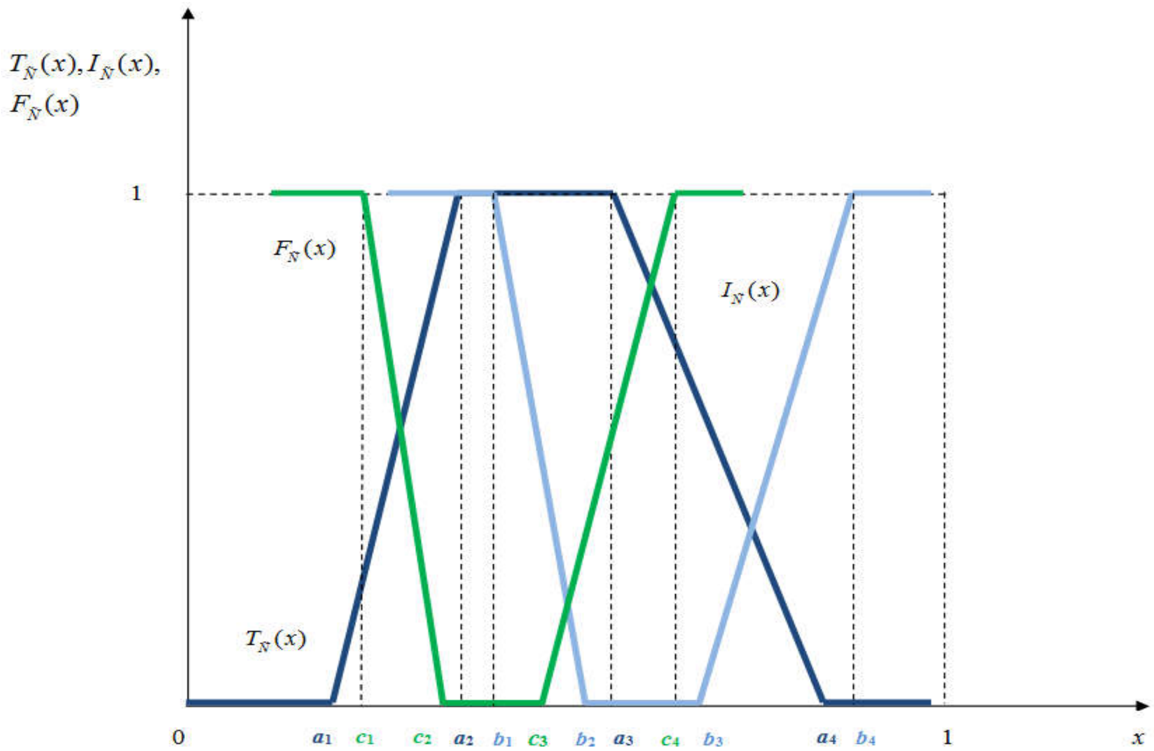

FINITE NEUTROSOPHIC
COMPLEX NUMBERS
W.B.Vasantha Kandasamy
Florentin Smarandache

- The following tables represents the various forms of trapezoidal fuzzy neutrosophic numbers (TrFNN) have been listed out and it shows the uniqueness of the proposed graphical representation among the existing graphical representations.

Trapezoidal fuzzy neutrosophic forms	Graphical representation
Darehmiraki [11]; A is a TrFNN, $a_1^{''}, a_1, a_1^{'}, a_2, a_3, a_4^{'}, a_4, a_4^{''} \in R$ such that $a_1^{''} \le a_1 \le a_1^{'} \le a_2 \le a_3 \le a_4^{'} \le a_4 \le a_4^{''}$ $A = \langle (a_1^{''}, a_1, a_1^{'}, a_2, a_3, a_4^{'}, a_4, a_4^{''}), T_A, I_A, F_A \rangle$	

Liang [21]; A is a TrFNN, $a_1, a_2, a_3, a_4 \in [0,1]$ such that $0 \le a_1 \le a_2 \le a_3 \le a_4 \le 1$ $A = \langle [a_1, a_2, a_3, a_4], (T_A, I_A, F_A) \rangle$	
Biswas [5]; A is a TpFNN, $(a_{41}, \mathrm{a}_{21}, \mathrm{a}_{31}, \mathrm{a}_{41}), (b_{41}, \mathrm{b}_{21}, \mathrm{b}_{31}, \mathrm{b}_{41}),$ $(c_{41}, \mathrm{c}_{21}, \mathrm{c}_{31}, \mathrm{c}_{41}) \in R$ such that $c_{11} \le b_{11} \le a_{11} \le \mathrm{c}_{21} \le \mathrm{b}_{21} \le \mathrm{a}_{21}$ $\le \mathrm{a}_{31} \le \mathrm{b}_{31} \le \mathrm{c}_{31} \le \mathrm{a}_{41} \le \mathrm{b}_{41} \le \mathrm{c}_{41}$ and $A = \langle (a_{11}, \mathrm{a}_{21}, \mathrm{a}_{31}, \mathrm{a}_{41}), (b_{11}, \mathrm{b}_{21}, \mathrm{b}_{31}, \mathrm{b}_{41}),$ $(c_{11}, \mathrm{c}_{21}, \mathrm{c}_{31}, \mathrm{c}_{41}) \rangle$	

Trapezoidal fuzzy neutrosophic numbers



(a) Graphical representation of TrNFN

Diffrence between TFN and NN

- About neutrosophic number(T,I,F) and triangular fuzzy number (a,b,c) although have three parametres;however;the three parametres in triangular fuzzy numbers can only express the membership, and those in neutrosophic number can express the membership function,indterminacy-membership function and non-membership function,So they are completley diffrent

The score function of neutrosophic numbers

- The score function is an important index for evaluating neutrosophic numbers. For a neutrosophic R =<T, I, F > , the truth-membership T is positively correlated with the score function, and the indeterminacy-membership I and false-membership F are negatively correlated with the score function. In terms of the accuracy function, the greater the difference between the truth-membership T and false-membership F is, the more affirmative the statement is. Additionally, in regard to the certainty function, it positively depends on the truth-membership T.

Ranking of neutrosophic numbers

$$S_{1,1}(x) = \frac{2}{3} + \frac{T_x}{3} - \frac{I_x}{3} - \frac{F_x}{3}.$$

$$sc(x) = T_1 + 1 - I_1 + 1 - F_1;$$

$$S_{\alpha,\beta}(x) = \frac{2}{3} + \frac{T_x}{3} - \alpha\frac{I_x}{3} - \beta\frac{F_x}{3},$$

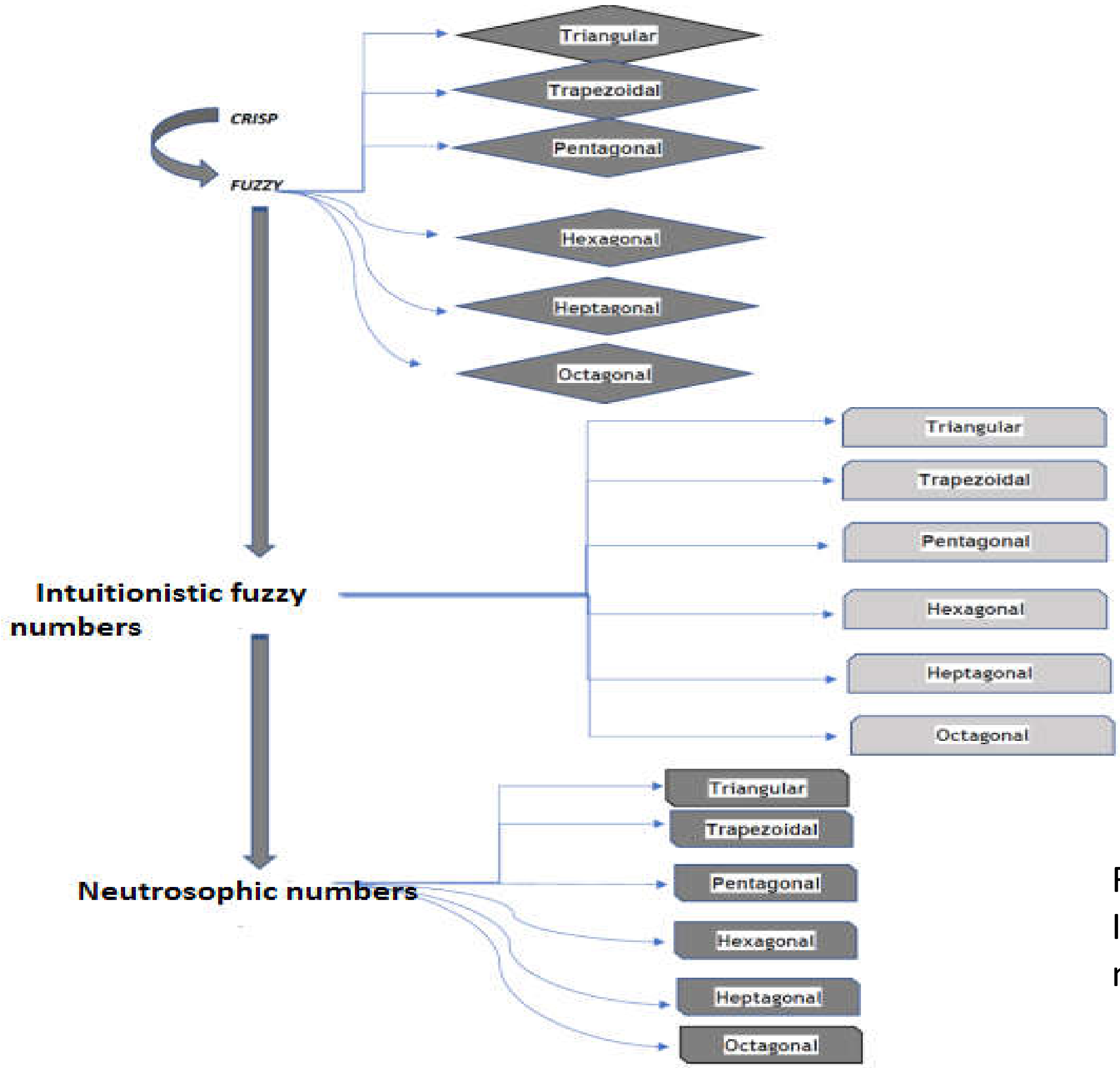
$$K(A) = \frac{1 + a - 2b - c}{2}$$

where $K(A) \in [-1,1]$.

Extensions of neutrosophic sets

Extension of neutrosophic sets

- Fuzzy sets extensions have been often used in the modeling of problems including vagueness and impreciseness in order to better define the membership functions together with the hesitancy of decision makers.
- More than 20 different extensions of ordinary fuzzy sets have appeared in the literature after the introductions of ordinary fuzzy sets by Zadeh (1965).
- These sets involve interval-type fuzzy sets, type-2 fuzzy sets, hesitant fuzzy sets, intuitionistic fuzzy sets, Pythagorean fuzzy sets, q-rung orthopair fuzzy sets, spherical fuzzy sets, picture fuzzy sets, fermatean fuzzy sets, etc.
- Mainly, these extensions can be divided into two classes: extensions with two independent membership parameters and extensions **with three independent membership parameters.**
- Smarandache and many other researchers also discussed the various extension of neutrosophic sets in TOPSIS and MCDM



Flow chart of the three types, fuzzy, Intuitionistic fuzzy,and neutrosophic logic numbers

Edge Parameter	Uncertainty Measurement	Hesitation Measurement	Vagueness Measurement	Fluctuations
Crisp number	*	*	*	*
Fuzzy number	determinable	*	*	*
Intuitionistic Fuzzy number	determinable	determinable	*	*
Neutrosophic number	determinable	determinable	determinable	determinable

Table 1: Fuzzy numbers, their extensions and applicability

The core idea of modeling such a neutrosophic situation has been expanded together with the previous methods and tools to the following new cases:

• to handle the neutrosophic in qualitative environments in which information is linguistic form

• to manage the truth-membership, indeterminacy-membership and falsity-membership that are not exactly defined but expressed by interval-values, intuitionistic fuzzy sets, triangular fuzzy sets, cubic sets, bipolar fuzzy set, trapezoidal fuzzy sets, or hesitant

fuzzy set

• to deal with the inadequacy of the parameterized by combining soft set

• to cope with the lower and upper approximations by fusing with rough set

• These extensions are further detailed in the following table ,

Table 1 The extensions of neutrosophic set

Sets	Abbreviation	Proposed
Single valued neutrosophic set	**SVNS**	Wang et al. (2010)
Interval neutrosophic set	**INS**	Wang et al. (2005a)
Simplified neutrosophic set	**SNS**	Ye (2014h)
Neutrosophic soft set	**NSS**	Maji (2013)
Single valued neutrosophic linguistic set	**SVNLS**	Ye (2015a)
Multi-valued neutrosophic set	**MVNS**	Wang and Li (2015)
Rough neutrosophic set	**RNS**	Broumi et al. (2014a)
Simplified neutrosophic linguistic set	**SNLS**	Tian et al. (2016b)
Bipolar neutrosophic set	BNS	Deli et al. (2015)
Trapezoidal neutrosophic set	TNS	Biswas et al. (2014b)
Neutrosophic hesitant fuzzy set	NHFS	Ye (2015d)
Neutrosophic cubic set	NCS	Ali and Deli (2016) and Jun et al. (2017)
Possibility neutrosophic soft set	PNSS	Karaaslan (2017b)
Neutrosophic vague soft expert set	NVSES	Al-Quran and Hassan (2016)
Time neutrosophic soft set	TNSS	Alkhazaleh (2016)
Triangular neutrosophic set	TrNS	Deli and Şubaş (2017b)
Interval-valued neutrosophic soft set	IVNSS	Deli (2017)
Complex neutrosophic set	CNS	Ali and Smarandache (2017)
Normal neutrosophic set	NNS	Liu and Teng (2017a)
Simplified neutrosophic uncertain linguistic set	SNULS	Tian et al. (2018)

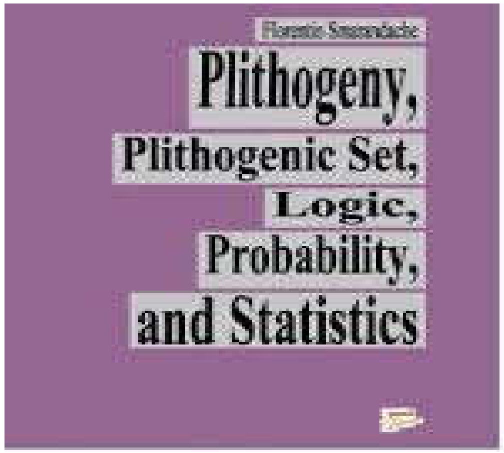
Interval neutrosophic linguistic set	INLS	Ye (2014f)
Single-valued neutrosophic refined soft set	SVNRSS	Karaaslan (2017a)
ivnpiv-Neutrosophic soft set	ivnpiv-NSS	Deli et al. (2018)
Probability multi-valued neutrosophic set	PMVNS	Peng et al. (2016b)
Probability multi-valued linguistic neutrosophic set	PMVLNS	Wang and Zhang (2017)
Interval neutrosophic hesitant fuzzy set	INHFS	Ye (2016a)
Intuitionistic neutrosophic set	InNS	Bhowmik and Pal (2009)
Generalized neutrosophic soft set	GNSS	Broumi (2013)
Intuitionistic neutrosophic soft set	INSS	Broumi and Smarandache (2013b)
Neutrosophic refined set	NRS	Smarandache (2013)
Possibility simplified neutrosophic set	PSNS	Şahin and Liu (2017c)
Linguistic neutrosophic set	LNS	Li et al. (2017)
Single valued neutrosophic trapezoid linguistic set	SVNTLS	Broumi and Smarandache (2014c)
Single-valued neutrosophic uncertain linguistic set	SVNULS	Liu and Shi (2017)
Multi-valued interval neutrosophic set	MVINS	Wang et al. (2005b)

Sets	Abbreviation	Proposed
Single valued neutrosophic rough set	SVNRS	Yang et al. (2017a)
Neutrosophic valued linguistic soft set	NVLSS	Zhao and Guan (2015)
Single valued neutrosophic multiset	SVNM	Ye and Ye (2014)
Single valued multigranulation neutrosophic rough set	SVMNRS	Zhang et al. (2016b)
n-Valued refined neutrosophic soft set	n-VRNSS	Alkhazaleh (2017)
Double-valued neutrosophic set	DVNS	Kandasamy (2018)

The bold eight NS extensions are widely used in real life

Plithogenic sets and plithogenic logic

- Plithogenic sets and plithogenic logic which is the generalisation of neutrosophic sets and logic.
- Plithogenic sets can model real-life applications in a better way as they are characterised by one or more attributes which can accommodate many values.



Complex neutrosophic set (CNS)

- Complex neutrosophic set (CNS) is a modified version of the complex fuzzy set, to cope with complicated and inconsistent information in the environment of fuzzy set theory.
- The CNS is characterised by three functions expressing the degree of complex-valued membership, complex-valued abstinence and degree of complex-valued non-membership.
- The CNS is characterized by complex-valued MS, complex-valued abstinence and complex-valued NMS grades with a condition that the sum of real-valued MS (Imaginary-valued MS), real-valued abstinence (Imaginary-valued abstinence) and real-valued NMS (Imaginary-valued NMS) grades is less than or equal to 3+

Definition Complex neutrosophic set.

A complex neutrosophic set S defined on a universe of discourse X, which is characterized by a truth membership function $T_S(x)$, an indeterminacy membership function $I_S(x)$, and a falsity membership function $F_S(x)$ that assigns a complex-valued grade of $T_S(x)$, $I_S(x)$, and $F_S(x)$ in S for any $x \in X$. The values $T_S(x)$, $I_S(x)$, $F_S(x)$ and their sum may all within the unit circle in the complex plane and so is of the following form,

$$T_S(x) = p_S(x).e^{j\mu_S(x)}, \quad I_S(x) = q_S(x).e^{j\nu_S(x)} \text{ and } F_S(x) = r_S(x).e^{j\omega_S(x)}$$

where $p_S(x)$, $q_S(x)$, $r_S(x)$ and $\mu_S(x)$, $\nu_S(x)$, $\omega_S(x)$ are, respectively, real valued and $p_S(x), q_S(x), r_S(x) \in [0, 1]$ such that $^{-}0 \leq p_S(x) + q_S(x) + r_S(x) \leq 3^{+}$.

The complex neutrosophic set S can be represented in set form as

$$S = \{(x, T_S(x) = a_T, I_S(x) = a_I, F_S(x) = a_F) : x \in X\},$$

where $T_S{:}X \to \{a_T{:}a_T \in C, |a_T| \leq 1\}$, $I_S{:}X \to \{a_I{:}a_I \in C, |a_I| \leq 1\}$ and $F_S{:}X \to \{a_F{:}a_F \in C, |a_F| \leq 1\}$ and $|T_S(x) + I_S(x) + F_S(x)| \leq 3$.

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ORIGINAL ARTICLE

Complex neutrosophic set

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Interval complex neutrosophic set

- As an extension of neutrosophic set, interval complex neutrosophic set is a new research topic in the field of neutrosophic set theory, which can handle the uncertain, inconsistent and incomplete information in periodic data.

Interval complex neutrosohic set

$\boxed{\textit{Interval complex neutrosohic set}}$

Definition *Let X be a space of points(objects) with generic elements in X denoted by x. An ICNS S in X is characterized by a truth-membership function $T_S(x)$, an indeterminacy-membership function $I_S(x)$, and a falsity-membership function $F_S(x)$, which are satisfied the following conditions:*

$$T_S(x) : X \to \Gamma^{[0,1]} \times R, T_S(x) = t_S(x) \cdot e^{j\omega_S(x)}$$

$$I_S(x) : X \to \Gamma^{[0,1]} \times R, I_S(x) = i_S(x) \cdot e^{j\psi_S(x)}$$

$$F_S(x) : X \to \Gamma^{[0,1]} \times R, F_S(x) = f_S(x) \cdot e^{j\phi_S(x)}$$

where $\Gamma^{[0,1]}$ is the collection of interval neutrosophic sets and R is the set of real numbers, $t_S(x)$ is the interval truth membership function, $i_S(x)$ is the interval indeterminate membership function and $f_S(x)$

is the interval falsehood membership function, while $e^{j\omega_S(x)}$, $e^{j\psi_S(x)}$ *and* $e^{j\phi_S(x)}$ *are the corresponding interval-valued phase terms, respectively, with* $j = \sqrt{-1}$. *In set theoretic form, an interval complex neutrosophic set can be written as:*

$$S = \left\{ \left\langle \frac{t_S(x) \cdot e^{j\omega_S(x)}, i_S(x) \cdot e^{j\psi_S(x)}, f_S(x) \cdot e^{j\phi_S(x)}}{x} \right\rangle : x \in X \right\} \tag{2.1}$$

In (2.1), the amplitude interval-valued terms $T_S(x)$, $I_S(x)$, $F_S(x)$ *can be further split as* $t_S(x) = \left[t_S^L(x), t_S^U(x)\right]$, $i_S(x) = \left[i_S^L(x), i_S^U(x)\right]$ *and* $f_S(x) = \left[f_S^L(x), f_S^U(x)\right]$. *Similarly, for the phase terms:* $\omega_S(x) = \left[\omega_S^L(x), \omega_S^U(x)\right]$, $\psi_S(x) = \left[\psi_S^L(x), \psi_S^U(x)\right]$ *and* $\phi_S(x) = \left[\phi_S^L(x), \phi_S^U(x)\right]$.

Definition 2.5. *[18] The complement of an ICNS S is denoted by* S^c *and is defined as*

$$S^c = \left\{ \left\langle \frac{t_{S^c}(x) \cdot e^{j\omega_{S^c}(x)}, i_{S^c}(x) \cdot e^{j\psi_{S^c}(x)}, f_{S^c}(x) \cdot e^{j\phi_{S^c}(x)}}{x} \right\rangle : x \in X \right\} \tag{2.2}$$

where $t_{S^c}(x) = f_S(x), \omega_{S^c}(x) = 2\pi - \omega_S(x), i_{S^c}(x) = \left[1 - i_S^U(x), 1 - i_S^L(x)\right], \psi_{S^c}(x) = 2\pi - \psi_S(x), f_{S^c}(x) = t_S(x), \phi_{S^c}(x) = 2\pi - \phi_S(x)$.

Definition . *Let A be an ICNN, then the score function S (A) of A is defined as:*

$$S(A)=\frac{1}{12}\left(\left(2+t_A^L-i_A^L-f_A^L\right)+\left(2+t_A^U-i_A^U-f_A^U\right)+\frac{1}{2\pi}\left(\left(4\pi+\omega_A^L-\psi_A^L-\phi_A^L\right)+\left(4\pi+\omega_A^U-\psi_A^U-\phi_A^U\right)\right)\right)$$

Definition . *Let A be an ICNN, then the accuracy function H (A) of A is defined as:*

$$H(A)=\frac{1}{3}\left(\frac{t_A^L-f_A^L+t_A^U-f_A^U}{2}+\frac{\omega_A^L-\phi_A^L+\omega_A^U-\phi_A^U}{2\pi}\right)$$

Definition *Let A_1 and A_2 be two ICNNs, and S be the score functions, H be the accuracy functions. If $S(A_1) < S(A_2)$ then $A_1 < A_2$, if $S(A_1) = S(A_2)$ then*

(1) If $H(A_1) < H(A_2)$, then $A_1 < A_2$;

(2) If $H(A_1) = H(A_2)$, then $A_1 = A_2$.

Pentagonal Neutrosophic numbers

Arithmetic Operations:

Suppose we consider two pentagonal neutrosophic fuzzy number as $\tilde{A}_{PtgNeu} = (p_1, p_2, p_3, p_4, p_5; \mu_a, \vartheta_a, \theta_a)$ and $\tilde{B}_{PtgNeu} = (q_1, q_2, q_3, q_4, q_5; \mu_b, \vartheta_b, \theta_b)$ then,

i) $\tilde{A}_{PtgNeu} + \tilde{B}_{PtgNeu} = [p_1 + q_1, p_2 + q_2, p_3 + q_3, p_4 + q_4, p_5 + q_5; \max\{\mu_a, \mu_b\}, \min\{\vartheta_a, \vartheta_b\}, \min\{\theta_a, \theta_b\}]$

ii) $\tilde{A}_{PtgNeu} - \tilde{B}_{PtgNeu} = [p_1 - q_5, p_2 - q_4, p_3 - q_3, p_4 - q_2, p_5 - q_1; \max\{\mu_a, \mu_b\}, \min\{\vartheta_a, \vartheta_b\}, \min\{\theta_a, \theta_b\}]$

iii) $k\tilde{A}_{PtgNeu} = [kp_1, kp_2, kp_3, kp_4, kp_5; \mu_a, \vartheta_a, \theta_a]$ $if\ k > 0$, $= [kp_5, kp_4, kp_3, kp_2, kp_1; \mu_a, \vartheta_a, \theta_a]$ $if\ k < 0$

iv) ${\tilde{A}_{PtgNeu}}^{-1} = (1/p_5, 1/p_4, 1/p_3, 1/p_2, 1/p_1; \mu_a, \vartheta_a, \theta_a)$

Score and Accuracy Function of :Pentagonal Single typed Neutrosophic Number (PTGNEU)

For any Pentagonal Single typed Neutrosophic Number (PTGNEU)

$$\tilde{A}_{PtgNeu} = (p_1, p_2, p_3, p_4, p_5; q_1, q_2, q_3, q_4, q_5; r_1, r_2, r_3, r_4, r_5)$$

T

I

F

We consider the beneficiary degree of truth indicator part as $= \frac{p_1+p_2+p_3+p_4+p_5}{5}$

Non- beneficiary degree of falsity indicator part as $= \frac{r_1+r_2+r_3+r_4+r_5}{5}$.

And the hesitation degree of indeterminacy indicator as $= \frac{q_1+q_2+q_3+q_4+q_5}{5}$

Thus, we defined the score function as $SC_{PtgNeu} = \frac{1}{3}\left(2 + \frac{p_1+p_2+p_3+p_4+p_5}{5} - \frac{q_1+q_2+q_3+q_4+q_5}{5} - \frac{r_1+r_2+r_3+r_4+r_5}{5}\right)$,

Where, $SC_{PtgNeu} \in [0,1]$ and the Accuracy function is defined as $AC_{PtgNeu} = \left(\frac{p_1+p_2+p_3+p_4+p_5}{5} - \frac{r_1+r_2+r_3+r_4+r_5}{5}\right)$,

Relationship between any two pentagonal neutrosophic fuzzy numbers:

Let us consider any two pentagonal neutrosophic fuzzy number defined as follows

$A_{PtgNeu1} = \left(T_{PtgNeu1}, I_{PtgNeu1}, F_{PtgNeu1}\right)$ and $A_{PtgNeu2} = \left(T_{PtgNeu2}, I_{PtgNeu2}, F_{PtgNeu2}\right)$ if,

1) $SC_{A_{PtgNeu1}} > SC_{A_{PtgNeu2}}, then\ A_{PtgNeu1} > A_{PtgNeu2}$

2) $SC_{A_{PtgNeu1}} < SC_{A_{PtgNeu2}}, then\ A_{PtgNeu1} < A_{PtgNeu2}$

3) $SC_{A_{PtgNeu1}} = SC_{A_{PtgNeu2}}, then$

i) $AC_{A_{PtgNeu1}} > AC_{A_{PtgNeu2}}, then\ A_{PtgNeu1} > A_{PtgNeu2}$

ii) $AC_{A_{PtgNeu1}} < AC_{A_{PtgNeu2}}, then\ A_{PtgNeu1} < A_{PtgNeu2}$

iii) $AC_{A_{PtgNeu1}} = AC_{A_{PtgNeu2}}, then\ A_{PtgNeu1} \sim A_{PtgNeu2}$

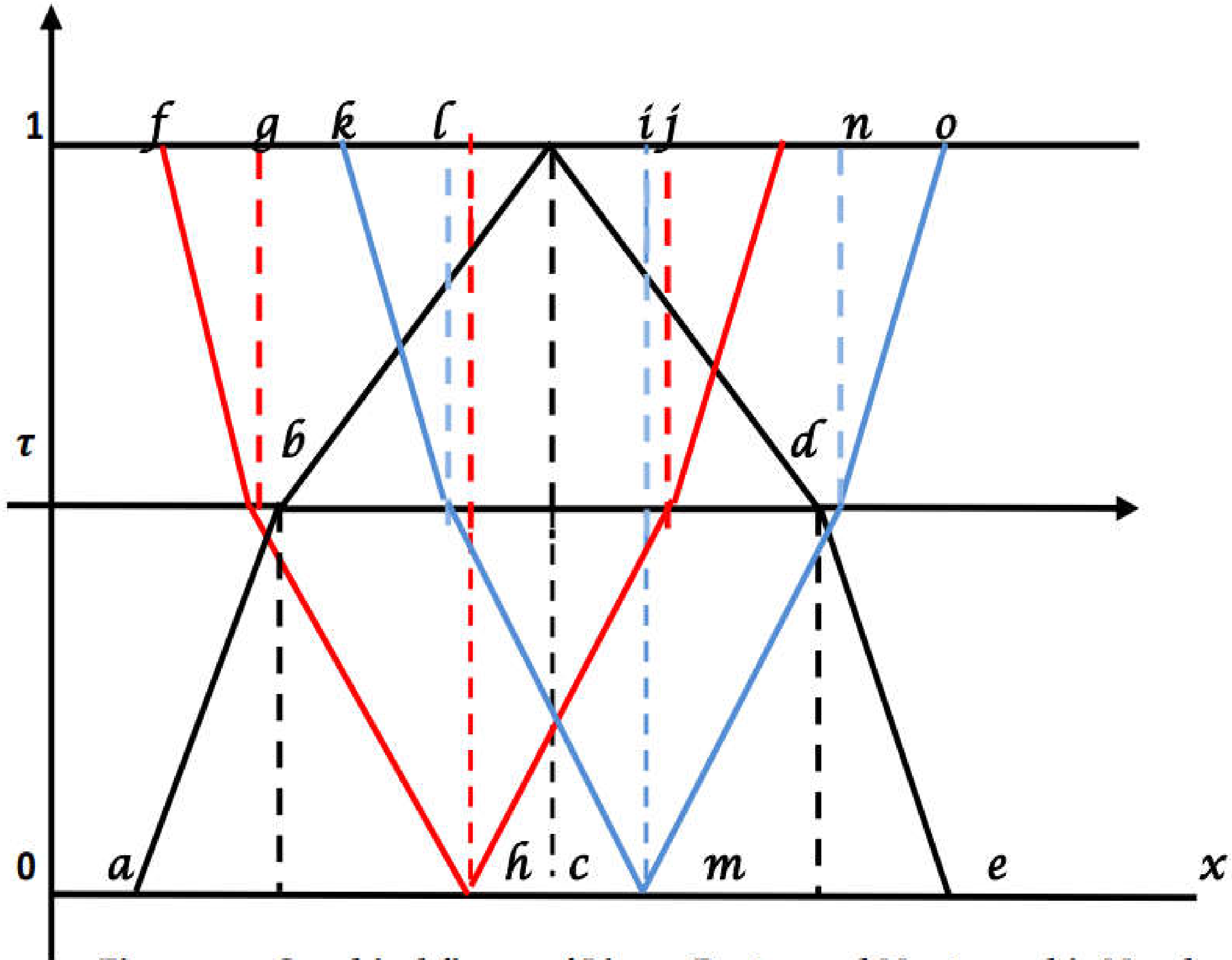

Figure : Graphical figure of Linear Pentagonal Neutrosophic Number.

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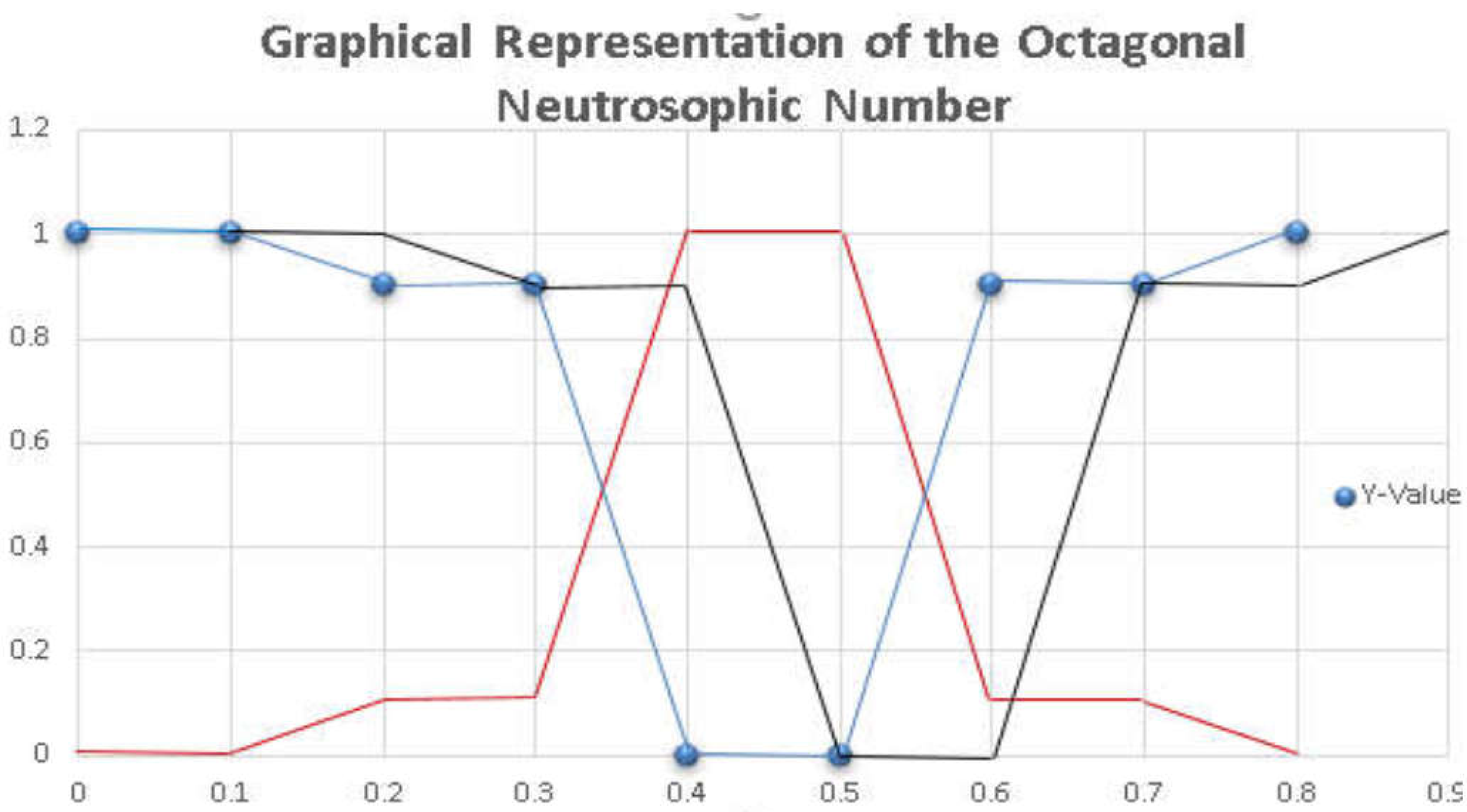
Octagonal neutrosophic number

A Octagonal neutrosophic number $\tilde{a}$ =($a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8$); $w_{\tilde{a}}$, $u_{\tilde{a}}, y_{\tilde{a}}$) is a special neutrosophic set on the set of real numbers $\mathbb{R}$, whose truth-membership, indeterminacy-membership and falsity-membership functions are respectively defined by

$$\mu_{\tilde{A}}(x) = \begin{cases} 0 & for x < a_1 \\ k\left(\frac{x-a_1}{a_2-a_1}\right) & for a_1 \leq x \leq a_2 \\ k & for a_2 \leq x \leq a_3 \\ k + (w_{\tilde{a}} - k)\left(\frac{x-a_3}{a_4-a_3}\right) & for a_3 \leq x \leq a_4 \\ w_{\tilde{a}} & for a_4 \leq x \leq a_5 \\ k + (w_{\tilde{a}} - k)\left(\frac{a_6-x}{a_6-a_5}\right) & for a_5 \leq x \leq a_6 \\ k & for a_6 \leq x \leq a_7 \\ k\left(\frac{a_8-x}{a_8-a_7}\right) & for a_7 \leq x \leq a_8 \\ 0 & for x > a_8 \end{cases}$$

$$\vartheta_{\tilde{A}}(x)=\begin{cases} 1 & \text{for } x<a_1 \\ 1+(1-k)\left(\dfrac{a_1{}'-x}{a_2{}'-a_1}\right) & \text{for } a_1\le x\le a_2 \\ k & \text{for } a_2\le x\le a_3 \\ k+(k-u_{\tilde{a}})\left(\dfrac{a_3{}'-x}{a_4{}'-a_3{}'}\right) & \text{for } a_3\le x\le a_4 \\ 0 & \text{for } a_4\le x\le a_5 \\ u_{\tilde{a}}+(k-u_{\tilde{a}})\left(\dfrac{x-a_5{}'}{a_6{}'-a_5}\right) & \text{for } a_5\le x\le a_6 \\ k & \text{for } a_6\le x\le a_7 \\ k+(1-k)\left(\dfrac{x-a_7{}'}{a_8{}'-a_7{}'}\right) & \text{for } a_7\le x\le a_8 \\ 1 & \text{for } x>a_8 \end{cases}$$

$$\lambda_{\tilde{A}}(x)=\begin{cases} 1 & \text{for } x<a_1 \\ 1+(1-k)\left(\dfrac{a_1{}'-x}{a_2{}'-a_1}\right) & \text{for } a_1\le x\le a_2 \\ k & \text{for } a_2\le x\le a_3 \\ k+(k-u_{\tilde{a}})\left(\dfrac{a_3{}'-x}{a_4{}'-a_3{}'}\right) & \text{for } a_3\le x\le a_4 \\ 0 & \text{for } a_4\le x\le a_5 \\ u_{\tilde{a}}+(k-u_{\tilde{a}})\left(\dfrac{x-a_5{}'}{a_6{}'-a_5}\right) & \text{for } a_5\le x\le a_6 \\ k & \text{for } a_6\le x\le a_7 \\ k+(1-k)\left(\dfrac{x-a_7{}'}{a_8{}'-a_7{}'}\right) & \text{for } a_7\le x\le a_8 \\ 1 & \text{for } x>a_8 \end{cases}$$


Graphical Representation of the Octagonal Neutrosophic Number
1.2
1
0.8
0.6
0.4
0.2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Y-Value

Refrences :Octagonal neutrosophic numbers

- Solving Fuzzy Game Problem in Octagonal NEUTROSOPHIC Numbers Using Heavy OWA Operator,
- Octagonal Neutrosophic Number: Its Different Representations, Properties,Graphs and De-neutrosophication with the application of Personnel Selection
- **Linear and Non-Linear Octagonal Neutrosophic Numbers: Its Representation,**

Definition —(Gaussian fuzzy number) A fuzzy number is said to be Gaussian fuzzy number $GFN(\mu, \sigma)$ whose membership function is given as follows:

$$f(x) = \exp(-\frac{1}{2}(\frac{x-\overline{\mu}}{\sigma})^2), -\infty < x < \infty,$$

where $\overline{\mu}$ denotes the mean and σ denotes standard deviations of the distribution.

Definition — α-cut of Gaussian fuzzy number: Let membership function for Gaussian fuzzy number is given as follows:

$$f(x) = \exp(-\frac{1}{2}(\frac{x-\overline{\mu}}{\sigma})^2).$$

Then, α-cut is given $A_\alpha = \left[\overline{\mu} - \sigma\sqrt{-2\log\alpha}, \overline{\mu} + \sigma\sqrt{-2\log\alpha}\right]$

Gaussian SVN-number:

Definition . A SVN-number is said to be Gaussian SVN-number $GSVNN\left((\overline{\mu}_t,\sigma_t),(\overline{\mu}_i,\sigma_i),(\overline{\mu}_f,\sigma_f)\right)$ whose truth-membership function, indeterminacy-membership function and falsity-membership function are given as follows:

$$\varphi(x_t) = \exp\left(-\frac{1}{2}\left(\frac{x_t-\overline{\mu}_t}{\sigma_t}\right)^2\right),$$

$$\varphi(x_i) = 1-\left(\exp\left(-\frac{1}{2}\left(\frac{x_i-\overline{\mu}_i}{\sigma_i}\right)^2\right)\right),$$

$$\varphi(x_f) = 1-\left(\exp\left(-\frac{1}{2}\left(\frac{x_f-\overline{\mu}_f}{\sigma_f}\right)^2\right)\right),$$

respectively. Here $\overline{\mu}_t$ $(\overline{\mu}_i,\overline{\mu}_f)$ denotes mean of truth-membership (indeterminacy-membership, falsity-membership) value. σ_t (σ_i,σ_f) denotes standard deviation of the distribution of truth-membership (indeterminacy-membership, falsity-membership) value.

Example Let $A = GSVNN\Big((0.4, 0.2), (0.6, 0.3), (0.3, 0.1)\Big)$ be Gaussian SVN-number. Then graphics of truth-membership function, indeterminacy-membership function and falsity-membership function of GSVNN $\tilde{A}$ are depicted in Fig 1.

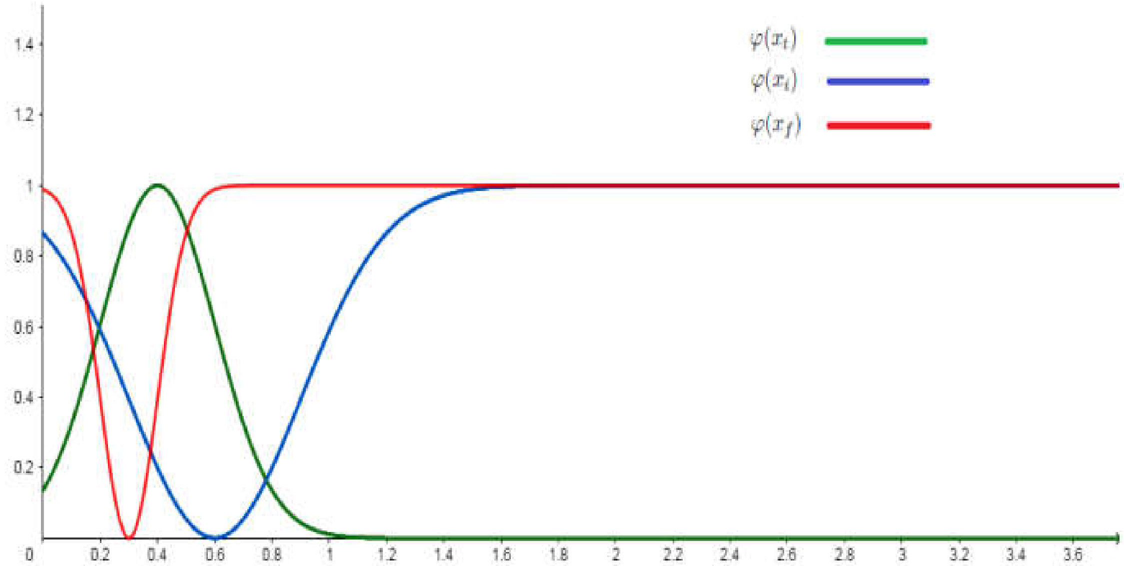


Figure 1: GSVNN $\tilde{A}$

Definition α**-cut of Gaussian SVN-number:** Truth-membership function, indeterminacy-membership function and falsity-membership function for Gaussian SVN-number $\tilde{A}$ are given as follows:

$$\varphi(x_t) = \exp(-\frac{1}{2}(\frac{x_t - \overline{\mu}_t}{\sigma_t})^2),$$

$$\varphi(x_i) = 1 - \exp(-\frac{1}{2}(\frac{x_i - \overline{\mu}_i}{\sigma_i})^2),$$

$$\varphi(x_f) = 1 - \exp(-\frac{1}{2}(\frac{x_f - \overline{\mu}_f}{\sigma_f})^2)$$

respectively.

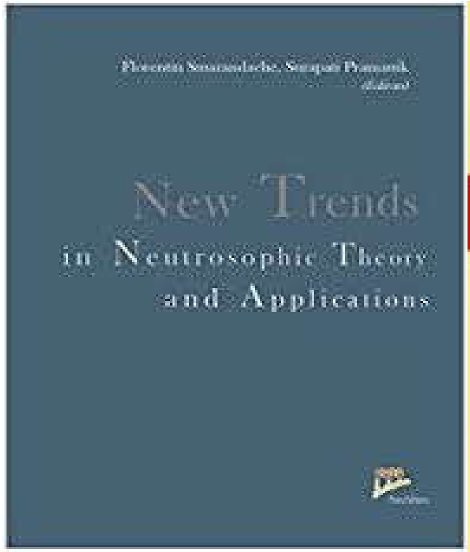
Then α-cuts of them are as follows:

$$A_{t_\alpha} = \left[\overline{\mu}_t - (\sigma_t\sqrt{-2\log\alpha}), \overline{\mu}_t + (\sigma_t\sqrt{-2\log\alpha})\right],$$

$$A_{i_\alpha} = \left[\overline{\mu}_i - (\sigma_i\sqrt{-2\log(1-\alpha)}), \overline{\mu}_i + (\sigma_i\sqrt{-2\log(1-\alpha)})\right],$$

$$A_{f_\alpha} = \left[\overline{\mu}_f - (\sigma_f\sqrt{-2\log(1-\alpha)}), \overline{\mu}_f + (\sigma_f\sqrt{-2\log(1-\alpha)})\right],$$

respectively.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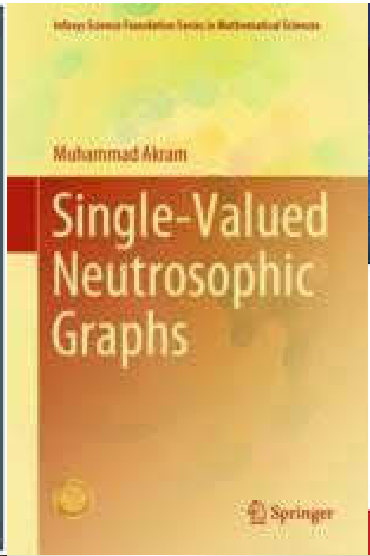
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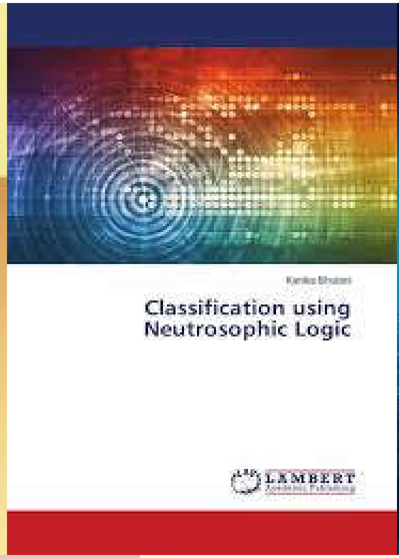
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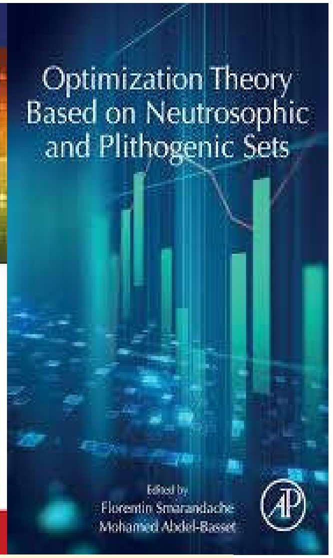
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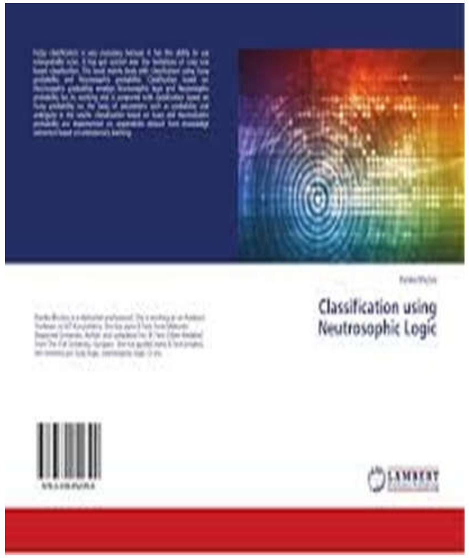
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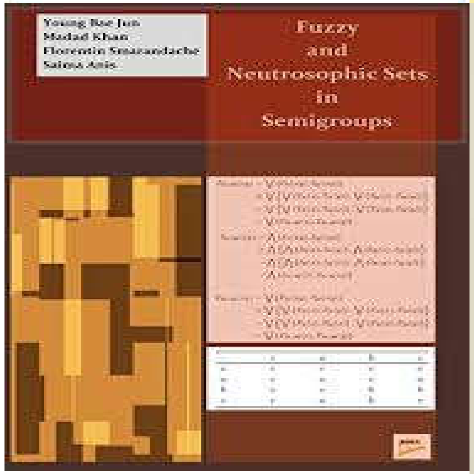
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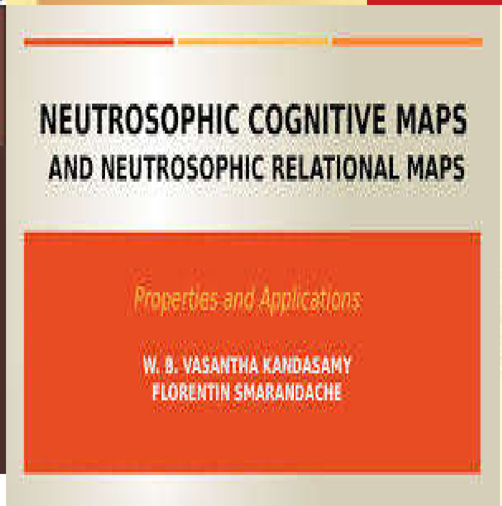
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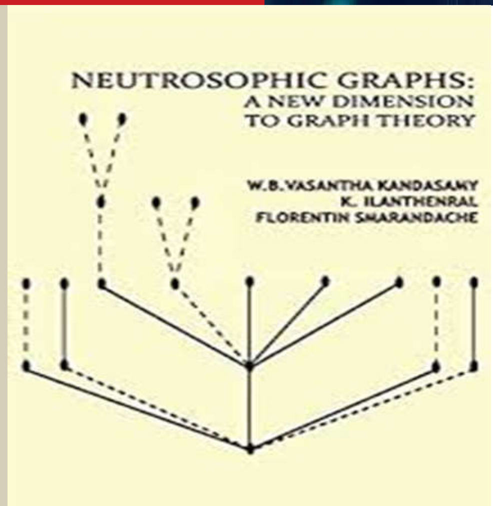
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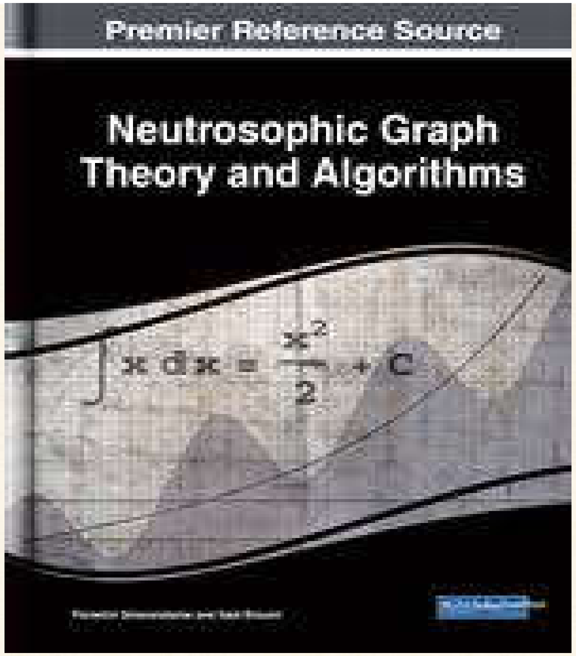

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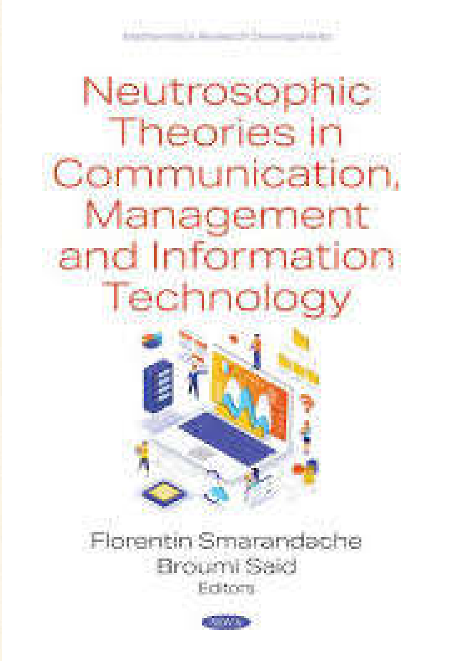

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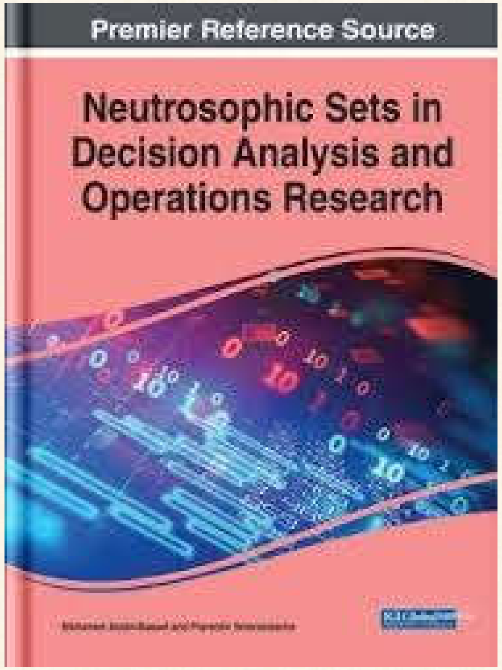

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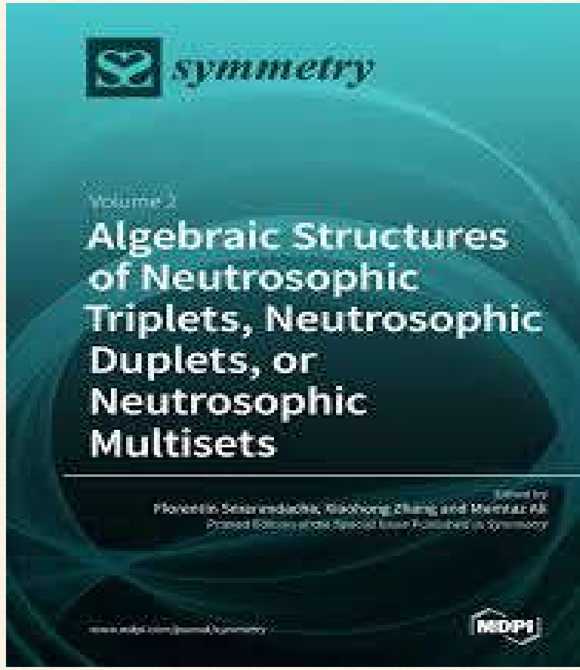

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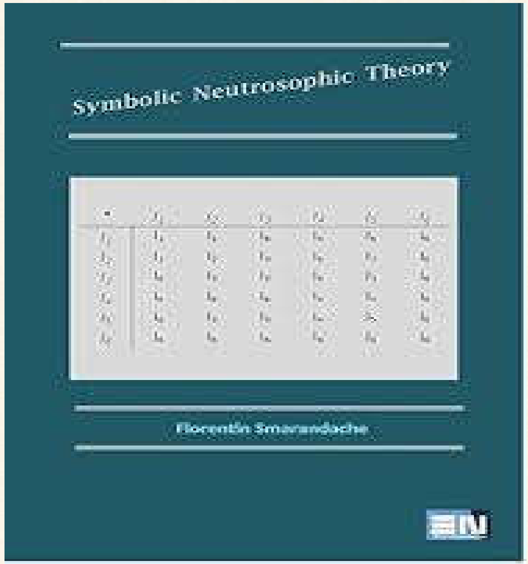

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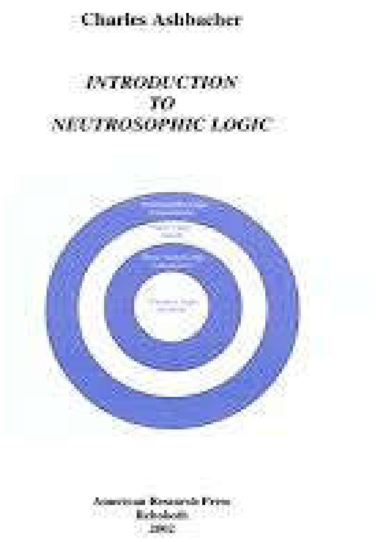
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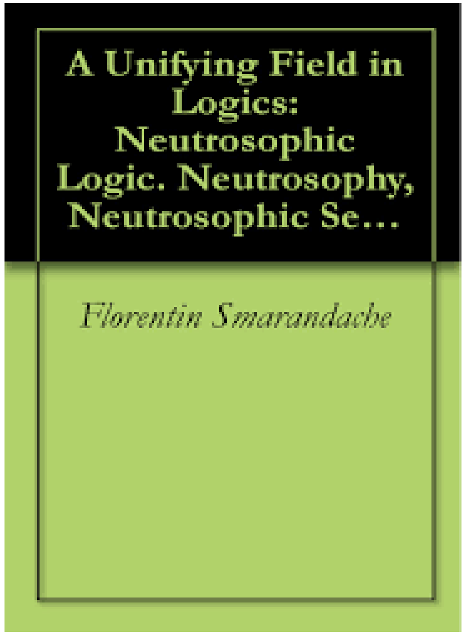
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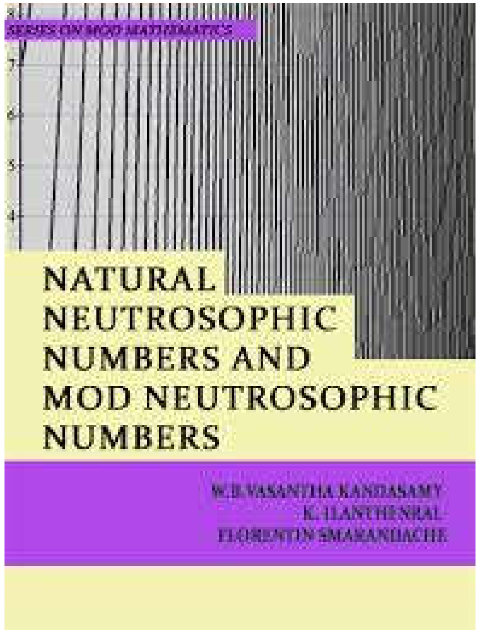
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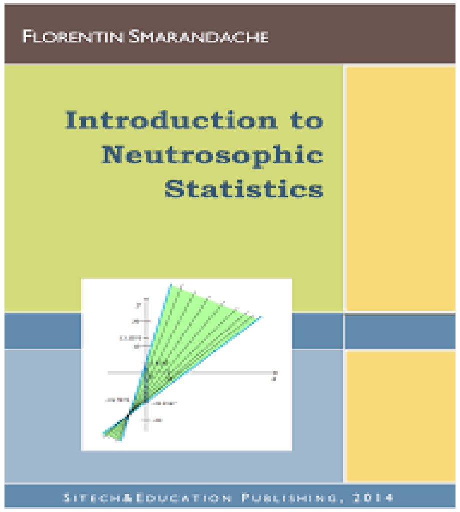
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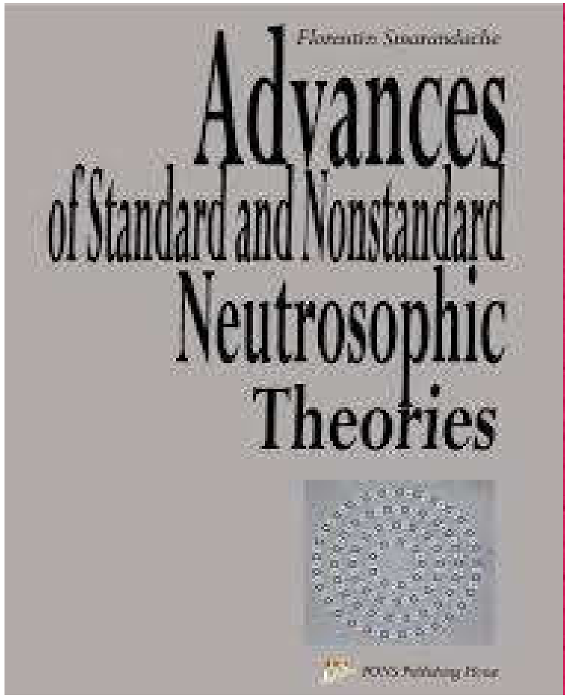

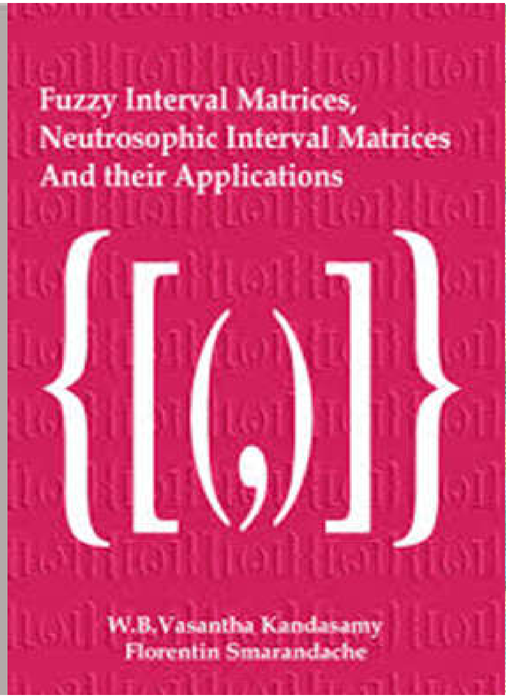

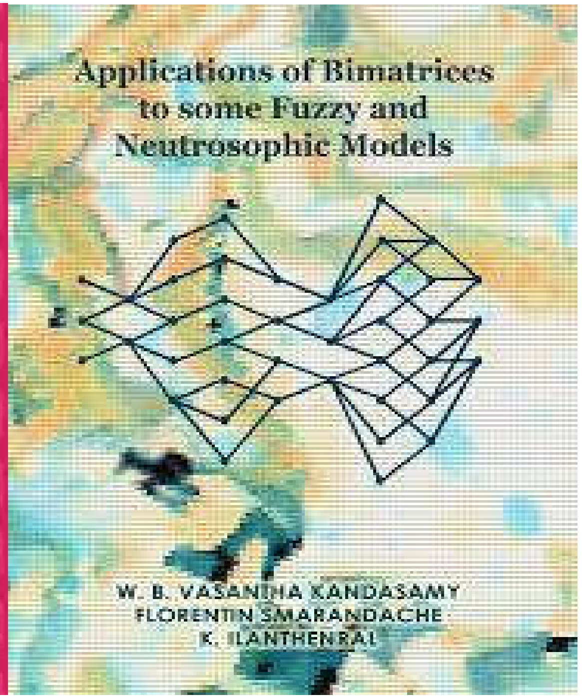

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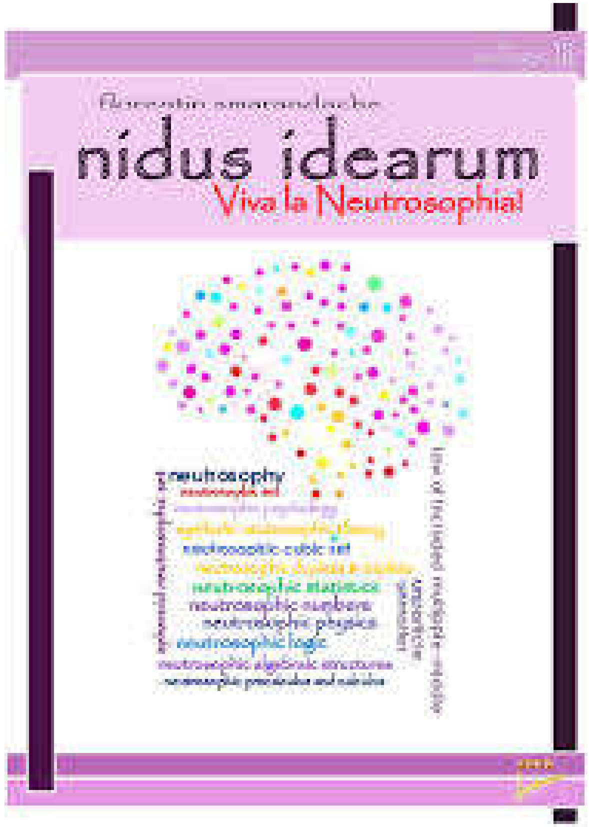

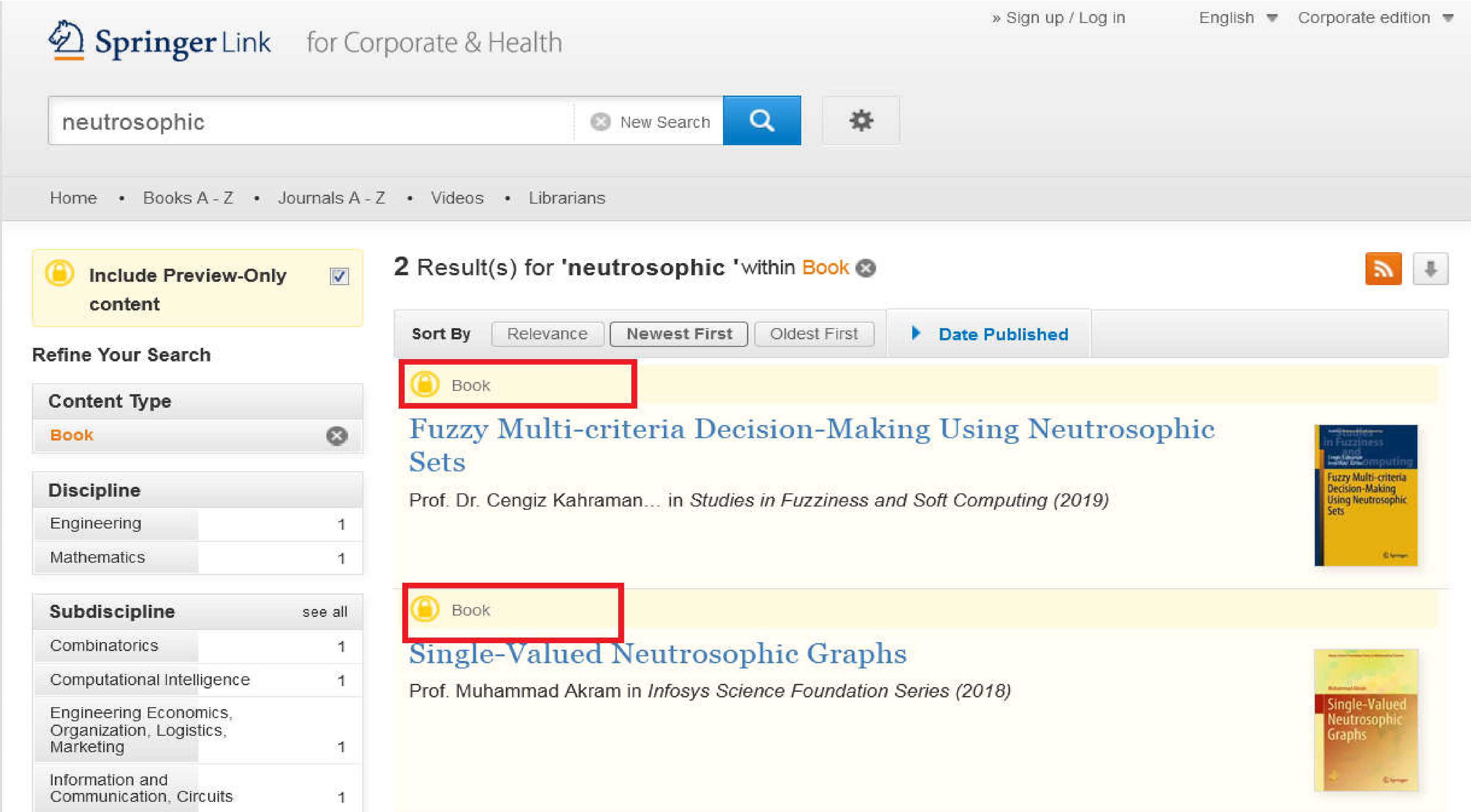
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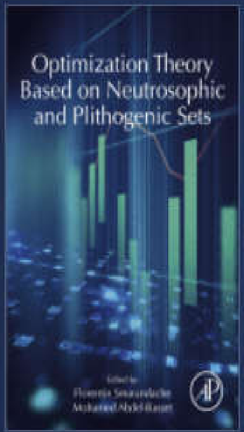

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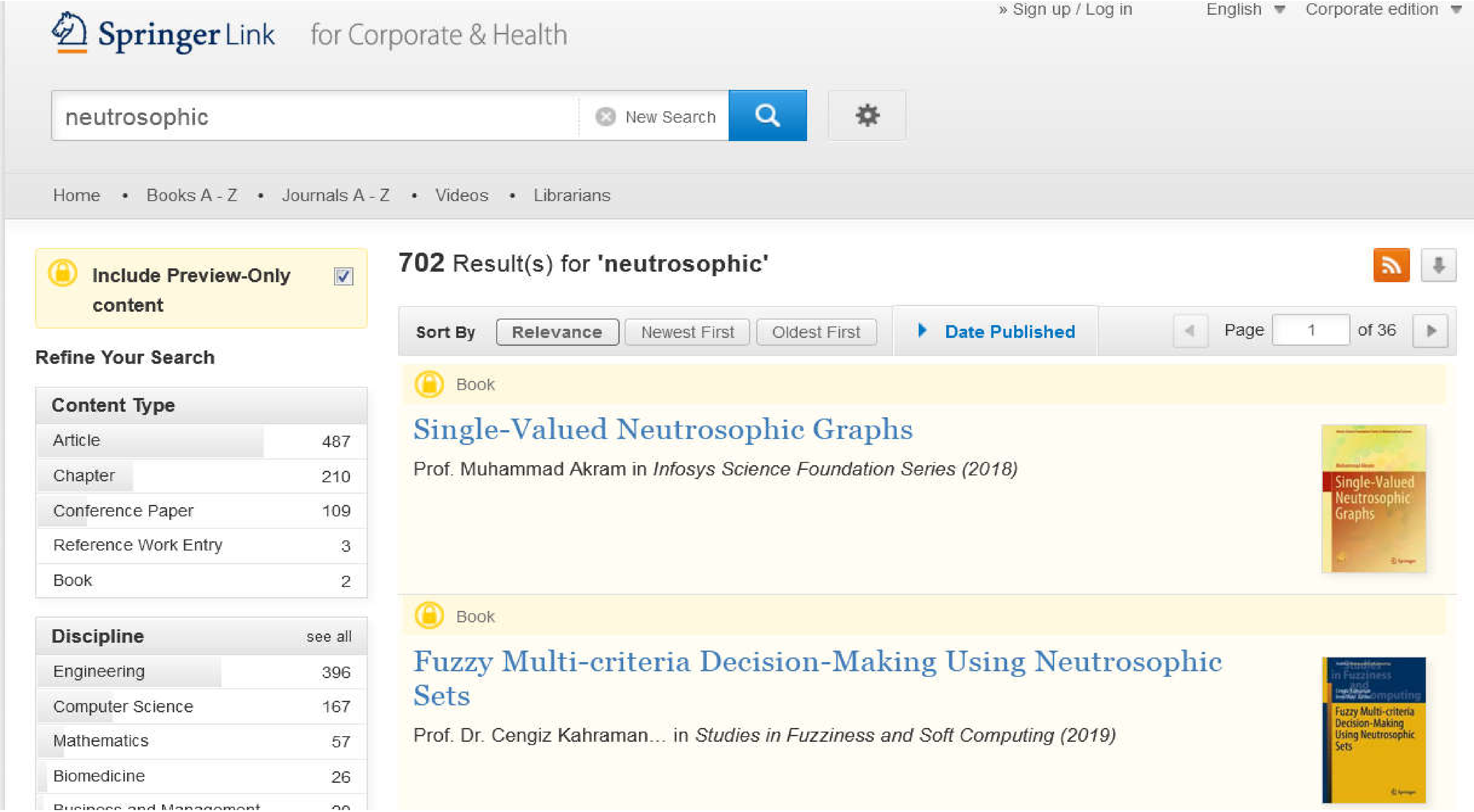

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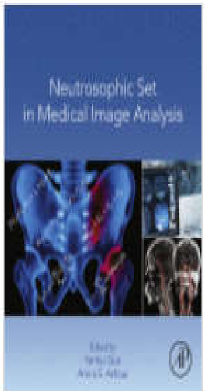

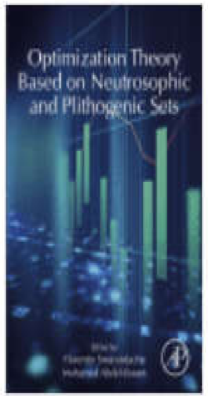

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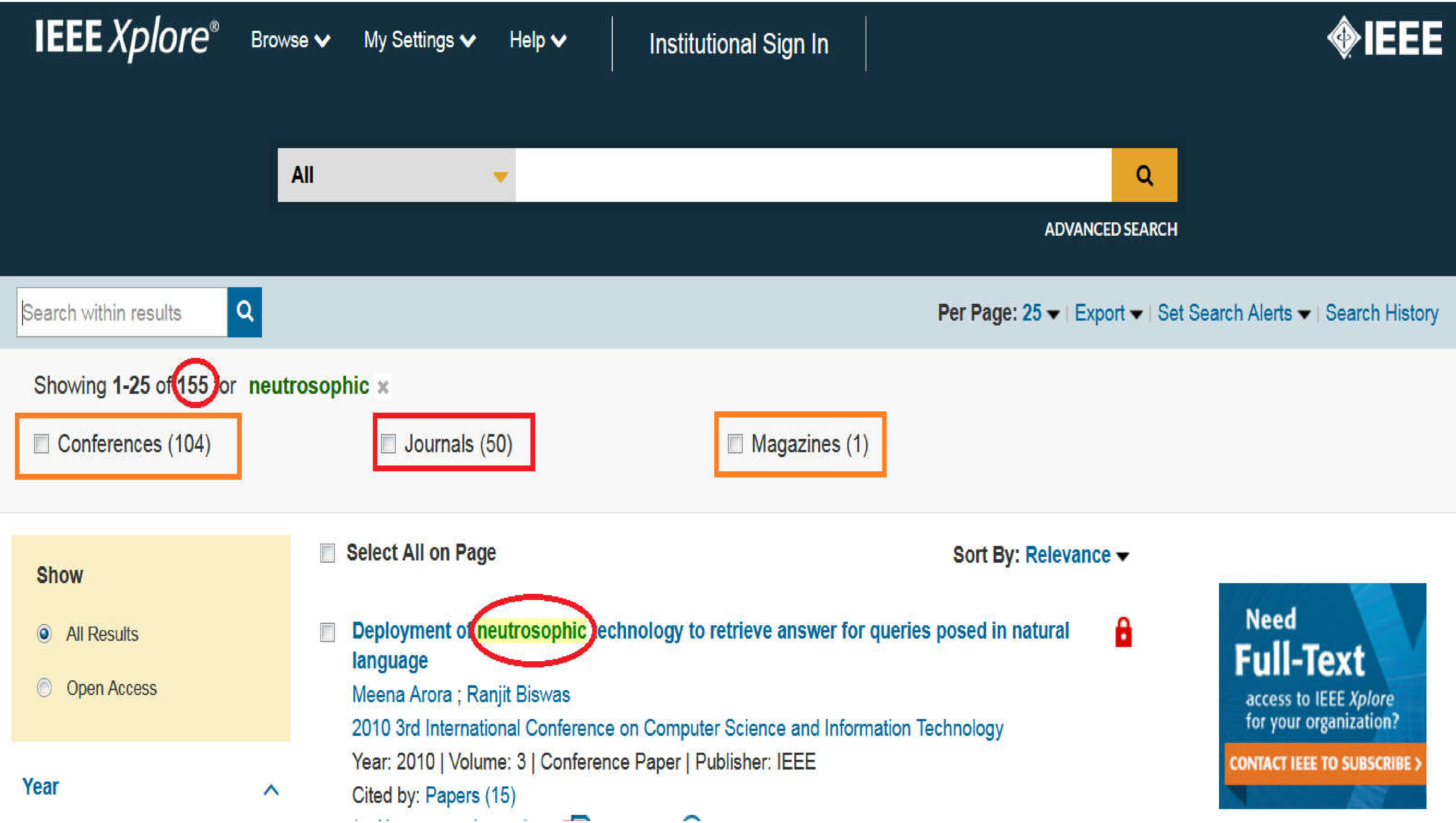
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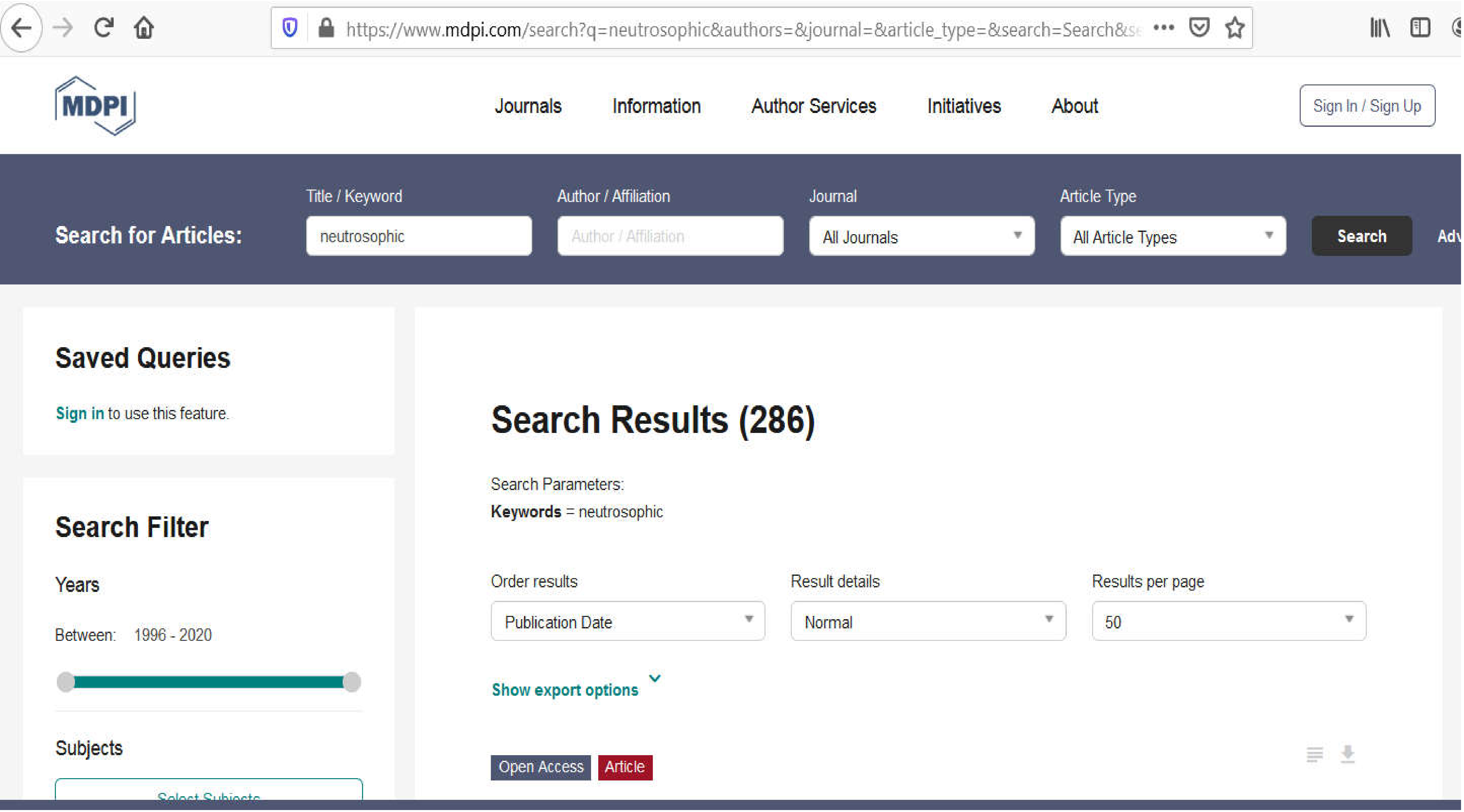
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Similarity Measures of Quadripartitioned Single Valued Bipolar Neutrosophic Sets and Its Application in Multi-Criteria Decision Making Problems

by Subhadip Roy , Jeong-Gon Lee , Anita Pal and Syamal Kumar Samanta

Symmetry **2020**, *12*(6), 1012; https://doi.org/10.3390/sym12061012 - 16 Jun 2020

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Abstract In this paper, a definition of quadripartitioned single valued bipolar neutrosophic set (QSVBNS) is introduced as a generalization of both quadripartitioned single valued neutrosophic sets (QSVNS) and bipolar neutrosophic sets (BNS). There is an inherent symmetry in the definition of QSVBNS. Some operations [...] Read more.

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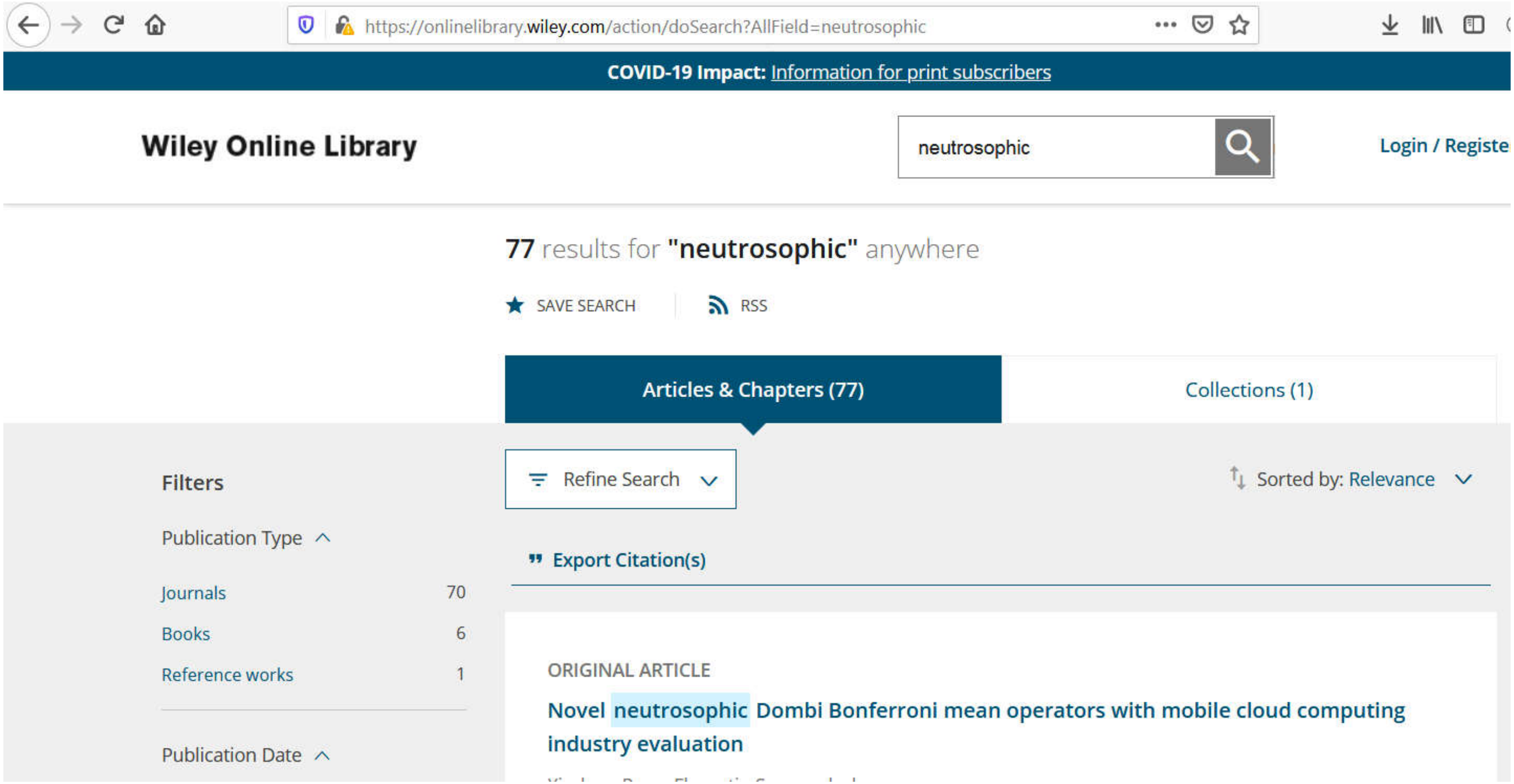
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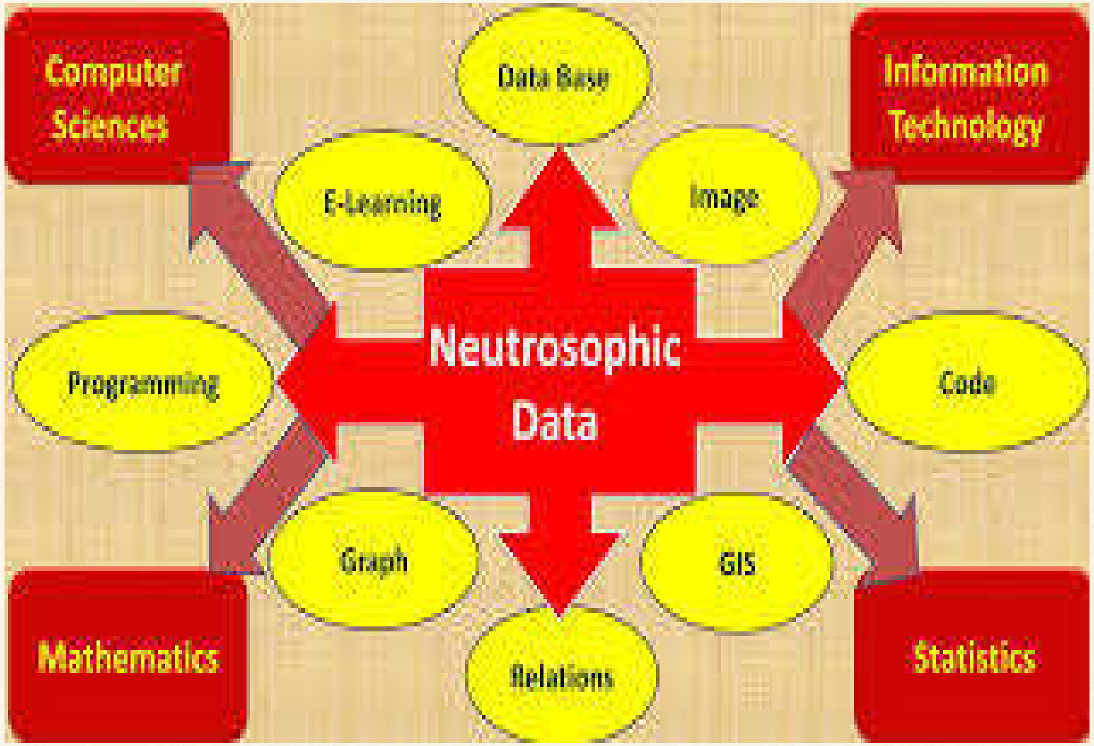

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Neutrosophic set in medical imaging

- Generally, the neutrosophic set (NS) approaches were applied successfully into image processing including image de-noising based on neutrosophic median filtering

Neutrosophic set for medical image de-noising

- Noise is one kind of indeterminant information on images. de-noising research domain Hence, NS can be successfully applied into image.
- The neutrosophic image properties allow the NS to achieve superior performance in several image de-noising applications in computer vision and image processing

Neutrosophic Set in Medical Image Analysis

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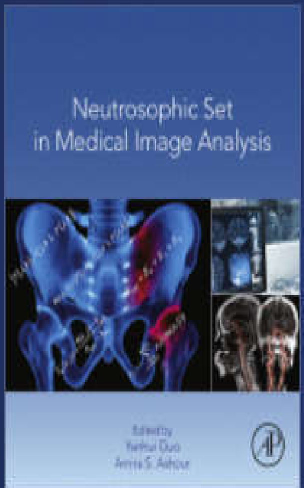

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D. Koundal [a], [b], *, S. Gupta [b], S. Singh [b]

[a] Department of Computer Science & Engineering, Chitkara University Institute of Engineering & Technology, Chitkara University, Baddi, Himachal Pradesh, India

[b] Department of Computer Science & Engineering, University Institute of Engineering & Technology, Panjab University, Chandigarh, Punjab, India

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authors propose a novel clustering approach called **neutrosophic** l-means (NLM) to detect the lesion boundary.... feature to improve the image quality, and a novel **neutrosophic**

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Soma Datta, Nabendu Chaki & Biswajit Modak

SN Computer Science **1**, Article number: 63 (2020) | Cite this article

Abstract; Dental caries is an infectious oral disease. The monitoring of caries region boundary, in regular intervals, is important for treatment purpose. To detect dental caries lesion, most of the time dentists use X-ray images. Due to human brain perception, sometimes it is difficult to detect the caries lesion accurately by observing the X-ray image manually. In this work, a framework has been proposed to detect caries lesion automatically within the optimum time. Almost all caries detection methods from the radiographic images apply iterative methods upon the entire image to separate initially suspected regions. Then, further processing is performed on the separated regions. This method reduced huge computation efforts by avoiding applying iterative methods upon the entire input image. This method transforms the input X-ray image into its equivalent neutrosophic domain to obtain initially suspected region. We have used a custom feature named 'weight' for neutrosophication. This feature is calculated by fusing other features differently. Once the initial region is detected, it is examined further to test whether there exists any iso-center rings like the catchment basin. This is the most important property of caries lesions. After the suspected region is confirmed as caries lesion, then the caries boundary is detected using active contour technique. The advantage of this system is that it avoids repetitive iterations at the time of suspected region selection using neutrosophication. Repetitive iterations upon the entire picture dimension are a time-consuming job. The performance of the proposed research work is satisfactory; the average accuracy is above 92%.

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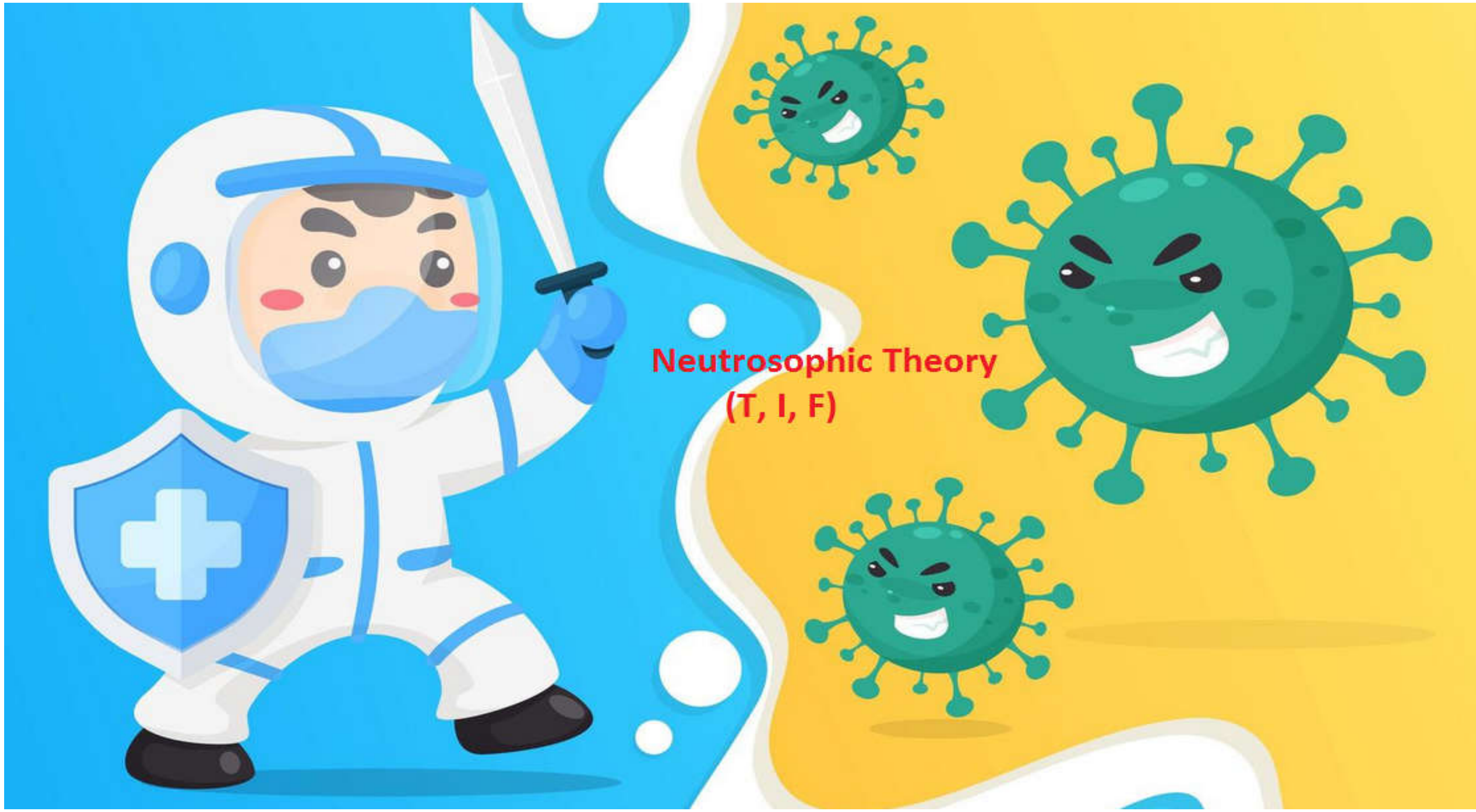

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Salama, A. A., Eisa, M., ELhafeez, S. A., Lotfy, M. M. (2015)	Review of recommender systems algorithms utilized in social networks based e-Learning systems neutrosophic system	Neutrosophic Sets and Systems 8 : 32-40
Ansari, A. Q., Biswas, R., Aggarwal, S. (2013)	Neutrosophic classifier: An extension of fuzzy classifer	Applied Soft Computing, 13(1), 563-573
Zhang, M., Zhang, L., Cheng, H. D. (2010)	A neutrosophic approach to image segmentation based on watershed method	Signal Processing, 90(5), 1510-1517
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Mondal, K. A. L. Y. A. N., Pramanik, S. U. R. A. P. A. T. I., Giri, B. C. (2016)	Role of neutrosophic logic in data mining. New Trends in Neutrosophic Theory and Application	Pons Editions, Brussels, 15-23.
Sengur, A., Guo, Y. (2011)	Color texture image segmentation based on neutrosophic set and wavelet transformation	Computer Vision and Image Understanding,115(8), 1134-1144
Akbulut, Y., engr, A., Guo, Y., Smarandache, F. (2017)	A novel neutrosophic weighted extreme learning machine for imbalanced data set	Symmetry, 9(8), 142
Kraipeerapun, P., Fung, C. C., Wong, K. W. (2007 August)	Ensemble neural networks using interval neutrosophic sets and bagging	In Third International Conference on Natural Computation (ICNC 2007) (Vol. 1, pp. 386-390). IEEE
Kavitha, B., Karthikeyan, S., Maybell, P. S(2012)	An ensemble design of intrusion detection system for handling uncertainty using Neutrosophic Logic Classifier	Knowledge-Based Systems, 28, 88-96

Ye, J. (2014).	Single-valued neutrosophic minimum spanning tree and its clustering method	Journal of intelligent Systems, 23(3), 311-324
Thanh, N. D., Ali, M. (2017, July)	Neutrosophic recommender system for medical diagnosis based on algebraic similarity measure and clustering	In 2017 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE) (pp. 1-6). IEEE
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A. Olaru, S. Olaru, N. Mihai, and N. Smidova

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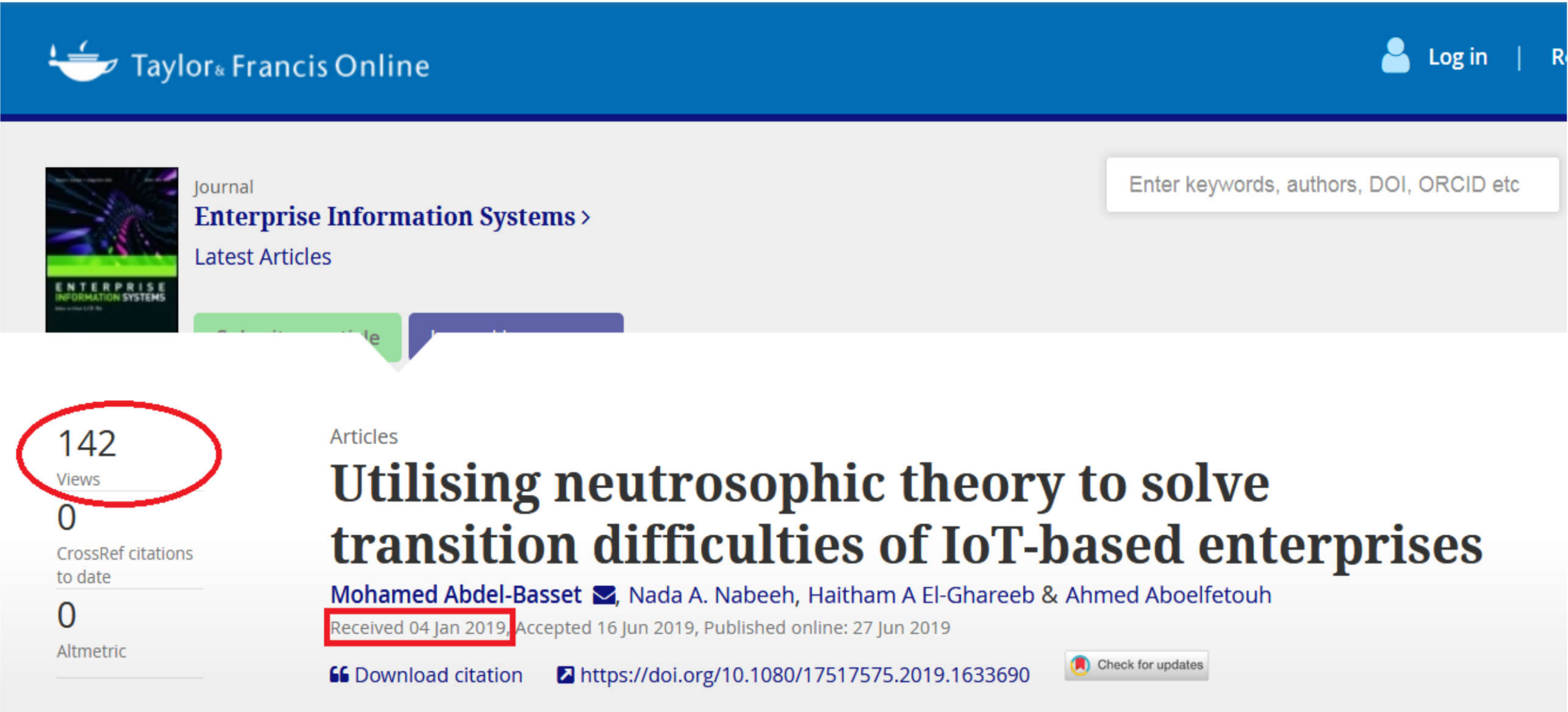

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Online Analytical Processing Operations via Neutrosophic Systems

A. A. Salama[1], M.S.Bondok Henawy[2], Rafif Alhabib[3]

[1,2]Department of Mathematics and Computer Science, Faculty of Sciences, Port Said University Egypt.
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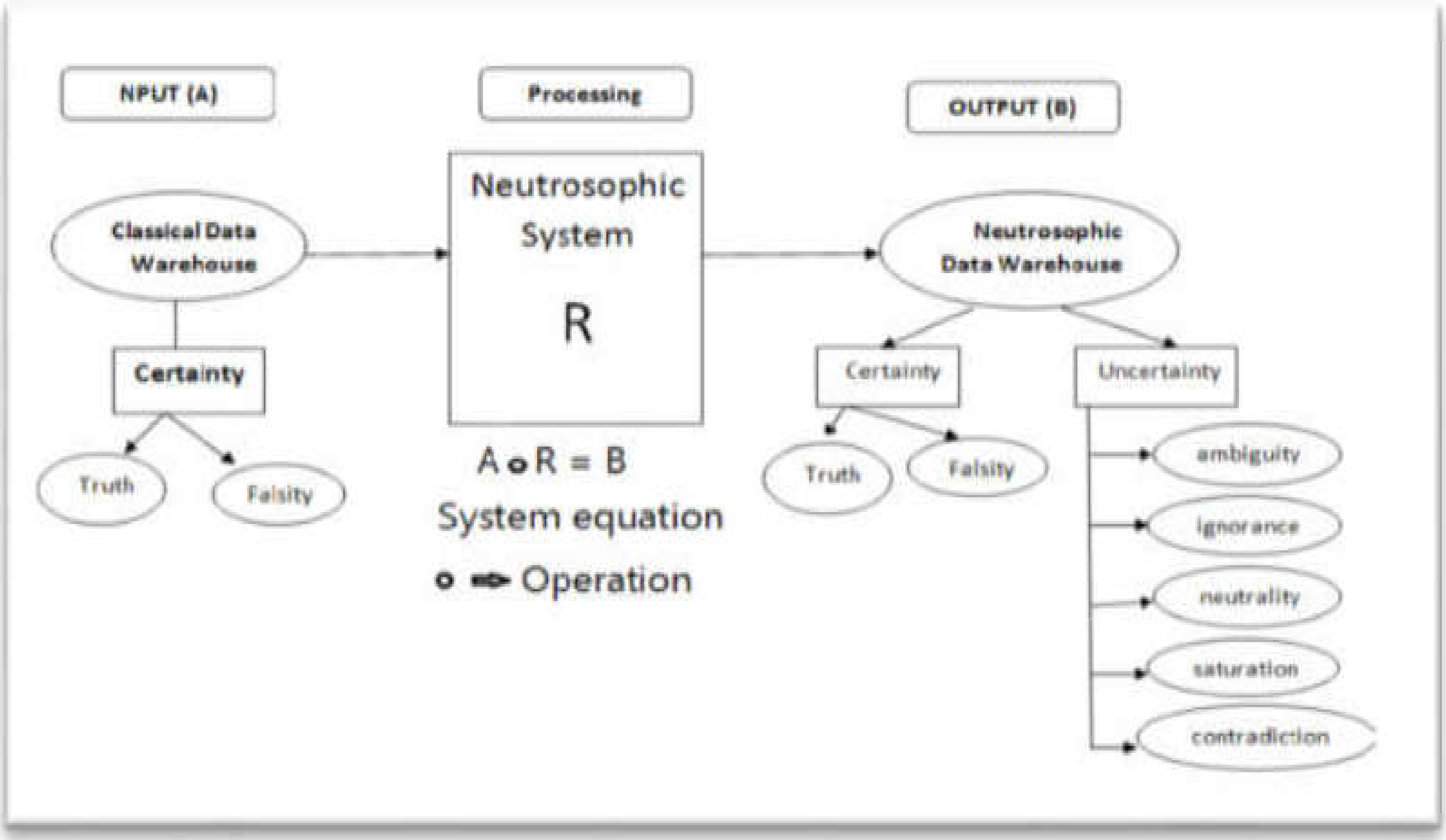

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A Novel Approach for Classifying MANETs Attacks with a Neutrosophic Intelligent System based on Genetic Algorithm

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Network, Web & Security
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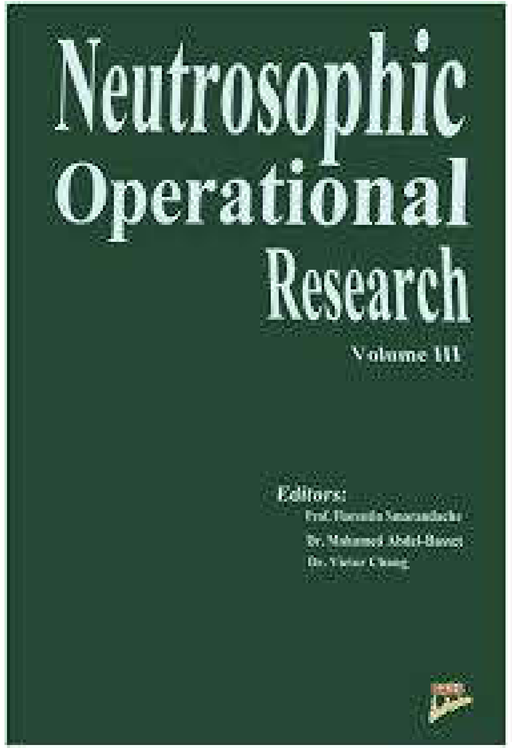
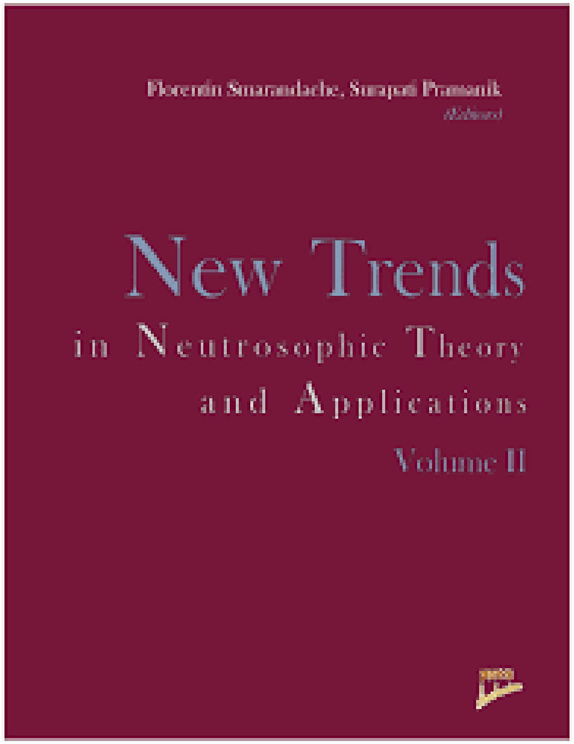
Novel System and Method for Telephone Network Planing based on Neutrosophic Graph

By Said Broumi, Kifayat Ullah, Assia Bakali, Mohamed Talea, Prem Kumar Singh, Tahir Mahmood, Florentin Smarandache, Ayoub Bahnasse, Santanu Kumar Patro & Angelo de Oliveira

University Hassan II

Neutrosophic operational Research





Published: 07 March 2019

Neutrosophic approach for enhancing quality of signals

Sudan Jha, Raghvendra Kumar, Le Hoang Son, Francisco Chiclana, Vikram Puri & Ishaani Priyadarshini

Multimedia Tools and Applications **79**, 16883–16914(2020) | Cite this article

Abstract : Information in a signal is often followed by undesirable disturbance which is termed as noise. Preventing noise in the signal leads to signal integrity, which also leads to better signal quality. The previous related works have the major issues while reducing noise in signals regarding assumptions, frequency and time domain, etc. This paper proposes a new Neutrosophic approach to reduce noises and errors in signal transmission. In the proposed method, confidence function is used as the truth membership function, which is associated with sampled time intervals. Then, we define a Dependency function at each time interval for the frequency of transmitted signal. Finally, a Falsehood function, which indicates the loss in information due to amplitude distortion, is defined. This function shows how much information has been lost. Our objective is to minimize the falsehood function using several neutrosophic systems. Experimental results show 1% decrease in loss compared to the original signal without PAM. It is shown the decrease of 0.1% if the frequency is shifted to a higher range.

Research on the Shortest Path Solution Method of Interval Valued Neutrosophic Graphs Based on the Ant Colony Algorithm

Publisher: IEEE

3 Author(s) Lehua Yang ; Dongmei Li ; Ruipu Tan All Authors

Abstract:
The shortest path problem (SPP) is considerably important in several fields. After typhoons, the resulting damage leads to uncertainty regarding the path weight that can be expressed accurately. A neutrosophic set is a collection of the truth membership, indeterminacy membership, and falsity membership degrees of the elements. In an uncertain environment, neutrosophic numbers can express the edge distance more effectively. Based on the theories of interval valued neutrosophy and neutrosophic graphs, this paper proposes a shortest path solution method of interval valued neutrosophic graphs using the ant colony algorithm. Further, an analysis comparing the proposed algorithm with the Dijkstra algorithm was used to probe the potential shortcomings and advantages of the proposed method. In addition, this approach confirmed the effectiveness of the proposed algorithm. Furthermore, we investigated the convergence processes of the ant colony algorithm with different parameter settings, analyzed their results, and used different score functions to solve the SPP and analyze the results.

Topic: Intelligent Information Services

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Publisher: IEEE

Outline

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Operations Research Perspectives

Volume 6, 2019, 100099

A new perspective on traffic control management using triangular interval type-2 fuzzy sets and interval neutrosophic sets

D. Nagarajan [a], M. Lathamaheswari [a], Said Broumi [b], J. Kavikumar [c]

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Neutrosophic state feedback design method for SISO neutrosophic linear systems

Jun Ye, Wenhua Cui

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Title: METHODS AND SYSTEMS FOR PERFORMING SEGMENTATION AND REGISTRATION OF IMAGES USING NEUTROSOPHIC SIMILARITY SCORES

Document Type and Number: United States Patent Application 20200226414 **Kind Code:** A1

Abstract: An example method for segmenting an object contained in an image includes receiving an image including a plurality of pixels, transforming a plurality of characteristics of a pixel into respective neutrosophic set domains, calculating a neutrosophic similarity score for the pixel based on the respective neutrosophic set domains for the characteristics of the pixel, segmenting an object from background of the image using a region growing algorithm based on the neutrosophic similarity score for the pixel, and receiving a margin adjustment related to the object segmented from the background of the image.

» Business & Management » Operations Research & Decision Theory

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Neutrosophic Operational Research

Methods and Applications

Editors: **Smarandache**, Florentin, **Abdel-Basset**, Mohamed (Eds.)

Presents state-of-the-art research on neutrosophic theory and its application in operations research

Book

Neutrosophic Operational Research

Smarandache, F. (Ed), Abdel-Basset, M. (Ed) *(2021)*

This book addresses new concepts, methods, algorithms, modeling, and applications of green supply chain, inventory control problems, assignment problems, transportation problem, ...

Available Formats: Hardcover | eBook

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Florentin Smarandache
Mohamed Abdel-Basset

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Topics
» Operation Research/Decision Theory

Guest Editorial: Neutrosophic decision making and applications in knowledge management

Publisher: IET

Cite This

PDF

1 Author(s) Harish Garg All Authors

Abstract

Authors

Published in: CAAI Transactions on Intelligence Technology (Volume: 5 , Issue: 2 , 6 2020)

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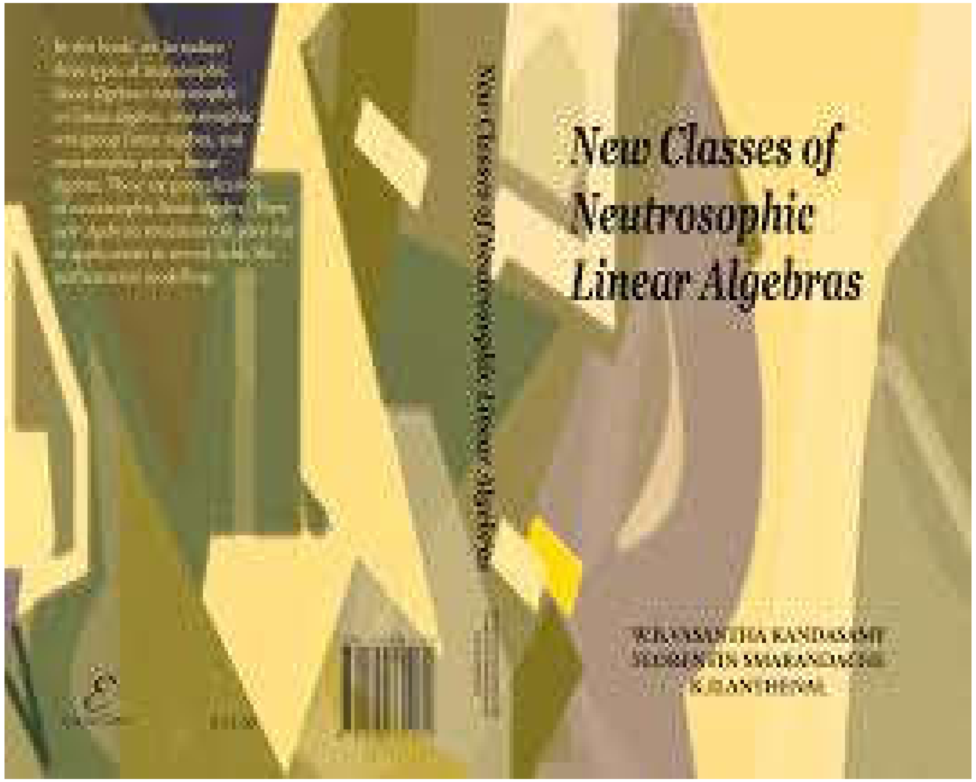
DOI: 10.1049/trit.2020.0096

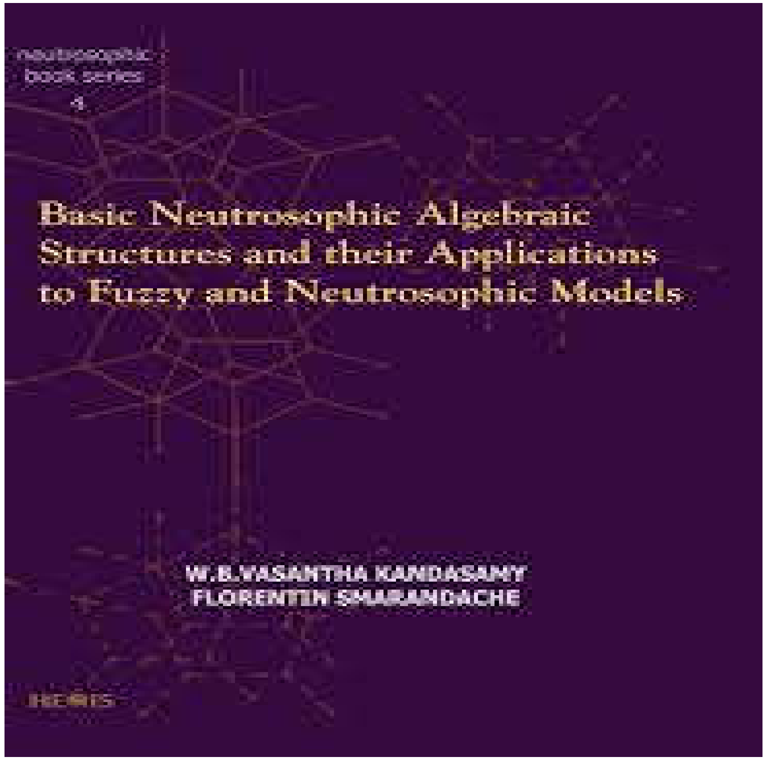
Date of Publication: 01 July 2020

Publisher: IET

Electronic ISSN: 2468-2322

Neutrosophic Linear Algebra





Neutrosophic Quantum Computer

Intern. J. Fuzzy Mathematical Archive
Vol. 10, No. 2, 2016, 139-145
ISSN: 2320 –3242 (P), 2320 –3250 (online)
Published on 12 May 2016
www.researchmathsci.org

International Journal of
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Neutrosophic Quantum Computer

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Email: smarand@unm.edu

symmetry

MDPI

Article

Neutrosophic Logic Based Quantum Computing

Ahmet Çevik [1], Selçuk Topal [2,*] and Florentin Smarandache [3]

[1] Gendarmerie and Coast Guard Academy, Department of Science, Ankara 06805, Turkey, a.cevik@hotmail.com
[2] Department of Mathematics, Faculty of Science and Arts, Bitlis Eren University, Bitlis 13000, Turkey
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Received: 18 October 2018; Accepted: 16 November 2018; Published: 20 November 2018

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Abstract

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Introduction to the Neutrosophic Quantum Theory

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Smarandache, Florentin

Neutrosophic Quantum Theory (NQT) is the study of the principle that certain physical

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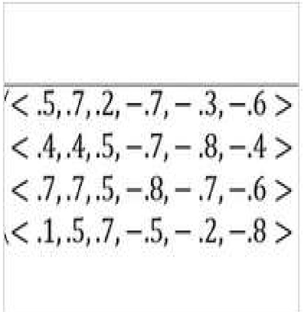

A Matlab Toolbox for Bipolar Neutrosophic Matrices version 1.0.1 by said broumi

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Software package for computing bipolar neutrosophic operational matrices

This toolbox is built in order to compute the operations of union, intersection, complement, transpose and other operations of bipolar neutrosophic matrices. Bipolar neutrosophic matrices are

- *fx* transpose - bipolar neutrosophic matrix A
- *fx* power - of bipolar neutrosophic matrix A
- *fx* complement - of bipolar valued neutrosophic matrix A
- *fx* display - s bipolar neutrosophic matrix A formated on the screen
- *fx* intersect

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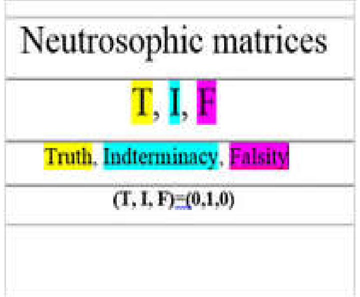
Toolbox



toolbox for the interval valued bipolar neutrosophic matrice

version 1.0.0 by said broumi

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software package for computing operations on interval valued bipolar neutrosophic matrices

This package is used to calculate the operations on interval valued bipolar neutrosophic matrices This package is descriped with examples in a submited articlethis pakage is under construction and

- *fx* transpose - interval valued bipolar neutrosophic matrix A
- *fx* minmaxmax - of two interval valued bipolar neutrosophic matrix A and B
- *fx* ivbnm
- *fx* isempty
- *fx* complement

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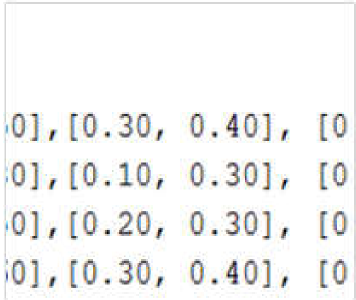
Toolbox



A Matlab Toolbox for Interval Valued Neutrosophic Matrices

version 1.0.0 by said broumi

5 Downloads

Updated 27 May 2019

Software package for computing a variety of operations on interval valued neutrosophic matrices

A Matlab Toolbox for Interval Valued Neutrosophic Matrices for Computer ApplicationsThis pakage aims to provide an new tools to be utilized in Neutrosophic community. This pakages was developped in

- *fx* transpose - interval valued neutrosophic matrix A
- *fx* power - of interval valued neutrosophic matrix A
- *fx* complement - of an interval valued neutrosophic matrix A
- *fx* scalar - of interval valued neutrosophic matrix A
- *fx* Spec - trum of an interval valued neutrosophic matrix A

Implementation of Neutrosophic Function Memberships Using MATLAB Program

Definition:A trapezoidal neutrosophic number $a = \langle (a,b,c,d); w_a, u_a, y_a \rangle$ is a special neutrosophic set on the real number set R, whose truth-membership, indeterminacy– membership and falsity-membership functions are defined as follows:

$$\mu_a(x) = \begin{cases} \dfrac{(x-a)}{(b-a)} w_a & , \quad a \le x \le b \\ w_a & , \quad b \le x \le c \\ \dfrac{(d-x)}{(d-c)} w_a & , \quad c \le x \le d \\ 0 & , \quad otherwise \end{cases}$$

$$v_a(x) = \begin{cases} \dfrac{(b-x)+u_a(x-a)}{(b-a)} & , \quad a \le x \le b \\ u_a & , \quad b \le x \le c \\ \dfrac{(x-c)+u_a(d-x)}{(d-c)} & , \quad c \le x \le d \\ 1 & , \quad otherwise \end{cases}$$

$$\lambda_a(x) = \begin{cases} \dfrac{(b-x)+y_a(x-a)}{(b-a)} & , \quad a \le x \le b \\ y_a & , \quad b \le x \le c \\ \dfrac{(x-c)+y_a(d-x)}{(d-c)} & , \quad c \le x \le d \\ 1 & , \quad otherwise \end{cases}$$

https://www.mathworks.com/matlabcentral/fileexchange?q=neutrosophic

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fx Spec - trum of an interval valued neutrosophic matrix A

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Toolbox

Matlab code to find Trapezoidal Neutrosophic Function version 1.0.1 by said broumi

A novel Matlab code for trapezoidal neutrosophic function

the matlab code of trapezoidal neutrosophic function is generalisation of trapezoidal fuzzy function and trapezoidal intuitionistic fuzzy function.

Function

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A Neutrosophic Recommender System for Medical Diagnosis Based on Algebraic Neutrosophic Measures version 1.0 by pham viet

Implementation of Neutrosophic Recommender System

Implementation of Neutrosophic Recommender System

Toolbox

1 Download

Updated 4 Feb 2016

Trapezoidal neutrosophic Function (trin)

```
%x=45:70;
%[y,z]=trin(x,50,55,60,65, 0.6, 0.4,0.6)%
```

U truth membership
V indterminacy membership
W :falsemembership

```
function [y,z,t]=trin(x,a,b,c,d,u,v,w)
y=zeros(1,length(x));
z=zeros(1,length(x));
t=zeros(1,length(x));
for j=1:length(x)
if(x(j)<=a)
   y(j)=0;
   z(j)=1;
   t(j)=1;
elseif(x(j)>=a)&&(x(j)<=b)
y(j)=u*(((x(j)-a)/(b-a)));
z(j)=(((b-x(j))+v*(x(j)-a))/(b-a));
t(j)=(((b-x(j))+w*(x(j)-a))/(b-a));
elseif(x(j)>=b)&&(x(j)<=c)
y(j)=u;
   z(j)=v;
   t(j)=w;
```

4.1 Example

The figure 1 portrayed the pictorical representation of the trapezoidal neutrosophic function $a=\langle(0.3,0.5,0.6,0.7);0.4,0.2,0.3\rangle$

The line command to show this function in Matlab is written below:

```
x=0:0.01:1;
[y,z,t]=trin(x,0.3,0.5,0.6,0.7, 0.4, 0.2,0.3)
```

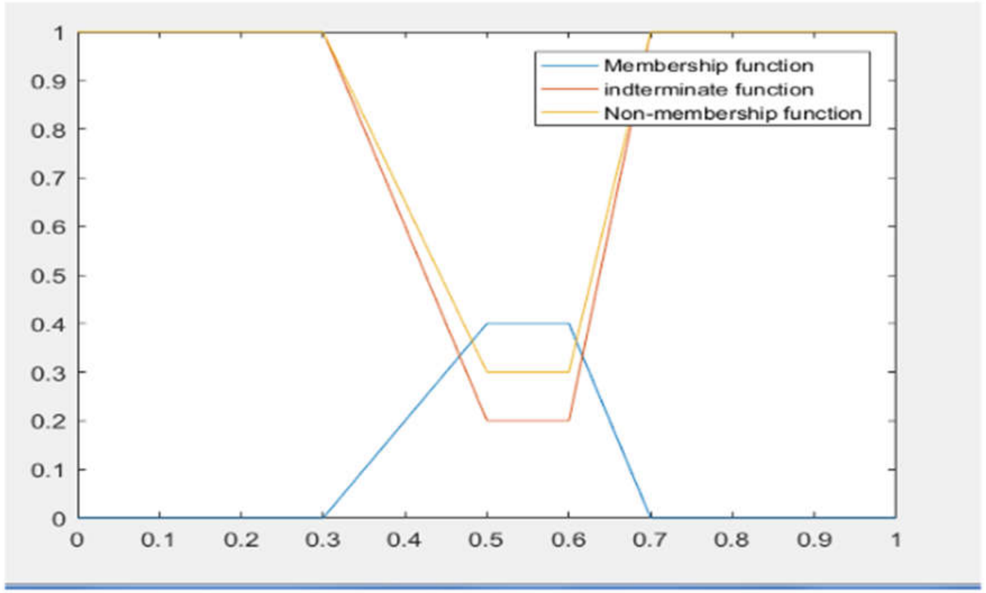

Figure 1: Trapezoidal neutrosophic function for example 4.1

neutrosophic 0.0.5

```
pip install neutrosophic
```

Latest version

Released: Oct 30, 2019

Novel Open Source Python based Neutrosophic Package

Navigation

- Project description
- Release history
- Download files

Statistics

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Project description

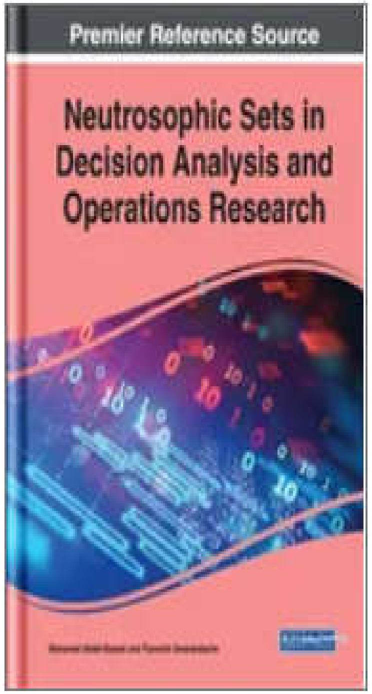
بسم الله الرحمن الرحيم

Open Source Neutrosophic Package

This project aims to provide an open-source Python package to be utilized in Neutrosophic research, academia, and insdustry. This project was initialized in 6th of January 2019.

Publications

Publications of the Projet



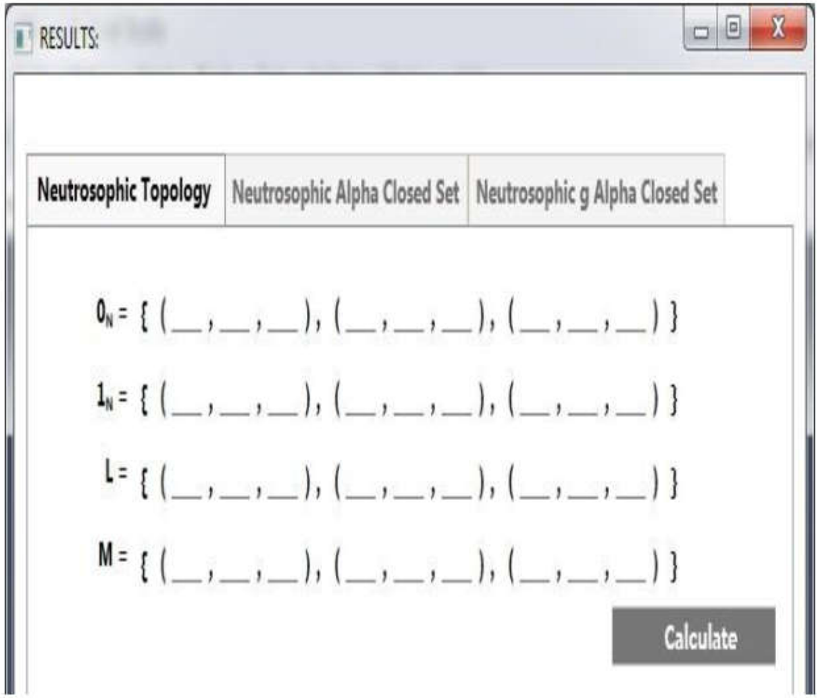
A Novel Python Toolbox for Single and Interval-Valued Neutrosophic Matrices

Said Broumi (Laboratory of Information Processing, Faculty of Science Ben M'Sik, University Hassan II, Morocco), Selçuk Topal (Faculty of Science and Arts, Bitlis Eren University, Turkey), Assia Bakali (Ecole Royale Navale, Casablanca, Morocco), Mohamed Talea (Laboratory of Information Processing, Faculty of Science Ben M'Sik, University Hassan II, Morocco) and Florentin Smarandache (Department of Mathematics, University of New Mexico, USA)

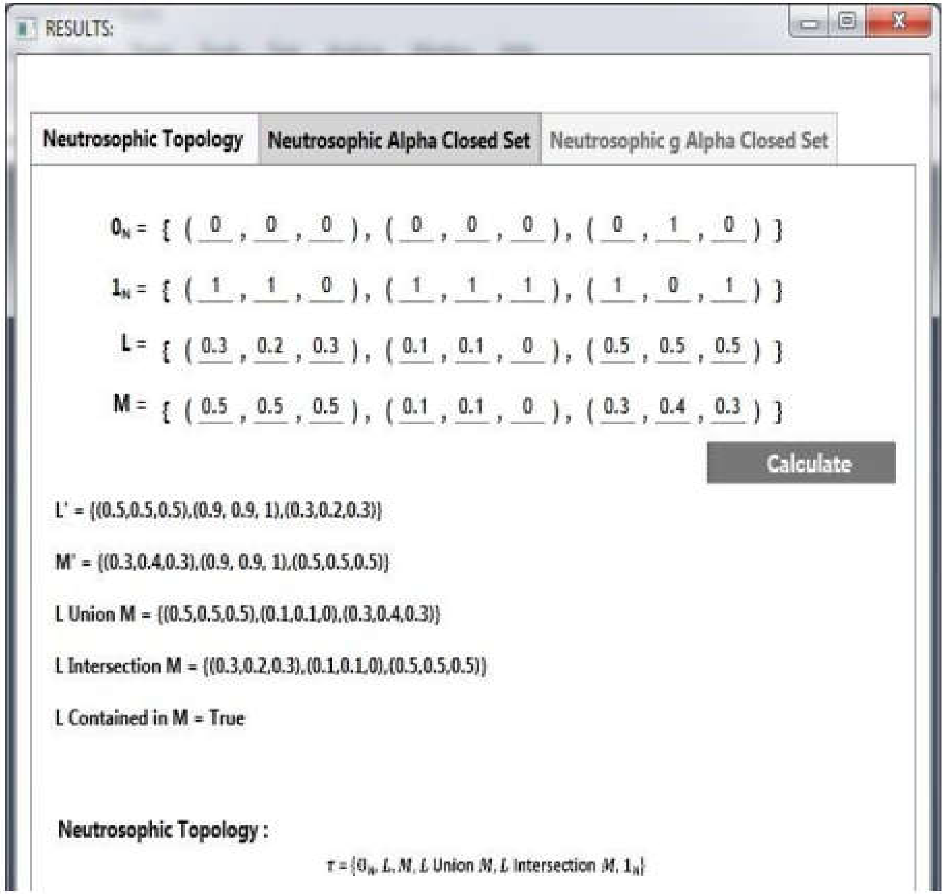
Source Title: Neutrosophic Sets in Decision Analysis and Operations Research

 | Pages: 50

DOI: 10.4018/978-1-7998-2555-5.ch013



"**Figure 2**: Initial Resultant Screen / User Screen"



"**Figure 7**: Existance of Neutrosophic Topology via *C#* Application"

Finally.

- Neutrosophic theory studies objects whose values vary in the sets of elements and are not true or false, but in between, that can be called by neutral, indeterminate, unclear, vague, ambiguous, incomplete or contradictory quantities,
- Neutrosophy is a modeling based on three states and not just two as in classical logic

Thank you