Non-Euclidean Data Exploration using Turiyam Set and its Complement

Prem Kumar Singh

Department of Computer Science and Engineering,
Gandhi Institute of Technology and Management-Visakhapatnam,
Andhra Pradesh 530045, India
ORCID: 0000-0003-1465-6572
Email: premsingh.csjm@gmail.com , premsingh.csjm@yahoo.com

Abstract

Recently, several researchers paid attention towards dealing the data sets beyond Non-Euclidean geometry. To achieve this goal, Turiyam set and its properties is introduced for precise measurement of uncertainty in data sets beyond acceptation, rejection and uncertain parts. However the characterization of uncertainty requires a new operator and method. To resolve this issue, the current paper introduces a method for precise characterization of fourth dimensional data based on Turiyam operator and its complement with an illustrative example. The proposed method also compared the given method with Euclidean, Non-Euclidean, and NeutroGeometry data characterization.

Keywords: Fourth Dimensions; Knowledge representation; Non-Euclidean; Quaternion; Unknown; Turiyam set

1. Introduction

Recently attention has been paid attention towards measuring the human consciousness [1-3] and its mathematical representation [4-6]. The Euclidean geometry is considered as one of the most prominent geometry for mathematical representation of data sets [7]. This geometry is based on five postulates defined by the Euclid. The problem arises when the Lobachevsky [8] given a data sets which does not follow the parallel postulates of Euclid geometry[1]. It created a problem while precise analysis of Sachheri quadrilateral as shown in Figure 1[2]. The problem arises when the many Non-Euclidean data sets were found due to failure of Euclid postulates[3] [9-11]. One of the suitable examples is move in chess board does not follow Euclidean postulates and its inequalities. In these types of cases precise characterization of data and its representation become major issues for adequate decision making process [12-13]. The reason is following possibility exists [14]:

(i) The data sets belongs to Euclidean geometry,

(ii) The data set does not belong to Euclidean geometry,

(iii) The data set is Hybrid means contains both Euclidean and Non-Euclidean,

(iv) The data sets are not Euclidean and Not Non-Euclidean. It is unknown, impossible, or undefined data sets which need human consciousness to explore.

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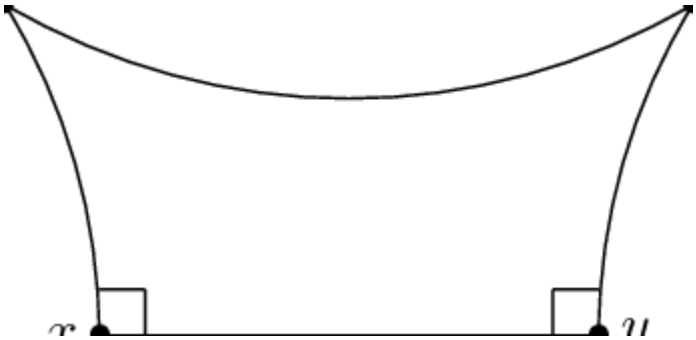

Figure 1: The Sachheri Quadrilateral the Non-Euclidean Data

It can be observed that the first case and second case can be represented easily by Euclidean and Non-Euclidean geometry [14]. The Riemannian geometry divorced the second and fifth law both which given a platform to introduce other geometry. The third hybrid case can be represented via NeutroGeometry which is recently studied [10-12]. The problem arises with fourth dimension data i.e. undefined, impossible, or unknown [15-16]. The exploration of these types of data sets like Algae [17], Organic structure [18] and its representation [19] is a major problem. Due to which Turiyam set [4], Turiyam context [5-6], Turiyam Modules [20], Turiyam Rings [21], Turiyam matrix [22] and its representation in Turiyam Space [23] is introduced. However still many researchers mailed me about existence of this fourth dimension and its geometry. They asked that these types of data sets do not exist then how come one can characterize. To resolve this issue the current paper focused on providing some examples for fourth dimension data for further analysis.

Recently, Turiyam set is introduced for dealing the fourth dimensional data sets based on human cognition and its awareness [4-6]. It is at early stage which needs more exploration. The first question arises about Turiyam data and its existence. One of the suitable examples is Voting system in mature democracy like India where human cognition is based on Fourth dimension, independently. The first is people support any party (*t*), second people reject the given party (*f*), people are absent or unable to reach at booth or may become late means uncertainty or indeterminacy arises (*i*), the last is NOTA[4] i.e. None of the Above (i.e. *l*). All of these votes are independent to each other. The people who refused to vote can be investigated as (1-*t*-*f*-*i*-*l*). However some researchers mailed that, NOTA has no meaning as it is confused votes. In this case social network chat can be considered as Turiyam dimension. The first case you know the particular person to whomsoever chatting done *(t*), you know the particular person is not chatting or not replying (*f*), Many people are chatting and who replied is indeterminant (*i*), the last is unknown person, undefined person or a person who is nothing is replying (*l*). The person who refused to chat can be found via (1-*t*-*f*-*i*-*l*). In this way the Turiyam set is distinct from any of the available set. Another example is opinion of any country towards India-Pakistan, Israel-Philistine, USA-Russia, USA-China relations is totally depends on their conduit metaphor which is unknown. It is beyond acceptation, rejection and indeterminacy for the same event. Any country support USA, does not support USA, uncertain about USA or Unknwon about the USA policy is totally based on its conduit metaphore. It was observed in Russia-Ukraine war where some country supported USA, some country does not supported USA(Supported Russia), some country support anyone from which they get profit, whereas the country like India, China or UAE were choose nothing. They took decision based on their conduit metaphor as per their Turiyam consciousness. This type of Turiyam awarenss is observed while India Pakistan cricket match also which is beyond Win, Draw or Loss of a match. Many times India (Pakistan) lose the match from low team also in case Pakistan (India) will be out from Tournament. This type of loss is done based on consciousness which can be represented as Turiyam set. In similar way any match some people support one team, some people support team B, some people support both team and their player to watch the match whereas the last one who donot want to watch the match. They are the people who thinks watching cricket match is waste of time. These are the people who aware that cricket is match fixing game. I should focus somewhere else on exploring my career rather than watching cricket. These last type of people having Turiyam awareness. It can be easily understand by Non-Duality concept of consciousness. In real life several image exists which cannot be represented via true, false or uncertain regions like Cardiac data sets, human body and making its cloth by Tailor is done by Turyam as shown in Figure 2[5-7].

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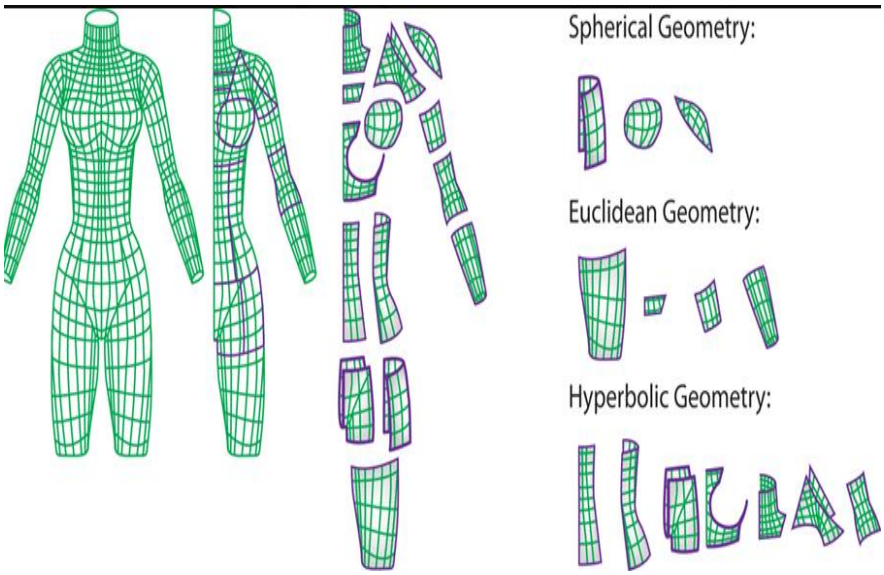

Figure 2: The Human body and its chacterization done by any Tailor using his/her Turiyam

The human cognition like feeling love for someone [24], consciousness and other cognition is based on non-dualism[5-6]. It can be characterized as the particular person loves you (*t*), does not Love you (*f*), Uncertain about love (*i*). The fourth dimension is nothingness, liberated, Separated, unknown, undefined divorced can be represented as (*l*). The refusal degree of love can be investigated via (1-*t*-*f*-*i*-*l*). Hence the Turiyam dimension is indeed requirement for dealing the quantum information or non commutative data sets. These types of data sets can be considered as dark data, unknown data, undefined data, and impossible objects[8-10]. One of the examples of dark data sets is citation data which contains lots of undefined, uncertain or unknown pattern [25-26]. The Belnap logic [27-28] somehow given a way to characterize them in four way [29-30]. Recently, some of the author tried to focus on dealing these four dimensional data using human consciousness [31-33] and unconsciousness [34-35]. Turiyam set found suitable for dealing the data with human consciousness when compared to other set theory. One of the problem is addressed while exploration of data with Turiyam attributes for real life applications like robotics[36] and self driving car [37]. Recently, some of the author paid attention towards Non-Euclidean geometry and its complement [38] for exploring the unknown graph [15, 39] using Turiyam relations [40-41]. Table 1 includes some of the important difference among fuzzy set, intuitionistic fuzzy set, bipolar fuzzy set, neutrosophic set and Turiyam set. It includes that Turiyam set (or geometry follows) D` Morgans law or not. It is possible to validate D'Morgans law using complement operator for Tuiryam set based on a defined (or undefined) geometrical data. It will provide more validation of exploring the unknown or impossible geometry using Human Turiyam cognition. To tackle this issue, the current paper introduces the Turiyam geometry and its graphical visualization basic for further improvement.

Other parts of the paper are structured as follows: Section 2 provides brief background about Turiyam set and its data representation. Section 3 provides the proposed method to characterize the data via Turiyam geometry. Section 4 provides some illustrative example for unknown data, impossible data, and fourth dimensional data for better understanding of Turiyam Geometry. Section 5 includes conclusions followed by acknowledgements and references.

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Table 1: The distinction among fuzzy, inuitionisitic, bipolar, neutrosophic and Turiyam set

	Fuzzy set	Intuitionistic fuzzy set	Bipolar fuzzy set	Neutrosophic set	Turiyam set
Data	Computing with word	Vague attributes	Yin-Yang	Indeterminancy or Hesitant part	Human consciousness
Membership-values	Single-values for true (*t*) and false (*f*)	Dependent values for true (*t*) and false (*f*)	Independent values for true (*t*) and false (*f*)	Independent values for true (*t*), false (*f*) and indeterminacy (*i*)	Independent and dependent values for true (*t*), false (*f*), uncertain (*i*) and liberation (*l*).
Range	[0, 1]	Dependent: [0, 1]	Independent: [-1, 1]	Independent case: $^{-}[-3, 3]^{+}$ or Dependent case: $^{-}[0, 1]^{+}$	Independent case: $^{-}[-4, 4]^{+}$ or Dependent case: $^{-}[0, 1]^{+}$
Unknown or Undefined objects	No	No	No		Yes
Dynamic attribute	No	No	Yes	No	Yes
Limit	$0\leq t\leq 1$	$0\leq t+f\leq 1$	$-1\leq t+f\leq 1$	Independent case: $-3\leq t+i+f\leq 3$ or Dependent case: $0\leq t+i+f\leq 1$	Independent case: $-4\leq t+i+f+l\leq 4$ or Dependent case: $0\leq t+i+f+l\leq 1$
Hesitant part	No	Yes (1-t-f)	No	Yes	Yes
Geometry	Euclidean	Euclidean	Euclidean or Non-Euclidean	Euclidean+Non-Eucidean, NeutroGeometry	Hybrid Geometry, Unknown Geoemtry or Turiyam Geometry
Graph	Fuzzy graph	Intuitionistic fuzzy graph	Bipolar fuzzy graph	Neutrosophic graph	Turiyam or Unknown Graph
Vertex or edges	Known	Known	Known	Known	Unknown which require exploration
Complement exists	Yes	Vague	No	No	Yes

2. Data with Turiyam Set

This section provides basic of Turiyam set for data representation:

Definition 1 (Turiyam Set) [4] **:** It contain 4-tuple: truth (*t*), Indeterminacy (*I*), falsity (*f*), and liberalization (*l*). Each of the dimensions is independent to each other as: $0\leq t+i+f+l\leq 4.$ The Turiyam value 0 represents the universal neutral values, -4 represents universal false cases and +4 represent the universal truth cases i.e. $T=\{\langle x:t,i,f,l\rangle : x\in\xi\}.$ It means this set contains a true, a false, an indeterminacy membership values and a liberalization values which can be characterized independently as. T = {<k; $t_t(k)$,$I_t(k)$, $F_t(k)$, $l_t(k)$>: k∈ξ} where $0^{-}\leq t(k)+I_t(k)+f_t(k)+l_t(k)\leq 4^{+}$. This set can be scaled within [0, 1] in case of dependent case.

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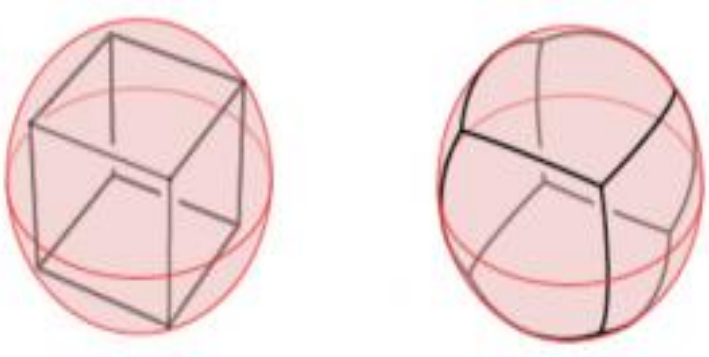

Figure 3: The Turiyam visualization of three-dimensions

In this way, the Turiyam set solves the above problem as follows:

1. The patients got recover from covid19 can be considered as truth membership-values (*t*),
2. The patient still active as covid19 can be considered as indeterminant (*i*),
3. The patients may be died due to covid19 can be considered as false (*f*),
4. The patient who got vaccinated and watching all these three-regions can be called as Turiyam dimensions (*l*).

In this way, the Turiyam set provides a way to find those patients who has not affected till now by COVID19 can be found as 1-(t+i+f+l). This is one of the major advantages of the Turiyam set while dealing with medical data set.

Definition 2 (Intersection of Turiyam) : The intersection of Turiyam set T_1 and T_2 can be computed as follows:

(i) $T_1 \wedge T_2 = ((t_1 \wedge t_2), (i_1 \vee i_2), (f_1 \vee f_2), (l_1 \wedge l_2))$.

(ii) $T_1 \wedge T_2 = (t_1.t_2, i_1 + i_2 - i_1.i_2, f_1 + f_2 - f_1.f_2, l_1.l_2)$.

It will helpful in finding the maximum common opinion in two intellectuals and their conversations.

Definition 3 (Union of Turiyam) : The union of turiyam set T_1 and T_2 can be computed as follows :

(i) $T_1 \vee T_2 = ((t_1 \vee t_2), (i_1 \wedge i_2), (f_1 \wedge f_2), (l_1 \vee l_2))$.

(ii) $T_1 \vee T_2 = (t_1 + t_2 - t_1.t_2, i_1.i_2, f_1.f_2, l_1 + l_2 - l_1.l_2)$.

It will helpful in finding that two intellectual of different era or space are once agree on a given thought.

Definition 4 (Complement of Turiyam) : The complement of turiyam set can be computed as follows:

(i) $t'=f$, $i'=1-i$, $f=t$, $l'=1-(t+i+f)$

It will be helpful in measuring the refusal degree of two intellectual based on their Turiyam consciousness. It means the complements of Turiyam is independent and provide maximum values of non-refusal.

In this way, the Turiyam set allows us to measure the universal false, universal true, universal neutral cases other than that are uncertain cases i.e. unknown, impossible, undefined objects based on human consciousness [5-6]. These types of data sets cannot be represented by Euclidean, Non-Euclidean, Hybrid or NeutroGeoemtry. It requires human consciousness to explore them. To achieve this goal, a method is proposed in the next section.

3. Proposed Methods

In this section, two methods are proposed for characterization of data with Turiyam attributes. The first method focused on characterization of Turiyam data based on defined operator whereas the second method focused on characterization of undefined or unknown images.

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3.1 A proposed method for characterization of Turiyam Geometry

In this section a method is proposed to explore the unknown, undefined or fourth dimensional data and its characterization via a defined Turiyam Geometry as follows:

Step 1. Let us suppose, the data sets (X) which cannot be represented via Euclidean (t), Non-Euclidean (f) or its Hybrid Geometry (i).

Step 2. The Turiyam Geometry data can be characterize via a Turiyam operator as $\circ: X \times X \to P^n(X)$ where$(t, i, f, l) \notin \{(1,0,0,0), (0,1,0,0), (0,0,1,0)\}$.

Step 3. It means this type of data is not a Euclidean (t), or Not Non-Euclidean (f) or not Hybrid (i). It is undefined, unknown, or impossible objects which can be characterized based on human consciousness called as Turiyam.

Step 4. The data can be characterized as follows:
(i) Let us suppose, $a, b \in X$ non-Euclidean geometry then Turiyam Operator $x \circ y \subseteq X$ provides a new element in Non-Euclidean space i.e. true (1, 0, 0, 1).
(ii) Let us suppose, $a, b \in X$ non-Euclidean geometry then $a \circ b \notin X$ provides a new element which does not exists in the Non-Euclidean geometry i.e. false region (0, 0, 1, 1).
(iii) Let us suppose, $a, b \in X$ non-Euclidean geometry provides a new element which is uncertain that Euclidean or Non-Euclidean. This type of element may be in Hybrid or saddle space to define its quantum state as indeterminacy (0, 1, 0, 1).
(iv) Let us suppose, $a, b \in X$ non-Euclidean geometry provide a new element which is undefined, unknown, and impossible or nothing. It can be characterized as Turiyam Geometry (t, i, f, l).

Step 5. This type of element can be represented via Turiyam or fourth dimension. The Up-Down or length (x), Left-Right or width (y), Back-Forth or height (z) and Trench or Turiyam (w). These can be written using the vertices of square (1,1,1,1), (1,1,-1,1), (1,1, - 1,- 1), and (1,1,1,-1).

Step 6. This vertex can be visualized using Turiyam Graph (V, E) where V represents Turiyam vertex and E represented Hyper edge. It means one edge can cover more vertex for characterization of Unknown, undefined or impossible data as Turiyam. It can be analyzed via intersection and union for pattern analysis:

(a) $\boldsymbol{T_1 \wedge T_2 = ((t_1 \wedge t_2), (i_1 \vee i_2), (f_1 \vee f_2), (l_1 \wedge l_2))}$.

(b) $T_1 \vee T_2 = ((t_1 \vee t_2), (i_1 \wedge i_2), (f_1 \wedge f_2), (l_1 \vee l_2))$.

Step 7. In case the data cannot be characterized then its complement can be defined to analyze via Anti-Turiyam : $t'=f$, $i'=1-i$, $f=t$, $l`=1-(t+i+f)$

Complexity: The time complexity to characterize the Turiyam Geometrical data and its graphical visualization may take $O(n^4)$ time complexity for true (t), false (f), uncertain (i) or undefined (l) regions. In the next section another method is proposed to characterize the undefined, impossible, unknown objects using complement operator.

3.2 A method to characterize the Unknown or Undefined data using Complement operator

In this section, a method is proposed to characterize the undefined, unknown, impossible data as given below:

Step 1. Let us suppose the data sets (X) having n-number of elements $x_1, x_2, \ldots, x_n$.

Step 2. The data can be characterized via its complement as $(x_1)`$, $(x_2)`$, …, $(x_n)`$

Step 3. Apply the reverse complement on the intersection of these characterized attributes as follows :$\{(x_1)` \cap (x_2)` \cap \ldots \cap (x_n)`\}`=X$

Step 4. The reverse it can be verified using the union operator on the attributes as D Morgan law : $\{x_1 \cup x_2 \cup \ldots \cup x_n\}`=(x_1)` \cap (x_2)` \cap \ldots \cap (x_n)`$

Step 5. The obtained knowledge from step 4 and 5 can be compared for adequate characterization.

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Complexity: The time complexity to characterize the unknown data via its complement may take $O(n^2)$. The computation of Union and Intersection may take $O(n^2)$ time again. The comparison of obtained knowledge will for each union and intersection will take extra $O(n)$ time. In this way, the total time complexity maximum $O(n^3)$ to characterized them based on complement of attributes will take place. In the next section some of the examples are given for the undefined, impossible, unknown objects and its characterization using the proposed method.

4. Illustrations

In this section both of the proposed methods are illustrated with an example.

4.1 The characterization of Turiyam geometry

In this section, some of the examples beyond Euclidean [7], Non-Euclidean [8, 14], and Hybrid Geometry [9-13] is given to characterize them via Turiyam Geometry [38] or its relations defined in [40]. These types of object can be called as undefined, unknown, impossible or nothing. Same time some human cognition examples is given for analyze the Turiyam Geometry as given below:

Example 1. (Chimera[8]): This type of object exists due to composition of several genotypes. The chimerism found in animal composition of two or more different genetically distinct cells in a single organism as shown in Figure 4. This type of animal can be characterized via Turiyam Geometry based on their characteristics. It will provide the pattern of those animals in the given chimera image.

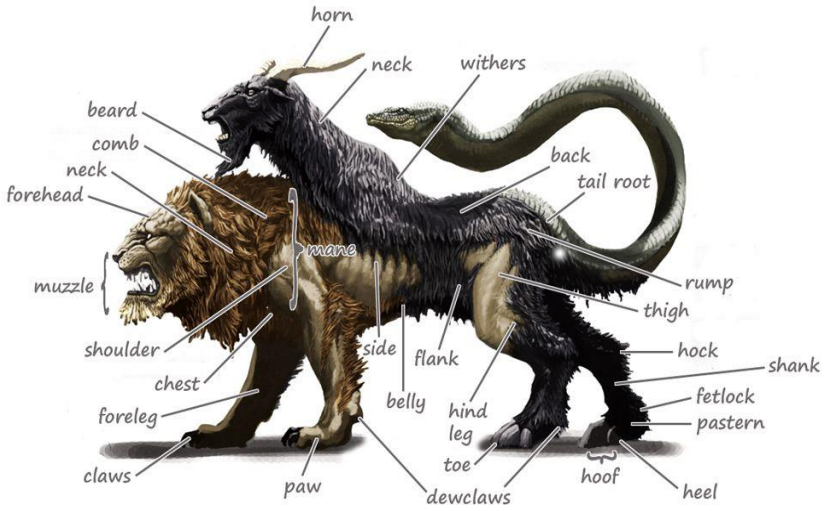

Figure 4: The chimera an undefined or unknown animal

Example 2. (Penrose Stair[9]): It is a stair case in which each stair made 90 degree turns in four side. Each of the stairs ascends or descends such that they form a continuous loop. In case any person climbs on the stair they cannot get any higher steps forever. It is one of impossible objects in three-dimensional Euclidean geometry as shown in Figure 5. It can be characterized via Turiyam Geometry and provide an awareness to liberate these type of Stairs.

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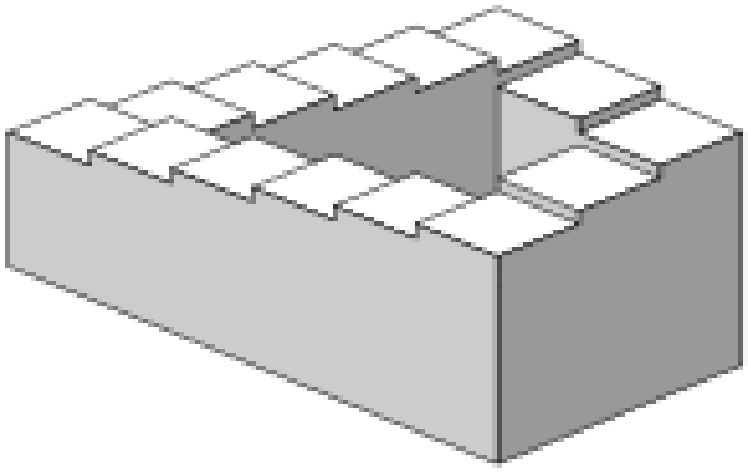

Figure 5: The Penrose Stair as an impossible object

Example 3. (**Impossible Waterfall**[9]): There are several arts which can be undefined. One of the arts is impossible waterfall as shown in Figure 6. It is beyond the Euclidean, Non-Euclidean and Hybrid Geometry which need human awareness to characterize it.

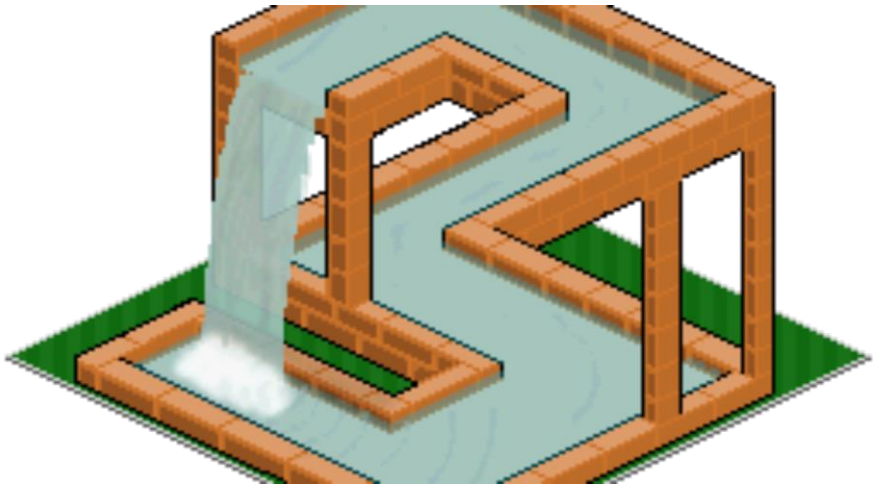

Figure 6: An impossible waterfall and its drawing

Example 4. (Turiyam Citation) [6, 25]: The precise characterization of citation is based on human Turiyam cognition. It is beyond acceptation, rejection and uncertain part. One of the reason is that the citation of particular paper based on awareness of researchers rather than cited references. Many published research paper does not contain founding paper in their reference due to unawareness of authors. Some time the author unknown about those papers due to unavailiability of papers. The citation of these papers require more exploration of papers which depends on researchers Turiyam Cognition. Hence, it can be characterized as follows: (i) Citation (1, 0, 0, 0): The research paper contains relevant paper of given topic rather than base or founding papers of the given area. It may happen that many times all the relevant papers are cited having same keywords, methodology except some founding papers due to unawareness of researchers. This type of paper and its reference can be characterized as Citation (1, 0, 0, 0), (ii) Anti-Citation (0, 0, 1, 1): It is the case when the paper contains irrelevant citation. These types of papers cited in falsity way within the host conference, within the department, without matching any keyword, methodology to honor the authors. The retracted papers citation can be counted as false citation. These all papers cited in

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awareness to manipulate the document count or *h*-index. Some time the author aware about other work but does not cite those founding work. It can be characterized as Anti-Citation (0, 0, 1, 1). (iii) Uncertain Citation (0, 0, 1, 0): These types of citation happens when author lacks in knowledge and just cited the paper without founding papers. Some time authors do not have indexing access in particular university. In this case, the author cited some uncertain papers due to less access. In same time the paper belongs to interdisciplinary areas due to that the measurement of citation become uncertain. The retracted paper also cited some time due to unawareness. It means the uncertain citation happened due to unawareness can be characterized as (0, 1, 0, 1). (iv) Turiyam Citation (*t, i, f, l*): These are the papers cited in awareness as true reference, the base papers, the domain experts papers, all the founding papers of given area. In case the false paper or retracted paper cited to discuss its methodology for further analysis. These types of citations are observed via awareness in given research area. It comes when the author is working as consciousness. This consciousness of citation can be characterized as Turiyam citation. One of the examples is anyone working in fuzzy logic must cites Zadeh first paper and other milestone papers. In this way, the Turiyam set provides that how much degree a paper contains Turiyam citations rather than uncertain. The refused paper also can be investigated via (1-*t*-*i*-*f*-*l*). However the exploration of Citation is much difficult tasks based on its acceptation, rejection, uncertain and Turiyam regions, independently. The reason is this type of characterization is based on human expertise and its consciousness which may raise conflict.

Example 5. (Conflict Analysis) [31-32]: The precise analysis of conflict among researchers can be characterized via Turiyam Geometry. The reason is conflict arises among two researchers when the author are aware about each other work. It can be characterized as follows: (i) Conflict (1, 0, 0, 1): This is case when the researchers have conflict among them. This type of conflict happened due to awareness among the researchers on their topic. (ii) Anti-Conflict (0, 0, 1, 1): The author are working on same area and influenced by each other. In this case both authors have no conflict among them. This can be characterized as Anti-Conflict. (iii) Uncertain conflict (0, 1, 0, 0): This type of conflict arises when the author agreed on some of the work and disagree on some other work. It can be called as partial disagreement. The conflict arises due to author changes, authors ordering or may be due to honor or posthumous authors name in the paper. Some time due to funded money and changes of affiliation uncertain conflict arises. It may arise when author does not know the law or research ethics. It is happened as indeterminacy rather than awareness. (iv) Turiyam Conflict (*t, i, f, l*): This conflict arises when a researcher mostly young researcher does not aware about other works. He/she considered everything as nothing, stupid or nuisance. He just does the research to survive the job. It means the research is nothing for him/her. This type of act is totally happened in awareness can be characterized by Turiyam. It also happened due to some financial or funded project issues. Some people paid the money and try to force others to keep his name. Just to get document count without knowing the work. This type of conflict can be characterized via Turiyam conflict.

Example 6. (Medical Diagnoses) [4-6]: It is another example as wrote earlier also. A woman observes the acceptation, rejection and uncertain position of a child in her womb for nine month as Turiyam state. In this case every woman lives in fourth dimensional Turiyam cognition for the nine months without knowing the boy or girl child. It is totally uncertain, undefined, unknown to characterize the boy or girl. It can be characterized via Turiyam as (i) Boy Child (or Girl) : This is the case when the woman gave birth of boy child without awareness the Turiyam state become 0 as (1, 0, 0, 0). However, the woman gives the birth of boy child with awareness like help of medical science or other ways. In this case, the Turiyam state will be represented as 1 as (1, 0, 0, 1). It can be written vice versa also. (ii) Not Boy (or Girl): This is the case when the woman did not give birth of boy child. It means the woman gave birth of girl child. In case the woman gave birth of girl child without awareness the Turiyam state become 0 as (0, 0, 1, 0). However, the woman gives the birth of girl child with awareness like help of medical science other ways. In this case the Turiyam state will be represented as 1 as (0, 0, 1, 1). It can be written vice versa also. (iii) Uncertain Child: It is the case the birth child has both attributes of boy and girl. It can be called as Transgender, twins or others. In case the woman gave the birth of transgender, twins or more children without awareness of medical science can be represented as (0, 1, 0, 0). However the woman gave birth of Transgender, twins or others using help of medical science in awareness can be represented as (0, 1, 0, 1). (iv) Turiyam Child (*t, I, f, l*): This is the case when woman is pregnant and did not give birth of any child. It is nothing, undefined, unknown, death child. Some time doctor also want to save the mother and remove the child. These types of liberation, separation or removal of child at time of pregnancy can be called as Turiyam. It is the condition when woman liberate her from the child after pregnancy. It is called Turiyam state. The reason is mother aware that she is pregnant and still wants to liberate her life from the child birth. It is called awareness or Turiyam. Surrogacy is another example of Turiyam. In this case the parent knows that he/she is my child rather the surrogated mother.

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Example 7. (Democracy) [31-32] : The characterization of democracy in different countries is totally based on awareness of experts. It is called Turiyam as follows: (i) Democracy: It is the case when the countries have democracy structure. It means there is no king rules in the country. People used to vote for particular leader for the given prime minister or president post as happened in India or USA can be represented as (1, 0, 0, 0). In case the country has democratic leader but some one behind ruling the country. This type of awareness can be written via Turiyam as (1, 0, 0, 1). One of the suitable examples is Prime Minister Man Mohan Singh of India was ruled by Congress president Sonia Gandhi. He was just a puppet prime minister rather than democratic. It is well aware by every citizen of India. This type of democracy can be written as (1, 0, 0, 1). It can be observed in Pakistan also where Imran Khan chosen by public but over ruled by ISI or Army chief. This is well aware by all Pakistani and world. This type of democracy can be written by Turiyam as (1, 0, 0, 1) (ii) Anti-Democracy: This is the case when the country do not have democracy. There is kingdom like Nepal, North Korea, Taliban or other countries can be written as (0, 0, 1, 0). In case the King is ruled by someone else can be written as (0, 0, 1, 1). It is observed in Nepal recently when a Prime Minister Koli was ruled by Chinese. Similarly, the Taliban is ruled by some countries. (iii) Uncertain Democracy: This is called partial democracy as observed in China, Russia where people vote for some party but over ruled by a person. Similarly, Srilanka, Bangladesh contains uncertain democracy where people have partial power. In this case, people are unaware about democracy and its right. Hence the uncertain democracy can be written as (0, 1, 0, 0). (iv) Turiyam Democracy (*t, i , f, l*): This is nothing, full freedom, liberated, undefined, none of the above democracy. It is like people living in forest. People are liberated their life like Saint. People do not care about anything. It is called Turiyam Democracy where people vote based on awareness.

Example 8.(Voting) [32]: The voting system in a democratic country can be considered characterized via Turiyam as (i) Voting: This is the vote which people give to any political party whom they support. It is totally based on awareness then written by (1, 0, 0, 1). However, the voter is not aware about the act of the given party and just voted by taking money or taking some privileges. In this case the Turiyam can be written as (1, 0, 0, 0), (ii) Anti-Voting: This is the vote against the given party. The people who voted against the given party in awareness can be written as (1, 0, 0, 1). The people who just voted other party due to unawareness of given party can be written as (1, 0, 0, 0), (iii) Uncertain Vote: These are the people given to any one by uneducated people, not local people, outsiders, fake voters, refugee people, poor people, or depressed people. These are the people are totally unaware while casting the vote which impact lot to the decision. It can be written as (0, 1, 0, 0), (iv) Turiyam Vote (*t, i, f, l*): These are the people who vote against all. They did not choose anything in ballot box. These people vote in totally awareness that none of the candidates are eligible due to their past work style. Same time the people who supports the given party but due to scarcity or unavailability at given time of Voting can be considered as Turiyam. These types of impossible or unknown vote which supports a given party without voting rights or without vote can be considered as Turiyam vote. The people who refused to vote can be investigated as (1-*t*-*i*-*f*-*l*).

Example 9. (Quality of Research paper) [25]: The investigations of quality research papers in your given research domain is totally based on human consciousness which develop after the hard work. It can be characterized as follows: (i) Quality (1, 0, 0, 1): The researcher able to characterized that the paper published at SCI or Scopus Indexed are good quality with respect to his/her research domain, (ii) Anti-quality (0, 0, 1, 1): The researcher came to know the given SCI or Scopus paper is not good quality with respect to his/her research domain, (iii) Uncertain Quality (0, 1, 0, 0): It happened with young researchers while characterization of quality papers in his/her research area. At initial stage the researcher uncertain about indexing and does not know which paper is good. How to characterize the paper based on title, keywords and all. The paper published at predatory journal is good or not. Today every journal becomes almost open access which can be published via paying money. In this case characterization of quality is totally uncertain due to unawareness, (iv) Turiyam Quality (*t, i, f, l*): This awareness comes after time to time and hard work done by researchers. The researcher came to know that all papers published at SCI or SCOPUS are not good. They just published due to connection or may be biasness. There are many papers which are indexed outside SCOPUS or SCI are good. There are many papers written in Non-English are good. Scopus and SCI is nothing just an indexing. This awareness to characterize the given paper is Turiyam cognition.

Example 10. (Undefined or Imaginary objects) [9-10]: In case, the Turiyam data does not exists which are totally virtual or imaginary. These types of imaginary thought or data can be represented via imaginary number *i*. One of the examples is everyone goes to vegetable shop and characterized the vegetables based on its red, green or blue color as shown in Figure 7. It is totally based on human awareness or Turiyam. However a method is proposed in Section 3.2 to characterize them based on their attribute and complement operator which is illustrated in the next section.

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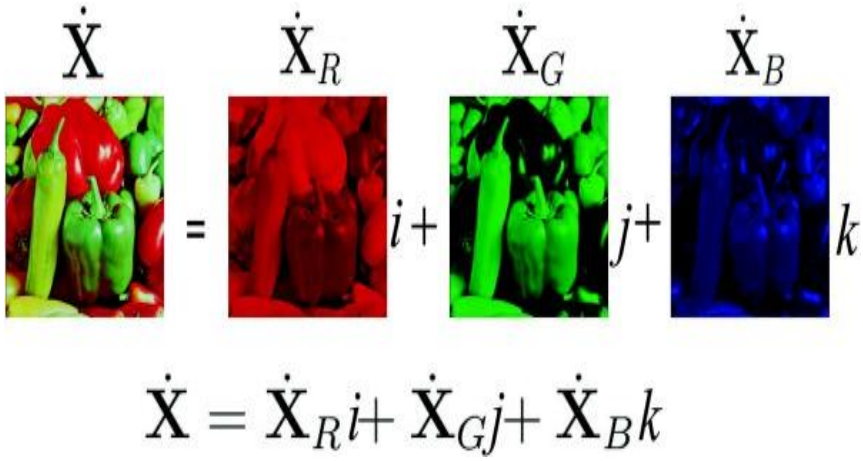

Figure 7: The Characterization of vegetable based on Quaternion

Example 11. (Unknown Father**)** Let us suppose a child wants to know his mother and father. In this case, four type exists : (i) True Father (1, 0, 0, 1): The child tells his father and mother name correctly using his Turiyam consciousness, (ii) False father (0, 0, 1, 0): The child says both father and mother name wrongly due to unconsciousness, (iii) Uncertain Guardian (0, 1, 0, 1): The child knows the name of either father or mother based on his/her Turiyam Consciouness , (iv) Turiyam or Unknown about father or Mother (*t, I, f, l*): The child knows nothing or unknown about the mother and father. In this case, the child need to explore the father and mother name based on DNA using his/her Turiyam.

Example 11. (Question and Answer) Let us suppose a student came for viva voice to answer some questions. In this case, the students uses his Turiyam cognition for answering the Viva voce questions. It can be characterized as follows : (i) True Answer (1, 0, 0, 0): The student says true answer of given question, (ii) False Answer (0, 0, 1, 0): The student says false answer of the given question, (iii) Uncertain Answer (0, 1, 0, 0): The student says partially true and partially false answer of the given question. The student is uncertain about the given answer, (iv) Turiyam Answer (*t, i, f, l*): The student does not know the answer. However he is trying to solve the question based on his/her consciousness. It is Turiyam which gave him to explore the unknown question and its answer based on his/her expertise.

Example 12. (Unknown Geometry or Unknown Graph**)** [38-39]. Dealing with geometry and its exploration also requires human Turiyam cognition. In this case four type of geometry exists: (i) True geometry (1, 0, 0, 0): The data is represented based on True definition of Geometrical concept. (ii) False geometry (0, 0, 1, 0) : The data is represented wrongly based on the definition of Geometry, (iii) Uncertain Geometry (0, 1, 0, 0): Some parts of data is represented true or some data as false manner using the definition of Geometry, (iv) Turiyam Geometry (*t, i, f, l*): The unknown geometry, ungeometry, none geometrical data need to be explored using Turiyam Consciousness. In this case the problem arises while finding the complement and its validation as discussed recently in[38]. To resolve this issue a new method is proposed to validate the Turiyam Geoemtry using the D` Morgan law.

4.1 The characterization of impossible object using the proposed method shown in Section 3.2

Table 1 shown that the D'Morgan law is applied on Turiyam set or not. In this section the proposed method shown in Section 3.2 is illustrated with an example. It is an extensive version of the complement operator discussed in [38] via D` Morgans law for exploring the unknown data [39]. To illustrate the method Figure 7 is considered for precise analysis.

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Step 1. The Figure 7 left side contains three types of attributes i.e. Red chili (x_1), Green chili (x_2), Blue chili (x_3) as combination.

Step 2. Find its complement like (x_1)`$=\{x_2, x_3\}$, $(x_2)$`$=\{ x_1, x_3\}$ and (x_3)`$=\{ x_1, x_2\}$.

Step 3. Take intersection of all the complement which provides nothing. It means none of the chili has anything common properties. In this case each one needs to be represented separately as shown in Figure 7 right side.

Step 4. Take union means red and green chili like $\{x_1, x_3\}$ find the complement which will provide $\{ x_3\}$ and similarly find for its intersection complement via D Morgan.

Step 5. It provides that the Figure 7 follows the D Morgan law. In case the expert can characterize any attribute from the mixture then the unknown data can be characterized. It is totally based on Turiyam. In similar way the Chimera and its properties can be characterized and represented by Turiyam space as follows:

(i) Euclidean represent as E (1, 0, 0, 0). Take its complement as complement C(E). It will be Non-Euclidean (NE). Now take its complement i.e. C(NE) which will provide as Euclidean (E).

(ii) Non-Euclidean i.e. (NE). Take its complement as C(NE) which will provide Euclidean (E). The double complement i.e. CC(NE) will provide again Non-Euclidean.

(iii) Third is Hybrid or Neutro geometry (NG) contains both Euclidean+Non-Euclidean take complement C(NG)=NG, CC(NG)=NG.

(iv) The last case all postulates fail and take complement means None Geometry or undefined Geometry, Unknown Geometry or nothing where Turiyam Geometry can be helpful.

It can be observed that the D'Morgan law helps in exploring unknown objects beyond Non-Euclidean Geoemtry. In this way the proposed method can be helpful for data science researchers who will work beyond non-euclidean geometry or unknown objects. It will be helpful for robotics, self driving car and medical diagnoses.

5. Discussions

Recently a problem is addressed while dealing the data sets and its characterization based on human cognition or its awareness [6-10]. Due to which several authors paid attention towards data characterization beyond Non-Euclidean Geometry [10-14]. It became more crucial when data sets are unknown objects [15] like Architecture [16], Algae image [17], Organic structure [18] or other human cognition [19, 23]. To deal with these types of data sets recently Turiyam set [4-6] and its other metric [20-23] is introduced for dealing the human cognition in fourth dimension [27-28]. However characterization of data in positive, negative, uncertain and nothing zone, independently is major issue as dicussed recently [29-31]. Recently, the four dimensional data set is explored using human consciousness [32-33] and unconsciousness [34-35]. The Turiyam set is considered as one of the useful tool for robotics[36] or self driving car [37]. Due to which recently the Non-Euclidean geometry and its complement is discussed for exploring the unknown or ungeometry [38] or unknown graph [39]. This paper proposed two methods for characterization of these types of data sets based on Turiyam geometry and its complement using D` Morgan law as shown in Section 3. It can be observed that the Turiyam geometry provides another way to deal unknown, undefined data beyond the Non-Euclidean as Shown in Table 2.

It can be observed that, several data sets available where Turiyam geometry can be helpful for the characterization. However, the precise ordering of Turiyam data sets and its characterization is an another issue. Hence, in near future the author will focus on discussing Turiyam lattice using D`Morgan law [26-28] and quaternion set [2-3, 31-32], Turiyam matrix [33] and its comparative study with other sets[34-35] for various applications [36-41].

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Table 2: The difference among Euclidean, Non-Euclidean, NeutroGeometry and Turiyam Geometry

	Euclidean Geometry	Non-Euclidean Geometry	NeutroGeometry	The proposed method
Euclid five postulates	Yes	No	No	No
Parallel Postulates	Yes	No	No	No
Hybrid means Euclidean+Non-Euclidean, Non-Euclidean+Anti-geometry etc.	No	No	Yes	No
Unknown or Undefined objects	No	No	No	Yes
Uncertain objects	No	No	Yes	Yes
Graph	Yes	Yes	Yes	Yes
Multi-attribute data	No	No	Yes	Yes

6. Conclusions

This paper focused on characterization of unknown, undefined, impossible objects based on Turiyam Geometry and its validation via D'Morgans law. To achieve this goal, a Turiyam Operator is defined in Section 3 with some illustrative example in Section 4. The proposed method is explained in Section 5 with an example. Table 2 represents that the proposed method is useful for dealing the data beyond non-euclidean and its exploration.

In near future the author will focus on dealing the imaginary data and its representation via Turiyam lattice for knowledge processing tasks. Same time the connection of Tuiryam with Quaternion set, complex set and other set will be explored for better understanding.

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Ethics approval: This article does not contain any studies with human or animals participants.

Data Availability Statements: Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

Footnotes

[1] https://en.wikipedia.org/wiki/Saccheri_quadrilateral
[2] https://www.euclideanspace.com/maths/geometry/space/nonEuclid/index.htm
[3] http://www.drmarkliu.com/noneuclidean
[4] https://en.wikipedia.org/wiki/None_of_the_above
[5] https://3010tangents.wordpress.com/2014/11/14/non-euclidean-geometry-in-pattern-making/
[6] https://en.wikipedia.org/wiki/Nondualism
[7] https://en.wikipedia.org/wiki/Turiya

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[8] https://en.wikipedia.org/wiki/Chimera_(genetics)
[9] https://en.wikipedia.org/wiki/Impossible_object

[10] https://en.wikipedia.org/wiki/Four-dimensional_space

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