Quaternion Set for Dealing Fluctuation in Quantum Turiyam Cognition

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Abstract

Recently, the data with Turiyam set is introduced for precise representation of human cognition. It gives a way to represent the conscious, unconscious, indeterminate and superconscious state of quantum cognition. In this way, the Turiyam set given a way to represent the human cognition in a democratic system like India where people support a party, reject the party, absent and support NOTA. In similar way conflict among two people can be represented via four way like there is conflict, no conflict, partially conflict or uncertainty about conflict, and last nothing unknown to each other. The precise representation of these types of data which changes at every given phase of time. To deal with these types of human cognition and its quantum state Quaternion set is introduced in this paper.

Keywords: Cognitive science; Fourth dimension; Non-Euclidean; Quantum State; Quaternion; Turiyam set

1. Introduction

The precise representation of human thought and characterization of uncertainty is considered as major issues by researchers [1-3]. The reason is human though used to change several time in the given period [4-6]. It became more interesting for data science researchers when people started NOTA in democratic country like India[1]. It become matter for super consciousness beyond the acceptation, rejection and uncertainty about selection of a leader in term of voting right. The cognitive science people defined this type of cognition as Advaitato express the state of liberation [2-3]. These types of cognition experience several infinite (*ananta*) and non-different (*advaita/abheda*) states to represent the human quantum information and its neutrality[4-5]. This type of quantum information used to be helpful in dealing the superconscious mind based on defined phase of time as discussed by Nagrajuna [6-7]:

(i) Acceptation of existence of an attribute, rejection of non-existence of the given attribute i.e. true region (*t*),
(ii) Acceptation of non-existence of given attribute, rejection of existence of given attribute i.e. false region (*f*),
(iii) Acceptation of both existence and non-existence of given attribute at same time i.e. indeterminate or uncertain region (*i*),
(iv) Rejection of both acceptation and rejection of attribute at the given time i.e. unknown region (*l*). It need Turiyam consciousness to explore it.

It is not only information there are several quantum objects exists in the real life. One of the suitable examples is balloon, airplane or atoms like C_{60}. These quantum objects have their own mass, position and dynamic velocity. To deal with these types of quantum information recently Singh [7] introduces Turiyam set [2] and its contextual representation [3]. However the problem arises when the human Turiyam cognition changes based on given phase of

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time [8-11] can be represented using extensive properties of complex fuzzy set [12-14] in four dimensions [15-16]. The Belnap logic somehow given a way to represent these types of data sets without consciousness or any algebraic properties [17-19]. To resolve these issues, current paper tried to introduce Quaternion set for dealing the uncertainty and fluctuation in Turiyam attributes.

Other parts of the paper are organized as follows: Section 2 contains algebra of Turiyam set and its issues. Section 3 provides basic background about Quaternion set and its examples in Section 4. Section 5 contains conclusions followed by references.

2. Data with Turiyam Attributes and Changes

This section provides basic background about data with Turiyam set and its necessity. Same time it will discuss uncertainty and fluctuation arises in Turiyam attributes.

The gimbal lock problem given a way to introduce the Turiyam set. The gimbal lock is the loss of one degree of freedom in a three-dimensional as shown in Figure 1.

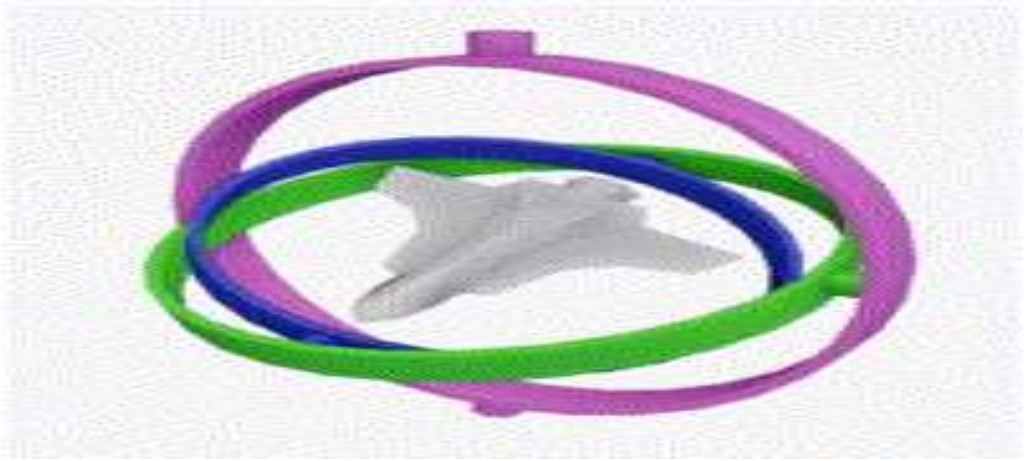

Figure 1: The gimbal lock of Third Dimensional data and its representation

Turiyam set given a way to deal these types of gimbal lock beyond three dimensions. It contains 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 in [0, 1]. T = $\{<k; t_t(k), I_t(k), F_t(k), l_t(k)>: k \in \xi\}$ ……..…… …… …….(1)

Whereas $0^- \leq t(k)+I_t(k) + f_t(k) + l_t(k) \leq 4^+$. …… …....(2)

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

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

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The complement of Turiyam set can be computed as follows:

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

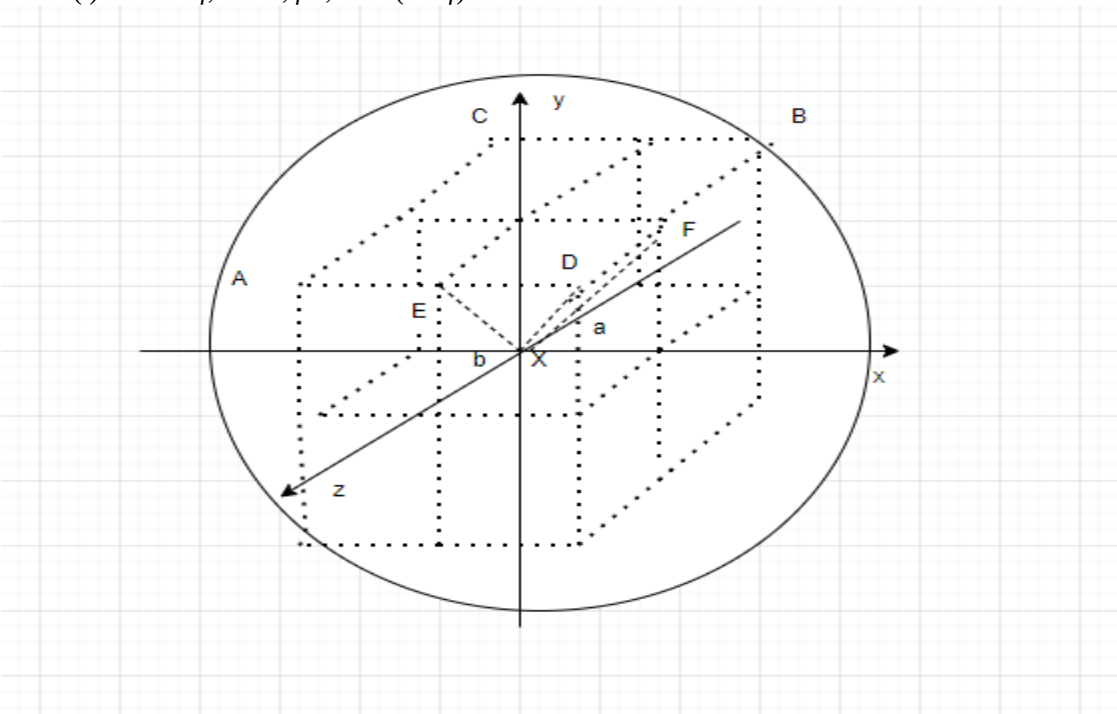

Figure 2: The uncertainty and fluctuation representation of third Dimensional data

$$m * \sin a = y$$
$$m * \cos a = x$$
$$n * \sin b = y$$
$$n * \cos b = z$$
$$x^2 + y^2 + z^2 = 1$$

$$m = \frac{\sin b}{\sqrt{(\sin a)^2 + (\cos a)^2 * (\sin b)^2}}$$

Figure 3: The intermediate step to measure the third dimension uncertainty and fluctuation

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$$e^{ia+jb} = \frac{\cos a * \sin b + i * \sin a * \sin b + j * \sin a * \cos b}{\sqrt{(\sin a)^2 + (\cos a)^2 * (\sin b)^2}}$$

Figure 4: The amplitude and phase term computation for two events in third dimension

The problem arises when an expert wants to analyze the changes in any controller based on up/down, left/right, forwards/backwards or equilibrium conditions as shown in Figure 3[9]. It means these data need representation as quadruples of Turiyam set (T, I, F, L) and its connection with phase term is required as shown in Figure 3 and Figure 4[10]. To achieve this goal, properties of quaternion set based Turiyam context is introduced in this paper with an example.

3. Quaternion Set based representation of Turiyam context

In this section a method is proposed to deal with changes in Turiyam attribute using Quaternion set based vertex and edges as given below:

Step 1. Let us suppose, the data with complex fuzzy Turiyam attributes as **F**=(T, I, F, L) where T represents the acceptation, F represents the rejection and I represents the uncertain values, L represents the Turiyam or liberation values which values changes based on given phase of time.

Step 2. It can be represented using Quaternion set in given Turiyam context as shown in Table 1. The Object represents the event whereas attributes represents the properties. The R represents the Turiyam relationship among $O \times A \rightarrow R(T, I, F, L)$where $0 \leq \sum T + \sum I + \sum F + \sum L \leq 4$. It can also be normalized as $0 \leq \sum T + \sum I + \sum F + \sum \mathrm{L} \leq 1$. The problem is how to visualize the turiyam attributes using vertex and edges of graph for knowledge processing tasks.

Table 1 : A Turiyam context representation using Quaternion set

	A_1	A_2	…	A_m
O_1	$(o_1, a_1)_L+i(o_1, a_1)_T+j(o_1, a_1)_I+k(o_1, a_1)_F$	$(o_2, a_2)_L+i(o_2, a_2)_T+j(o_2, a_3)_I+k(o_2, a_2)_F$	…	$(o_1, a_m)_L+i(o_1, a_m)_T+j(o_1, a_m)_I+k(o_1, a_m)_F$
O_2	$(o_2, a_1)_L+i(o_2, a_1)_T+j(o_2, a_1)_I+k(o_2, a_1)_F$	$(o_2, a_2)_L+i(o_2, a_2)_T+j(o_2, a_3)_I+k(o_2, a_2)_F$	…	$(o_2, a_m)_L+i(o_2, a_m)_T+j(o_2, a_m)_I+k(o_2, a_m)_F$
…				
O_n	$(o_n, a_1)_L+i(o_n, a_m)_T+j(o_n, a_m)_I+k(o_n, a_m)_F$	$(o_n, a_2)_L+i(o_n, a_2)_T+j(o_n, a_2)_I+k(o_n, a_2)_F$	…	$(o_n, a_m)_L+i(o_n, a_m)_T+j(o_n, a_m)_I+k(o_n, a_m)_F$

Step 3. The quaternion table for i, j, k and its implementation can be computed using the Table 2.

Table 2 : The computation of Quaternion multiplication

Quaternion multiplication

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	1	**i**	**j**	**k**
1	1	**i**	**j**	**k**
i	**i**	−1	**k**	**−j**
j	**j**	**−k**	−1	**i**
k	**k**	**j**	**−i**	−

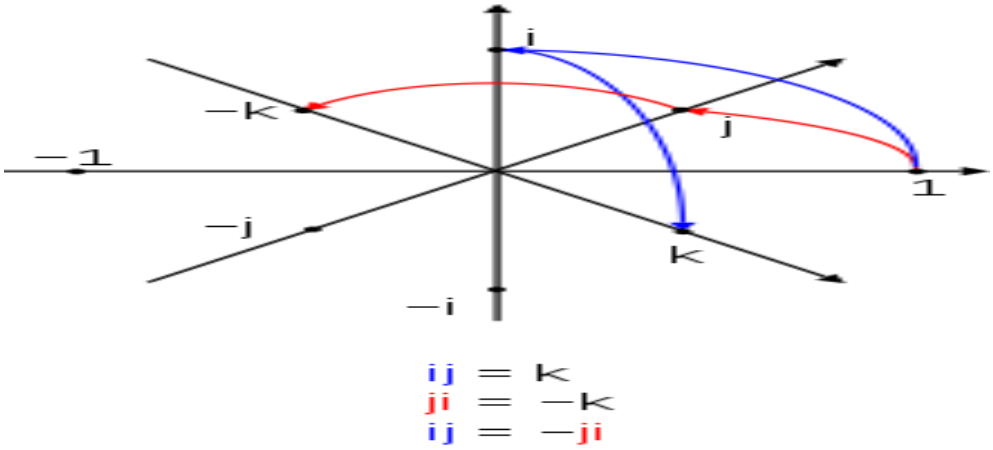

Figure 5: The computation of quaternion table and its visualization

Step 4. The Quaternion Turiyam graph $T_G = (V, E, Q)$ where (V) represents the attributes as vertex, (E) represents the quaternion set based Turiyam edges among them as follows: $Q_{(n, m)} \longrightarrow (o_n, a_m)_L + i(o_n, a_m)_T + j(o_n, a_m)_I + k(o_n, a_m)_F$.

$V_1((o_1, a_1)_L + i(o_1, a_1)_T + j(o_1, a_1)_I + k(o_1, a_1)_F)$ ——————— $V_2((o_1, a_1)_L + i(o_1, a_1)_T + j(o_1, a_1)_I + k(o_1, a_1)_F)$

Figure 6: The quaternion Turiyam graph among two vertex

Step 5. The QuaternionTuriyam graph can be visualized as shown in Figure 6.

Time complexity: Let us suppose, there are *n*-number of Turiyam vertices in the graph and its phase term. In this case drawing the Turiyam graph may take $O(n^2)$ whereas computing the quaternion tables and its values again a loop will execute till *n*-vertex. In this case the proposed method maximum takes $O(n^3)$ time complexity.

4. Illustration of Quaternion and its extensions

Recently, the data with Turiyam set is introduced to deal the gimbal lock of third dimensional data representation and its uncertainty. The problem arises when the changes happened in Turiyam attributes at given phase of time. One of the suitable examples is win, draw or loss of a match is based on qualification and disqualification of a team. Due to which, the performance of player changes for the particular match or trophy. In case of India-Pakistan match this changes observed a lot.

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Example 1: **(Conscious Representation of Turiyam)** [1-3, 7]**:** Let us suppose, any Trophy where Pakistan is qualified for semifinals. The remaining match is not going to affect the Pakistan qualification. In this case, the Pakistan will try to loss or win the match when it affects the India qualification. To measure this type of fluctuation in Turiyam attributes quaternion set is useful as shown in Table 3. The expert 1 written that the Pakistan is already reached in final. In this case, the Turiyam attributes will contain 1 as shown in table 3. The expert 1 wrote that in case Pakistan will loss this match India will be disqualified. To achieve this goalthe performance of 80 percent player will change to loss the match whereas 10 percent player will try to win and draw the match as per their performance. In similar way the Expert 2 agreed that the performance of each player will change to loss the match. This type of human cognition can be written using Quaternion set as shown in Table 3.

Table 3 : A Turiyam context representation of Sports data using Quaternion Set

	Quaternion Turiyam Relationship $(Qualification_L, Win_T, Draw_I, Loss_F)$
Expert 1 opinion for Pakistan match	(1.0, 0.1i, 0.1j, 0.8k)
Expert 2 opinion for Pakistan match	(1.0, 0.0i, 0.0j, 1.0k)
Intersection	(1.0, 0.0i, 0.0j, 0.8k)
Union	(1.0, 0.1i, 0.1j, 1.0k)

Example 2: (Love) [7]**:** It is observed that many times in India a girl (or boy) already decided not to marry the given classmates. In this case, this type of cognition can be considered as Turiyam. However they used to represent the love, does not love or uncertain about love. These three acts of girl (or boy) does not changes the Turiyam attributes i.e. marriage. It means the boy (or girl) time and his career used to ruin by the given girl. It can be easily analyzed using the quaternion Turiyam set as shown in Table 4. The expert 1 agreed that the 50 percent act of girl is in favor of love, 30 percent act is uncertain and 20 percent act shows that she hates some of his behavior. In similar way the second expert agreed that the girl 60 percent acts are in favor of love, 20 percent acts are uncertain, 20 percent acts are showing hate. However both the expert agreed that the girl will not marry just using the boy for time pass. It is called as Turiyam. In this case boys just spend their time and career which can be represented using Quaternion set as shown in Table 4.

Table 4 : A Turiyam context representation of Love using Quaternion Set

	Quaternion Turiyam Relationship $(Marriage_L, Love_T, Uncertain_I, Hate_F)$
Expert 1 opinion about Girl	(1.0, 0.5i, 0.3j, 0.2k)
Expert 2 opinion for Girl	(1.0, 0.6i, 0.2j, 0.2k)
Intersection	(1.0, 0.5i, 0.2j, 0.2k)
Union	(1.0, 0.6i, 0.2j, 0.2k)

Example 3: (Medical Diagnoses Data Set) [11-12**]:** It is well known that the doctor knows the patient and its disease recovery. However to earn money they used to write the disease is critical, uncertain and uncritical. Let us suppose a patient has no symptoms of the particular disease. It can be considered as Turiyam consciousness [15-16] rather than Belnap hard logic [17-18]. The changes in disease and its images based on time can be written using the quaternion set as shown in Figure 6 [13].

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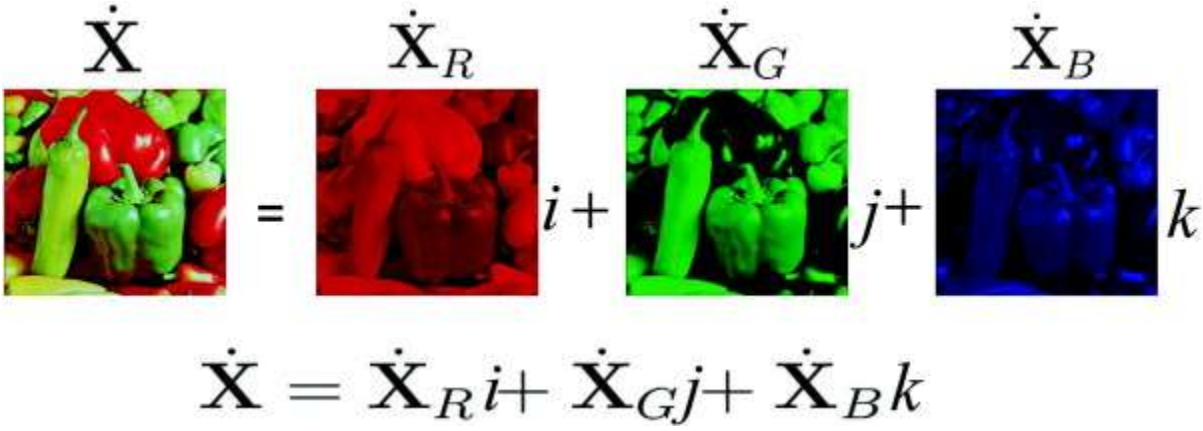

Figure 6: The image representation using Quaternion set

Example 5. (**Law or Justice)** [5-7]**:** It is observed in many cases that the given person is not criminal the false FIR is written by police. The person is not criminal known by everyone but still he/she went through illogical law. The awareness that everyone knows he/she is not criminal can be considered as Turiyam. However to prove this act changes in FIR that he/she is criminal, not criminal or uncertain can be written using quaternion set to measure the rotational changes. The court and law is one of the most suitable examples of Turiyam context with Quaternion set. Many cases used to be written against any person just because he/she writes against the government. Even though he/she is not criminal. The changes in law happened time to time based on government and its policy whereas justice is Turiyam. Same time it is observed that the particular person belongs to ruling party, or upper class business man then he/she never get punishment even he/she does crime. The awareness that the given person did criminal activity or not in any case he/she will not get punishment is called as Turiyam. The criminal activity and its changes can be measured using Quaternion set. The precise analysis of these types of dark data sets and its fluctuation required the quaternion set and its extensive properties [14-18].

It can be observed that the proposed method provides a foundation for precise representation of changes in fourth dimensional data or human cognition using quaternion set. Some of the examples are also given for better understanding. In near future the author will focus on dealing the quantum objects and its properties for finding some useful pattern.

5. Conclusions

This paper focused on measuring the uncertainty and changes in Turiyam attributes. To achieve this goal, the Turiyam context representation using quaternion set is introduced in this paper with illustrative examples. In near future the author will try to extend this idea for dealing other data sets.

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

Footnotes:

[1] https://en.wikipedia.org/wiki/None_of_the_above
[2] https://www.tribuneindia.com/news/archive/lifestyle/turiya-the-fourth-dimension-of-being-448113
[3] https://en.wikipedia.org/wiki/Turiya
[4] http://yogananda.com.au/g/g_turiya.html
[5] https://sreenivasaraos.com/tag/turiya/
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