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New Similarity measures for Neutrosophic Binary topology using Euclidean distance.

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Abstract. This paper focuses on introducing a new similarity measure for the neutrosophic binary set.Similarity measure are used in multi attribute desicion making problems to find the difference between the alternatives.In this paper a new measure based on Euclidean distance is introduced to find the measure between two binary single valued neutrosophic set.Further its is applied in a multi attribute desicion problem to see the attainability of the proposed measure.

Keywords: Similarity measure, Euclidean distance, Neutrosophic binary set .

1. Introduction

The concept of neutrosophy was mainly used during the problems with uncertinity.Similarity metric is used in multi-attribute decision making problems to measure the difference between the attributes.Majumdar and Samanta [29] proposed a similarity function between Single valued neutrosophic set based on the membership degree.Donghai Liu,Guangyan Liu and Zaiming Liu proposed a new similarity measure based on the similarity measure proposed by Majumdar and Samanta [29] for single valued neutrosophic set.In this paper a new similarity function for a neutrosophic binary set is introduced based on the similarity measure proposed by Donghai Liu,Guangyan

Liu and Zaiming Liu [20] and its been checked with a real life situation. In this paper a sample with both male and female of all age group is taken and their preference for their well being is been analysed using this new similarity measure. The final result is been shown in a pictorial form in five different age category like less than 25 years of age, 26-35 years of age,36-45 years of age, 46-55 years of age and above 56 years of age.

2. Preliminaries

Some basis definition of Similarity measure, Euclidean measure are defined in this section.

Definition 2.1. [22] Let $\tilde{X} = \{\tilde{x}_i, 1 \leq i \leq n\}$ and $\tilde{Y} = \{\tilde{y}_i, 1 \leq i \leq n\}$ be the universal sets. The Neutrosophic binary set $(\mathcal{A}, \mathcal{B}) \subseteq (\tilde{X}, \tilde{Y})$ is given by

$$(\mathcal{A}, \mathcal{B}) = \{< \tilde{X}, (\mu_{\mathcal{A}}(\tilde{x}_i), \sigma_{\mathcal{A}}(\tilde{x}_i), \gamma_{\mathcal{A}}(\tilde{x}_i) >; \tilde{x}_i \in \tilde{X}, \\ < \tilde{Y}, (\mu_{\mathcal{B}}(\tilde{y}_i), \sigma_{\mathcal{B}}(\tilde{y}_i), \gamma_{\mathcal{B}}(\tilde{y}_i) >; \tilde{y}_i \in \tilde{Y}\}$$

where $\mu_{\mathcal{A}}, \sigma_{\mathcal{A}}, \gamma_{\mathcal{A}} \rightarrow [0, 1]$; $\mu_{\mathcal{B}}, \sigma_{\mathcal{B}}, \gamma_{\mathcal{B}} \rightarrow [0, 1]$ and $0 \leq \mu_{\mathcal{A}}(\tilde{x}) + \sigma_{\mathcal{A}}(\tilde{x}) + \gamma_{\mathcal{A}}(\tilde{x}) \leq 3$; $0 \leq \mu_{\mathcal{B}}(\tilde{y}) + \sigma_{\mathcal{B}}(\tilde{y}) + \gamma_{\mathcal{B}}(\tilde{y}) \leq 3$. The Neutrosophic Binary Set over the universe $(\tilde{\mathcal{X}}, \tilde{\mathcal{Y}})$ is denoted as $M_N(\tilde{\mathcal{X}}, \tilde{\mathcal{Y}})$.

Definition 2.2. [22][Empty set and Universal Set] Let $\tilde{\mathcal{X}}$ and $\tilde{\mathcal{Y}}$ be the universe. Then, (Empty Set) $(0_{\tilde{\mathcal{X}}}, 0_{\tilde{\mathcal{Y}}})$ can be defined as

(0_1) $0_{\tilde{\mathcal{X}}} = \{< \tilde{x}, 0, 0, 1 >: \tilde{x} \in \tilde{\mathcal{X}}\}$, $0_{\tilde{\mathcal{Y}}} = \{< \tilde{y}, 0, 0, 1 >: \tilde{y} \in \tilde{\mathcal{Y}}\}$
(0_2) $0_{\tilde{\mathcal{X}}} = \{< \tilde{x}, 0, 1, 1 >: \tilde{x} \in \tilde{\mathcal{X}}\}$, $0_{\tilde{\mathcal{Y}}} = \{< \tilde{y}, 0, 1, 1 >: \tilde{y} \in \tilde{\mathcal{Y}}\}$
(0_3) $0_{\tilde{\mathcal{X}}} = \{< \tilde{x}, 0, 1, 0 >: \tilde{x} \in \tilde{\mathcal{X}}\}$, $0_{\tilde{\mathcal{Y}}} = \{< \tilde{y}, 0, 1, 0 >: \tilde{y} \in \tilde{\mathcal{Y}}\}$
(0_4) $0_{\tilde{\mathcal{X}}} = \{< \tilde{x}, 0, 0, 1 >: \tilde{x} \in \tilde{\mathcal{X}}\}$, $0_{\tilde{\mathcal{Y}}} = \{< \tilde{y}, 0, 0, 0 >: \tilde{y} \in \tilde{\mathcal{Y}}\}$

(Universal Set) $(1_{\tilde{\mathcal{X}}}, 1_{\tilde{\mathcal{Y}}})$ can be defined as

(1_1) $1_{\tilde{\mathcal{X}}} = \{< \tilde{x}, 1, 0, 0 >: \tilde{x} \in \tilde{\mathcal{X}}\}$, $1_{\tilde{\mathcal{Y}}} = \{< \tilde{y}, 1, 0, 0 >: \tilde{y} \in \tilde{\mathcal{Y}}\}$
(1_2) $1_{\tilde{\mathcal{X}}} = \{< \tilde{x}, 1, 0, 1 >: \tilde{x} \in \tilde{\mathcal{X}}\}$, $1_{\tilde{\mathcal{Y}}} = \{< \tilde{y}, 1, 0, 1 >: \tilde{y} \in \tilde{\mathcal{Y}}\}$
(1_3) $1_{\tilde{\mathcal{X}}} = \{< \tilde{x}, 1, 1, 0 >: \tilde{x} \in \tilde{\mathcal{X}}\}$, $1_{\tilde{\mathcal{Y}}} = \{< \tilde{y}, 1, 1, 0 >: \tilde{y} \in \tilde{\mathcal{Y}}\}$
(1_4) $1_{\tilde{\mathcal{X}}} = \{< \tilde{x}, 1, 1, 1 >: \tilde{x} \in \tilde{\mathcal{X}}\}$, $1_{\tilde{\mathcal{Y}}} = \{< \tilde{y}, 1, 1, 1 >: \tilde{y} \in \tilde{\mathcal{Y}}\}$

Definition 2.3. [22](Complement) Let $(\mathcal{A}, \mathcal{B}) = \{< \mu_{\mathcal{A}}, \sigma_{\mathcal{A}}, \gamma_{\mathcal{A}} >, < \mu_{\mathcal{B}}, \sigma_{\mathcal{B}}, \gamma_{\mathcal{B}} >\}$ be a neutrosophic binary set on $(\tilde{\mathcal{X}}, \tilde{\mathcal{Y}}, \mathcal{M}_{\mathcal{N}})$, then the complement of the set $C(A, B)$ may be defined as

$$
\begin{aligned}
(C_1)\quad C(\mathcal{A},\mathcal{B}) =&\{\tilde{x}, < 1-\mu_{\mathcal{A}}(\tilde{x}), \sigma_{\mathcal{A}}(\tilde{x}), 1-\gamma_{\mathcal{A}}(\tilde{x}) >: \tilde{x} \in \tilde{\mathcal{X}},\\
&< \tilde{y}, 1-\mu_{B}(\tilde{y}), \sigma_{B}(\tilde{y}), 1-\gamma_{B}(\tilde{y}) >: \tilde{y} \in \tilde{\mathcal{Y}}\}\\
(C_2)\quad C(\mathcal{A},\mathcal{B}) =&\{\tilde{x}, < \gamma_{\mathcal{A}}(\tilde{x}), \sigma_{\mathcal{A}}(\tilde{x}), \mu_{\mathcal{A}}(\tilde{x}) >: \tilde{x} \in \tilde{\mathcal{X}},\\
&< \tilde{y}, \gamma_{\mathcal{B}}(\tilde{y}), \sigma_{\mathcal{B}}(\tilde{y}), \mu_{\mathcal{B}}(\tilde{y}) >: \tilde{y} \in \tilde{\mathcal{Y}}\tilde{y} \in \tilde{\mathcal{Y}}\}\\
(C_3)\quad C(\mathcal{A},\mathcal{B}) =&\{\tilde{x}, < \gamma_{\mathcal{A}}(\tilde{x}), 1-\sigma_{\mathcal{A}}(\tilde{x}), \mu_{\mathcal{A}}(\tilde{x}) >: \tilde{x} \in \tilde{\mathcal{X}},\\
&< \tilde{y}, \gamma_{\mathcal{B}}(\tilde{y}), 1-\sigma_{\mathcal{B}}(\tilde{y}), \mu_{\mathcal{B}}(\tilde{y}) >: \tilde{y} \in \tilde{\mathcal{Y}}\}
\end{aligned}
$$

Definition 2.4. [22](Inclusion) Let $(\mathcal{A},\mathcal{B})$ and $(\mathcal{C},\mathcal{D})$ be two neutrosophic binary sets which is in the form
$(\mathcal{A},\mathcal{B}) = \{< \mu_{\mathcal{A}}, \sigma_{\mathcal{A}}, \gamma_{\mathcal{A}} >, < \mu_{\mathcal{B}}, \sigma_{\mathcal{B}}, \gamma_{\mathcal{B}} >\}$ and
$(\mathcal{C},\mathcal{D}) = \{< \mu_{\mathcal{C}}, \sigma_{\mathcal{C}}, \gamma_{\mathcal{C}} >, < \mu_{\mathcal{D}}, \sigma_{\mathcal{D}}, \gamma_{\mathcal{D}} >\}$.
Then $(\mathcal{A},\mathcal{B}) \subseteq (\mathcal{C},\mathcal{D})$ can be defined as

$$
\begin{aligned}
(\mathcal{A},\mathcal{B}) \subseteq (\mathcal{C},\mathcal{D}) \iff& \mu_{\mathcal{A}}(\tilde{x}) \leq \mu_{\mathcal{C}}(\tilde{x}), \sigma_{\mathcal{A}}(\tilde{x}) \leq \sigma_{\mathcal{C}}(\tilde{x}), \gamma_{\mathcal{A}}(\tilde{x}) \geq \gamma_{\mathcal{C}}(\tilde{x}) \forall \tilde{x} \in \tilde{\mathcal{X}}\\
&\mu_{\mathcal{B}}(\tilde{y}) \leq \mu_{\mathcal{D}}(\tilde{y}), \sigma_{\mathcal{B}}(\tilde{y}) \leq \sigma_{\mathcal{D}}(\tilde{y}), \gamma_{\mathcal{B}}(\tilde{y}) \geq \gamma_{\mathcal{D}}(\tilde{y}) \forall \tilde{y} \in \tilde{\mathcal{Y}}
\end{aligned}
$$

$$
\begin{aligned}
(\mathcal{A},\mathcal{B}) \subseteq (\mathcal{C},\mathcal{D}) \iff& \mu_{\mathcal{A}}(\tilde{x}) \leq \mu_{\mathcal{C}}(\tilde{x}), \sigma_{\mathcal{A}}(\tilde{x}) \geq \sigma_{\mathcal{C}}(\tilde{x}), \gamma_{\mathcal{A}}(\tilde{x}) \geq \gamma_{\mathcal{C}}(\tilde{x}) \forall \tilde{x} \in \tilde{\mathcal{X}}\\
&\mu_{\mathcal{B}}(\tilde{y}) \leq \mu_{\mathcal{D}}(\tilde{y}), \sigma_{\mathcal{B}}(\tilde{y}) \geq \sigma_{\mathcal{D}}(\tilde{y}), \gamma_{\mathcal{B}}(\tilde{y}) \geq \gamma_{\mathcal{D}}(\tilde{y}) \forall \tilde{y} \in \tilde{\mathcal{Y}}
\end{aligned}
$$

Definition 2.5. [22][Intersection and Union] Let $(\mathcal{A},\mathcal{B})$ and $(\mathcal{C},\mathcal{D})$ be two neutrosophic binary sets which is in the form
$(\mathcal{A},\mathcal{B}) = \{< \mu_{\mathcal{A}}, \sigma_{\mathcal{A}}, \gamma_{\mathcal{A}} >, < \mu_{\mathcal{B}}, \sigma_{\mathcal{B}}, \gamma_{\mathcal{B}} >\}$ and
$(\mathcal{C},\mathcal{D}) = \{< \mu_{\mathcal{C}}, \sigma_{\mathcal{C}}, \gamma_{\mathcal{C}} >, < \mu_{\mathcal{D}}, \sigma_{\mathcal{D}}, \gamma_{\mathcal{D}} >\}$.
(1) Intersection: $(\mathcal{A},\mathcal{B}) \cap (\mathcal{C},\mathcal{D})$ can be defined as

$$
\begin{aligned}
(\mathcal{A},\mathcal{B}) \cap (\mathcal{C},\mathcal{D}) = \{& < \tilde{x}, \mu_{\mathcal{A}}(\tilde{x}) \wedge \mu_{\mathcal{C}}(\tilde{x}), \sigma_{\mathcal{A}}(\tilde{x}) \wedge \sigma_{\mathcal{C}}(\tilde{x}), \gamma_{\mathcal{A}}(\tilde{x}) \vee \gamma_{\mathcal{A}}(\tilde{x}) >\\
&< \tilde{y}, \mu_{\mathcal{A}}(\tilde{y}) \wedge \mu_{\mathcal{C}}(\tilde{y}), \sigma_{\mathcal{A}}(\tilde{y}) \wedge \sigma_{\mathcal{C}}(\tilde{y}), \gamma_{\mathcal{A}}(\tilde{y}) \vee \gamma_{\mathcal{A}}(\tilde{y}) >\}
\end{aligned}
$$

$$
\begin{aligned}
(\mathcal{A},\mathcal{B}) \cap (\mathcal{C},\mathcal{D}) = \{& < \tilde{x}, \mu_{\mathcal{A}}(\tilde{x}) \wedge \mu_{\mathcal{C}}(\tilde{x}), \sigma_{\mathcal{A}}(\tilde{x}) \vee \sigma_{\mathcal{C}}(\tilde{x}), \gamma_{\mathcal{A}}(\tilde{x}) \vee \gamma_{\mathcal{A}}(\tilde{x}) >\\
&< \tilde{y}, \mu_{\mathcal{A}}(\tilde{y}) \wedge \mu_{\mathcal{C}}(\tilde{y}), \sigma_{\mathcal{A}}(\tilde{y}) \vee \sigma_{\mathcal{C}}(\tilde{y}), \gamma_{\mathcal{A}}(\tilde{y}) \vee \gamma_{\mathcal{A}}(\tilde{y}) >\}
\end{aligned}
$$

(2) Union: $(\mathcal{A},\mathcal{B}) \cup (\mathcal{C},\mathcal{D})$ can be defined as

$$
\begin{aligned}
(\mathcal{A},\mathcal{B}) \cup (\mathcal{C},\mathcal{D}) = \{& < \tilde{x}, \mu_{\mathcal{A}}(\tilde{x}) \vee \mu_{\mathcal{C}}(\tilde{x}), \sigma_{\mathcal{A}}(\tilde{x}) \vee \sigma_{\mathcal{C}}(\tilde{x}), \gamma_{\mathcal{A}}(\tilde{x}) \wedge \gamma_{\mathcal{A}}(\tilde{x}) >\\
&< \tilde{y}, \mu_{\mathcal{A}}(\tilde{y}) \vee \mu_{\mathcal{C}}(\tilde{y}), \sigma_{\mathcal{A}}(\tilde{y}) \vee \sigma_{\mathcal{C}}(\tilde{y}), \gamma_{\mathcal{A}}(\tilde{y}) \wedge \gamma_{\mathcal{A}}(\tilde{y}) >\}
\end{aligned}
$$

$$(\mathcal{A},\mathcal{B})\cap(\mathcal{C},\mathcal{D}) = \{ < \tilde{x}, \mu_{\mathcal{A}}(\tilde{x}) \vee \mu_{\mathcal{C}}(\tilde{x}), \sigma_{\mathcal{A}}(\tilde{x}) \wedge \sigma_{\mathcal{C}}(\tilde{x}), \gamma_{\mathcal{A}}(\tilde{x}) \wedge \gamma_{\mathcal{A}}(\tilde{x}) > \\ < \tilde{y}, \mu_{\mathcal{A}}(\tilde{y}) \vee \mu_{\mathcal{C}}(\tilde{y}), \sigma_{\mathcal{A}}(\tilde{y}) \wedge \sigma_{\mathcal{C}}(\tilde{y}), \gamma_{\mathcal{A}}(\tilde{y}) \wedge \gamma_{\mathcal{A}}(\tilde{y}) >\}$$

Definition 2.6. [22] A Neutrosophic binary topology from $\tilde{\mathcal{X}}$ to $\tilde{\mathcal{Y}}$ is a binary structure $M_{\mathcal{N}} \subseteq P(\tilde{\mathcal{X}}) \times P(\tilde{\mathcal{Y}})$ that satisfies the following conditions:

(1) $(0_{\tilde{\mathcal{X}}}, 0_{\tilde{\mathcal{Y}}}) \in M_{\mathcal{N}}$ and $(1_{\tilde{\mathcal{X}}}, 1_{\tilde{\mathcal{Y}}}) \in M_{\mathcal{N}}$.
(2) $(\mathcal{A}_1 \cap \mathcal{A}_2, \mathcal{B}_1 \cap \mathcal{B}_2) \in M_{\mathcal{N}}$ whenever $(\mathcal{A}_1, \mathcal{B}_1) \in M_{\mathcal{N}}$ and $(\mathcal{A}_2, \mathcal{B}_2) \in M_{\mathcal{N}}$.
(3) If $(\mathcal{A}_\alpha, \mathcal{B}_\alpha)_{\alpha\in\Delta}$ is a family of members of $M_{\mathcal{N}}$, then $(\cup_{\alpha\in\Delta}\mathcal{A}_\alpha, \cup_{\alpha\in\Delta}\mathcal{B}_\alpha) \in M_{\mathcal{N}}$.

The triplet $(\tilde{\mathcal{X}}, \tilde{\mathcal{Y}}, M_{\mathcal{N}})$ is called Neutrosophic Binary Topological space. The members of $M_{\mathcal{N}}$ are called the neutrosophic binary open sets and the complement of neutrosophic binary open sets are called the neutrosophic binary closed sets in the neutrosophic binary topological space $(\tilde{\mathcal{X}}, \tilde{\mathcal{Y}}, M_{\mathcal{N}})$.

Definition 2.7. [29] Similarity measure for Single valued neutrosophic set:
Let $X = \{x_1, x_2, ...x_n\}$ be a universal set [15],for any two SVNSs $\mathcal{N}_1 = \{<x_i, T_{N_1}(x_i), I_{N_1}(x_i), F_{N_1}(x_i)>|x_i \in X\}$and $\mathcal{N}_2 = \{<x_i, T_{N_2}(x_i), I_{N_2}(x_i), F_{N_2}(x_i)>|x_i \in X\}$; the similarity measure of SVNSs between $\mathcal{N}_1$ and $\mathcal{N}_2$ is defined as

$$S_{1SVNS}(\mathcal{N}_1,\mathcal{N}_2) = \frac{\sum\limits_{i=1}^{n} min(T_{N_1}(x_i),T_{N_2}(x_i))+min(I_{N_1}(x_i),I_{N_2}(x_i))+min(F_{N_1}(x_i),F_{N_2}(x_i))}{\sum\limits_{i=1}^{n} max(T_{N_1}(x_i),T_{N_2}(x_i))+max(I_{N_1}(x_i),I_{N_2}(x_i))+max(F_{N_1}(x_i),F_{N_2}(x_i))}$$

Definition 2.8. [29] Let $\mathcal{N}_1 = \{<x_i, T_{N_1}(x_i), I_{N_1}(x_i), F_{N_1}(x_i)>|x_i \in X\}$and $\mathcal{N}_2 = \{<x_i, T_{N_2}(x_i), I_{N_2}(x_i), F_{N_2}(x_i)>|x_i \in X\}$; be any two SVNSs in $X = x_1, x_2, ..., x_n$; then, the Euclidean distance between SVNSs $\mathcal{N}_1$ and $\mathcal{N}_2$ is defined as

$$D_{SVNS}(\mathcal{N}_1,\mathcal{N}_2) = \sqrt{\frac{\sum\limits_{i=1}^{n}[(T_{N_1}(x_i)-T_{N_2}(x_i))^2+(I_{N_1}(x_i)-I_{N_2}(x_i))^2+(F_{N_1}(x_i)-F_{N_2}(x_i))^2]}{3n}}$$

Definition 2.9. [20] Similarity measure for Single valued neutrosophic set:
Let $X = \{x_1, x_2, ...x_n\}$ be a universal set for any two SVNSs $\mathcal{N}_1 = \{<x_i, T_{N_1}(x_i), I_{N_1}(x_i), F_{N_1}(x_i)>|x_i \in X\}$and $\mathcal{N}_2 = \{<x_i, T_{N_2}(x_i), I_{N_2}(x_i), F_{N_2}(x_i)>|x_i \in X\}$; the similarity measure of SVNSs between $\mathcal{N}_1$ and $\mathcal{N}_2$ is defined as
$\mathcal{S}^*_{1SVNS}(\mathcal{N}_{B_1},\mathcal{N}_{B_2}) = \frac{1}{2}[S_{1SVNS}(\mathcal{N}_1,\mathcal{N}_2) + 1 - D_{SVNS}(\mathcal{N}_1,\mathcal{N}_2)]$ where $S_{1SVNS}(\mathcal{N}_1,\mathcal{N}_2)$ and $D_{SVNS}(\mathcal{N}_1,\mathcal{N}_2)$ are the similarity measure [29] and the Euclidean distance between SVNSs [29]

3. Similarity measure for Binary neutrosophic set.

A new Similarity measure is used to find the measure between two different Binary single valued neutrosophic set which is defined as follows:

Definition 3.1. Let $\tilde{\mathcal{X}} = \{\tilde{x}_1, \tilde{x}_2, ..., \tilde{x}_n\}; \tilde{\mathcal{Y}} = \{\tilde{y}_1, \tilde{y}_2, .., \tilde{y}_n\}$ be the two universal set of the binary topology and let

$$\mathcal{N}_{B_1} = \{< \tilde{\mathcal{X}}, \mu_{N_{B_1}}(\tilde{x}_i), \sigma_{N_{B_1}}(\tilde{x}_i), \gamma_{N_{B_1}}(\tilde{x}_i) >; \tilde{x}_i \in \tilde{\mathcal{X}}, \\ < \tilde{\mathcal{Y}}, \mu_{N_{B_1}}(\tilde{y}_i), \sigma_{N_{B_1}}(\tilde{y}_i), \gamma_{N_{B_1}}(\tilde{y}_i) >; \tilde{y}_i \in \tilde{\mathcal{Y}}\}$$

and

$$\mathcal{N}_{B_2} = \{< \tilde{\mathcal{X}}, (\mu_{N_{B_2}}(\tilde{x}_i), \sigma_{N_{B_2}}(\tilde{x}_i), \gamma_{N_{B_2}}(\tilde{x}_i) >; \tilde{x}_i \in \tilde{\mathcal{X}}, \\ < \tilde{\mathcal{Y}}, (\mu_{N_{B_2}}(\tilde{y}_i), \sigma_{N_{B_2}}(\tilde{y}_i), \gamma_{N_{B_2}}(\tilde{y}_i) >; \tilde{y}_i \in \tilde{\mathcal{Y}}\}$$

be the two neutrosophic binary sets then the similarity measure between the two neutrosophic binary set is defined as

$$\mathcal{SM}^*_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2}) = \frac{1}{2}[\mathcal{SM}_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2}) + 1 - \mathcal{D}_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})]$$

where $\mathcal{SM}_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})$ and $\mathcal{D}_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})$ are the Similarity measure and the Euclidean distance respectively and is defined as follows.

Definition 3.2. The similarity measure $\mathcal{SM}_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})$ for the Neutrosophic binary set $\mathcal{N}_{B_1}$ and $\mathcal{N}_{B_2}$ is defined as $\mathcal{SM}_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2}) =$

$$\frac{\sum_{i=1}^{n}[\{\mu_{N_{B_1}}(\tilde{x}_i) \wedge \mu_{N_{B_2}}(\tilde{x}_i)\} + \{\sigma_{N_{B_1}}(\tilde{x}_i) \wedge \sigma_{N_{B_2}}(\tilde{x}_i)\} + \{\gamma_{N_{B_1}}(\tilde{x}_i) \wedge \gamma_{N_{B_2}}(\tilde{x}_i)\} + \{\mu_{N_{B_1}}(\tilde{y}_i) \wedge \mu_{N_{B_2}}(\tilde{y}_i)\} + \{\sigma_{N_{B_1}}(\tilde{y}_i) \wedge \sigma_{N_{B_2}}(\tilde{y}_i)\} + \{\gamma_{N_{B_1}}(\tilde{y}_i) \wedge \gamma_{N_{B_2}}(\tilde{y}_i)\}]}{\sum_{i=1}^{n}[\{\mu_{N_{B_1}}(\tilde{x}_i) \vee \mu_{N_{B_2}}(\tilde{x}_i)\} + \{\sigma_{N_{B_1}}(\tilde{x}_i) \vee \sigma_{N_{B_2}}(\tilde{x}_i)\} + \{\gamma_{N_{B_1}}(\tilde{x}_i) \vee \gamma_{N_{B_2}}(\tilde{x}_i)\} + \{\mu_{N_{B_1}}(\tilde{y}_i) \vee \mu_{N_{B_2}}(\tilde{y}_i)\} + \{\sigma_{N_{B_1}}(\tilde{y}_i) \vee \sigma_{N_{B_2}}(\tilde{y}_i)\} + \{\gamma_{N_{B_1}}(\tilde{y}_i) \vee \gamma_{N_{B_2}}(\tilde{y}_i)\}]}$$

Definition 3.3. The Euclidean distance $D_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})$ between the Neutrosophic binary set $\mathcal{N}_{B_1}$ and $\mathcal{N}_{B_2}$ is defined as
$D_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2}) =$

$$\sqrt{\frac{\sum_{i=1}^{n}[(\mu_{N_{B_1}}(\tilde{x}_i) - \mu_{N_{B_2}}(\tilde{x}_i))^2 + (\sigma_{N_{B_1}}(\tilde{x}_i) - \sigma_{N_{B_2}}(\tilde{x}_i))^2 + (\gamma_{N_{B_1}}(\tilde{x}_i) - \gamma_{N_{B_2}}(\tilde{x}_i))^2 + (\mu_{N_{B_1}}(\tilde{y}_i) - \mu_{N_{B_2}}(\tilde{y}_i))^2 + (\sigma_{N_{B_1}}(\tilde{y}_i) - \sigma_{N_{B_2}}(\tilde{y}_i))^2 + (\gamma_{N_{B_1}}(\tilde{y}_i) - \gamma_{N_{B_2}}(\tilde{y}_i))^2]}{3n}}$$

Example 3.4. $E_1 = \{a_1, a_2\}$ and $E_2 = \{b_1, b_2\}$ be the universe of the neutrosophic binary topological space $\mathcal{M}_N = \{(0_N(E_1), 0_N(E_2)), (1_N(E_1), 1_N(E_2)), (V_1, W_1), (V_2, W_2)\}$ where $(V_1, W_1) = \{< (0.4, 0.5, 0.5), (0.3, 0.5, 0.6) >, < (0.3, 0.5, 0.5), (0.4, 0.5, 0.7) >\}$
$(V_2, W_2) = \{< (0.3, 0.5, 0.6), (0.2, 0.5, 0.7) >, < (0.2, 0.5, 0.6), (0.3, 0.5, 0.7) >\}$ the similarity measure $\mathcal{SM}_{N_B}\{(V_1, W_1), (V_2, W_2)\} = 0.8833$ and The Euclidean distance

$D_{N_B}\{(V_1, W_1), (V_2, W_2)\} = 0.10798$. The similarity measure between the two neutrosophic binary set $(V_1, W_1), (V_2, W_2)$ is $\mathcal{SM}^*_{N_B}\{(V_1, W_1), (V_2, W_2)\} = \frac{1}{2}[0.8833 + 1 - 0.10798] = 0.88766$.

Theorem 3.5. *The Similarity measure $\mathcal{SM}^*_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})$ between the neutrosophic Binary set*

$$\mathcal{N}_{B_1} = \{< \tilde{\mathcal{X}}, \mu_{N_{B_1}}(\tilde{x}_i), \sigma_{N_{B_1}}(\tilde{x}_i), \gamma_{N_{B_1}}(\tilde{x}_i) >; \tilde{x}_i \in \tilde{\mathcal{X}},$$
$$< \tilde{\mathcal{Y}}, \mu_{N_{B_1}}(\tilde{y}_i), \sigma_{N_{B_1}}(\tilde{y}_i), \gamma_{N_{B_1}}(\tilde{y}_i) >; \tilde{y}_i \in \tilde{\mathcal{Y}}\}$$

$$\mathcal{N}_{B_2} = \{< \tilde{\mathcal{X}}, (\mu_{N_{B_2}}(\tilde{x}_i), \sigma_{N_{B_2}}(\tilde{x}_i), \gamma_{N_{B_2}}(\tilde{x}_i) >; \tilde{x}_i \in \tilde{\mathcal{X}},$$
$$< \tilde{\mathcal{Y}}, (\mu_{N_{B_2}}(\tilde{y}_i), \sigma_{N_{B_2}}(\tilde{y}_i), \gamma_{N_{B_2}}(\tilde{y}_i) >; \tilde{y}_i \in \tilde{\mathcal{Y}}\}$$

satisfies the following properties
(i) $0 \leq \mathcal{SM}^*_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2}) \leq 1$
(ii) $\mathcal{SM}^*_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2}) = 1$ *iff* $\mathcal{N}_{B_1} = \mathcal{N}_{B_2}$
(iii) $\mathcal{SM}^*_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2}) = \mathcal{SM}^*_{N_B}(\mathcal{N}_{B_2}, \mathcal{N}_{B_1})$

Proof. To prove the above properties it is important to prove that $\mathcal{SM}_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})$ and $D_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})$ also satifies the property.
(i)Since the three membership values of the neutrosophic binary set lies between o to 1, the minimum value, the maximum value and their difference also lies between 0 to 1. Hence the value of $\mathcal{SM}_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})$ and $D_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})$ also lies between o to 1. hence $\mathcal{SM}^*_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})$ satisfies (i).
(ii) When two neutrosophic binary sets are equal it is obviouse from the definition of $\mathcal{SM}_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})$ and $D_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})$ that $\mathcal{SM}_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2}) = 1$ and $D_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2}) = 0$. Hence $\mathcal{SM}^*_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2}) = \frac{1}{2}[1 + 1 - 0] = 1$
(iii) Since,
$max/min\{\mu_{N_{B_1}}(\tilde{x}_i), \mu_{N_{B_2}}(\tilde{x}_i)\} = max/min\{\mu_{N_{B_2}}(\tilde{x}_i), \mu_{N_{B_1}}(\tilde{x}_i)\}; 1 \leq i \leq n,$
$max/min\{\sigma_{N_{B_1}}(\tilde{x}_i), \sigma_{N_{B_2}}(\tilde{x}_i)\} = max/min\{\sigma_{N_{B_2}}(\tilde{x}_i), \sigma_{N_{B_1}}(\tilde{x}_i)\}; 1 \leq i \leq n,$
$max/min\{\gamma_{N_{B_1}}(\tilde{x}_i), \gamma_{N_{B_2}}(\tilde{x}_i)\} = max/min\{\gamma_{N_{B_2}}(\tilde{x}_i), \gamma_{N_{B_1}}(\tilde{x}_i)\}; 1 \leq i \leq n.$
Similarly,
$max/min\{\mu_{N_{B_1}}(\tilde{y}_i), \mu_{N_{B_2}}(\tilde{y}_i)\} = max/min\{\mu_{N_{B_2}}(\tilde{y}_i), \mu_{N_{B_1}}(\tilde{y}_i)\}; 1 \leq i \leq n,$
$max/min\{\sigma_{N_{B_1}}(\tilde{y}_i), \sigma_{N_{B_2}}(\tilde{y}_i)\} = max/min\{\sigma_{N_{B_2}}(\tilde{y}_i), \sigma_{N_{B_1}}(\tilde{y}_i)\}; 1 \leq i \leq n,$
$max/min\{\gamma_{N_{B_1}}(\tilde{y}_i), \gamma_{N_{B_2}}(\tilde{y}_i)\} = max/min\{\gamma_{N_{B_2}}(\tilde{y}_i), \gamma_{N_{B_1}}(\tilde{y}_i)\}; 1 \leq i \leq n.$
Hence $\mathcal{SM}_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2}) = \mathcal{SM}_{N_B}(\mathcal{N}_{B_2}, \mathcal{N}_{B_1})$ and $D_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2}) = D_{N_B}(\mathcal{N}_{B_2}, \mathcal{N}_{B_1})$ which implies $\mathcal{SM}^*_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2}) = \mathcal{SM}^*_{N_B}(\mathcal{N}_{B_2}, \mathcal{N}_{B_1})$. □

4. Application of the Proposed Similarity measure

The newly introduced Similarity measure based on set theory for a neutrosophic binary set is now used to find the choice made by the male and female who are categorized by age for their well-being.the data is being collected using a Questionnaire of all age category and segregated into five age groups and its been converted into a neutrosophic data.

4.1. *Methodology*

Let $\mathfrak{m}_1, \mathfrak{m}_2, ..., \mathfrak{m}_n$ be the set of male and $\mathfrak{f}_1, \mathfrak{f}_2, ..., \mathfrak{f}_n$ be the set of female; $\mathfrak{H}_{\mathfrak{m}_1}, \mathfrak{H}_{\mathfrak{m}_2}, ..., \mathfrak{H}_{\mathfrak{m}_n}$ be the criteria (well-being) prefered by male and $\mathfrak{H}_{\mathfrak{f}_1}, \mathfrak{H}_{\mathfrak{f}_2}, ..., \mathfrak{H}_{\mathfrak{f}_n}$ be the criteria (well-being) prefered by female ; $\mathfrak{R}_{\mathfrak{m}_1}, \mathfrak{R}_{\mathfrak{m}_2}, ..., \mathfrak{R}_{\mathfrak{m}_n}$ be the alternatives of male individuals and $\mathfrak{R}_{\mathfrak{f}_1}, \mathfrak{R}_{\mathfrak{f}_2}, ..., \mathfrak{R}_{\mathfrak{f}_n}$ be the alternatives of female individual. The ranking of the alternatives is based on the preference made by the individuals against the well-being chosen by them. For a MADM problem, the values associated with the alternatives of male and female individuals can be represented in a decision matrix which is shown in table 1 , table 2.

	$(\mathfrak{R}_{\mathfrak{m}_1}, \mathfrak{R}_{\mathfrak{f}_1})$	$(\mathfrak{R}_{\mathfrak{m}_2}, \mathfrak{R}_{\mathfrak{f}_2})$	$\dots$	$\dots$	$(\mathfrak{R}_{\mathfrak{m}_n}, \mathfrak{R}_{\mathfrak{f}_n})$
$(\mathfrak{m}_1, \mathfrak{f}_1)$	ϕ_{11}	ϕ_{12}	$\dots$	$\dots$	ϕ_{1n}
$(\mathfrak{m}_2, \mathfrak{f}_2)$	ϕ_{21}	ϕ_{22}	$\dots$	$\dots$	ϕ_{2n}
$\vdots$	$\vdots$	$\vdots$	$\dots$	$\dots$	$\vdots$
$\vdots$	$\vdots$	$\vdots$	$\dots$	$\dots$	$\vdots$
$(\mathfrak{m}_n, \mathfrak{f}_n)$	ϕ_{n1}	ϕ_{n2}	$\dots$	$\dots$	ϕ_{nn}

TABLE 1. The relation between Individual and attributes

	$(\mathfrak{H}_{\mathfrak{m}_1}, \mathfrak{H}_{\mathfrak{f}_1})$	$(\mathfrak{H}_{\mathfrak{m}_2}, \mathfrak{H}_{\mathfrak{f}_2})$	$\dots$	$\dots$	$(\mathfrak{H}_{\mathfrak{m}_n}, \mathfrak{H}_{\mathfrak{f}_n})$
$(\mathfrak{R}_{\mathfrak{m}_1}, \mathfrak{R}_{\mathfrak{f}_1})$	Ψ_{11}	Ψ_{12}	$\dots$	$\dots$	Ψ_{1n}
$(\mathfrak{R}_{\mathfrak{m}_2}, \mathfrak{R}_{\mathfrak{f}_2})$	Ψ_{21}	Ψ_{22}	$\dots$	$\dots$	Ψ_{2n}
$\vdots$	$\vdots$	$\vdots$	$\dots$	$\dots$	$\vdots$
$\vdots$	$\vdots$	$\vdots$	$\dots$	$\dots$	$\vdots$
$(\mathfrak{R}_{\mathfrak{m}_n}, \mathfrak{R}_{\mathfrak{f}_n})$	Ψ_{n1}	Ψ_{n2}	$\dots$	$\dots$	Ψ_{nn}

TABLE 2. The relation between attributes and alternatives

Here ϕ_{ij} and Ψ_{ij} represents the neutrosophic binary sets.

The algorithm for this method is demonstrated below:

Step 1: Deliberate the association between the individuals and the attributes.

	$(\mathfrak{R}_{\mathfrak{m}_1}, \mathfrak{R}_{\mathfrak{f}_1})$	$(\mathfrak{R}_{\mathfrak{m}_2}, \mathfrak{R}_{\mathfrak{f}_2})$	$\ldots\ldots (\mathfrak{R}_{\mathfrak{m}_n}, \mathfrak{R}_{\mathfrak{f}_n})$
$(\mathfrak{m}_1, \mathfrak{f}_1)$	$< \mu_{11}(\tilde{x}_i), \sigma_{11}(\tilde{x}_i), \gamma_{11}(\tilde{x}_i) >, < \mu_{11}(\tilde{y}_i), \sigma_{11}(\tilde{y}_i), \gamma_{11}(\tilde{y}_i) >$	$< \mu_{12}(\tilde{x}_i), \sigma_{12}(\tilde{x}_i), \gamma_{12}(\tilde{x}_i) >, < \mu_{12}(\tilde{y}_i), \sigma_{12}(\tilde{y}_i), \gamma_{12}(\tilde{y}_i) >$	$\ldots\ldots < \mu_{1n}(\tilde{x}_i), \sigma_{1n}(\tilde{x}_i), \gamma_{1n}(\tilde{x}_i) >, < \mu_{1n}(\tilde{y}_i), \sigma_{1n}(\tilde{y}_i), \gamma_{1n}(\tilde{y}_i) >$
$(\mathfrak{m}_2, \mathfrak{f}_2)$	$< \mu_{21}(\tilde{x}_i), \sigma_{21}(\tilde{x}_i), \gamma_{21}(\tilde{x}_i) >, < \mu_{21}(\tilde{y}_i), \sigma_{21}(\tilde{y}_i), \gamma_{21}(\tilde{y}_i) >$	$< \mu_{22}(\tilde{x}_i), \sigma_{22}(\tilde{x}_i), \gamma_{22}(\tilde{x}_i) >, < \mu_{22}(\tilde{y}_i), \sigma_{22}(\tilde{y}_i), \gamma_{22}(\tilde{y}_i) >$	$\ldots\ldots < \mu_{2n}(\tilde{x}_i), \sigma_{2n}(\tilde{x}_i), \gamma_{2n}(\tilde{x}_i) >, < \mu_{2n}(\tilde{y}_i), \sigma_{2n}(\tilde{y}_i), \gamma_{2n}(\tilde{y}_i) >$
$\ldots$	$\ldots$	$\ldots$	$\ldots\ldots\ldots$
$(\mathfrak{m}_n, \mathfrak{f}_n)$	$< \mu_{n1}(\tilde{x}_i), \sigma_{n1}(\tilde{x}_i), \gamma_{n1}(\tilde{x}_i) >, < \mu_{n1}(\tilde{y}_i), \sigma_{n1}(\tilde{y}_i), \gamma_{n1}(\tilde{y}_i) >$	$< \mu_{n2}(\tilde{x}_i), \sigma_{n2}(\tilde{x}_i), \gamma_{n2}(\tilde{x}_i) >, < \mu_{n2}(\tilde{y}_i), \sigma_{n2}(\tilde{y}_i), \gamma_{n2}(\tilde{y}_i) >$	$\ldots\ldots < \mu_{nn}(\tilde{x}_i), \sigma_{nn}(\tilde{x}_i), \gamma_{nn}(\tilde{x}_i) >, < \mu_{nn}(\tilde{y}_i), \sigma_{nn}(\tilde{y}_i), \gamma_{nn}(\tilde{y}_i) >$

Step 2: Deliberate the association between the attributes and the alternatives.

	$(\mathfrak{H}_{\mathfrak{m}_1}, \mathfrak{H}_{\mathfrak{f}_1})$	$(\mathfrak{H}_{\mathfrak{m}_2}, \mathfrak{H}_{\mathfrak{f}_2})$	$\ldots\ldots (\mathfrak{H}_{\mathfrak{m}_n}, \mathfrak{H}_{\mathfrak{f}_n})$
$(\mathfrak{R}_{\mathfrak{m}_1}, \mathfrak{R}_{\mathfrak{f}_1})$	$< \mu_{11}(\tilde{x}_i), \sigma_{11}(\tilde{x}_i), \gamma_{11}(\tilde{x}_i) >, < \mu_{11}(\tilde{y}_i), \sigma_{11}(\tilde{y}_i), \gamma_{11}(\tilde{y}_i) >$	$< \mu_{12}(\tilde{x}_i), \sigma_{12}(\tilde{x}_i), \gamma_{12}(\tilde{x}_i) >, < \mu_{12}(\tilde{y}_i \sigma_{12}(\tilde{y}_i), \gamma_{12}(\tilde{y}_i) >$	$\ldots\ldots < \mu_{1n}(\tilde{x}_i), \sigma_{1n}(\tilde{x}_i), \gamma_{1n}(\tilde{x}_i) >, < \mu_{1n}(\tilde{y}_i), \sigma_{1n}(\tilde{y}_i), \gamma_{1n}(\tilde{y}_i) >$
$\ldots$	$\ldots$	$\ldots$	$\ldots\ldots\ldots$
$\ldots$	$\ldots$	$\ldots$	$\ldots\ldots\ldots$
$\ldots$	$\ldots$	$\ldots$	$\ldots\ldots\ldots$
$(\mathfrak{R}_{\mathfrak{m}_n}, \mathfrak{R}_{\mathfrak{f}_n})$	$< \mu_{n1}(\tilde{x}_i), \sigma_{n1}(\tilde{x}_i), \gamma_{n1}(\tilde{x}_i) >, < \mu_{n1}(\tilde{y}_i), \sigma_{n1}(\tilde{y}_i), \gamma_{n1}(\tilde{y}_i) >$	$< \mu_{n2}(\tilde{x}_i), \sigma_{n2}(\tilde{x}_i), \gamma_{n2}(\tilde{x}_i) >, < \mu_{n2}(\tilde{y}_i), \sigma_{n2}(\tilde{y}_i), \gamma_{n2}(\tilde{y}_i) >$	$\ldots\ldots < \mu_{nn}(\tilde{x}_i), \sigma_{nn}(\tilde{x}_i), \gamma_{nn}(\tilde{x}_i) >, < \mu_{nn}(\tilde{y}_i), \sigma_{nn}(\tilde{y}_i), \gamma_{nn}(\tilde{y}_i) >$

TABLE 3

Step: 3 apply the new similarity measure using the formula $\mathcal{SM}^*_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})$ as proposed in the definition 3.1.

Step:4 Ranking of alternatives.

The alternatives are ranked by the decision makers and it is ranked in inclined form of similarity measure $\mathcal{SM}^*_{N_B}(\mathcal{N}_{B_1}, \mathcal{N}_{B_2})$. The highest value of the similarity measure gives the best alternative.

4.2. *Numerical example*

let the two universal set be $\mathfrak{M} = \{\mathfrak{m}_1, ,m_2,m_3,m_4,m_5\}; \mathfrak{F} = \{\mathfrak{f}_1, \mathfrak{f}_2, \mathfrak{f}_3, \mathfrak{f}_4, \mathfrak{f}_5\}$ where $(\mathfrak{m}_1, \mathfrak{f}_1)$ represent male and female belong to less than or 25 age category;$(\mathfrak{m}_2, \mathfrak{f}_2)$ represent male and female belong to 26-35 age category;$(\mathfrak{m}_3, \mathfrak{f}_3)$ represent male and female belong to 36-45 age category;$(\mathfrak{m}_4, \mathfrak{f}_4)$ represent male and female belong to 46-55 age category;$(\mathfrak{m}_5, \mathfrak{f}_5)$ represent male and female belong to above 56 age category. Let $\mathfrak{H}_{\mathfrak{m}_1}, \mathfrak{H}_{\mathfrak{m}_2}, \mathfrak{H}_{\mathfrak{m}_3}, \mathfrak{H}_{\mathfrak{m}_4}, \mathfrak{H}_{\mathfrak{m}_5}$ and $\mathfrak{H}_{\mathfrak{f}_1}, \mathfrak{H}_{\mathfrak{f}_2}, \mathfrak{H}_{\mathfrak{f}_3}, \mathfrak{H}_{\mathfrak{f}_4}, \mathfrak{H}_{\mathfrak{f}_5}$ be the well-being prefered by male and female of the five age category respectively. Let $\mathfrak{R}_{\mathfrak{m}_1}, \mathfrak{R}_{\mathfrak{m}_2}, \mathfrak{R}_{\mathfrak{m}_3}, \mathfrak{R}_{\mathfrak{m}_4}, \mathfrak{R}_{\mathfrak{m}_5}$ and $\mathfrak{R}_{\mathfrak{f}_1}, \mathfrak{R}_{\mathfrak{f}_2}, \mathfrak{R}_{\mathfrak{f}_3}, \mathfrak{R}_{\mathfrak{f}_4}, \mathfrak{R}_{\mathfrak{f}_5}$ be the Reason prefered by male and female for selecting a particular well-being of the five age category respectively.let $(\mathfrak{H}_{\mathfrak{m}_1}, \mathfrak{H}_{\mathfrak{f}_1})$ represent the set of male and female who prefer yoga /meditation for their well- being who is less than or 25 years of age; $(\mathfrak{H}_{\mathfrak{m}_2}, \mathfrak{H}_{\mathfrak{f}_2})$ represent the set of male and female who prefer Gym/Walking for their well- being who is 26-35 years og age;$(\mathfrak{H}_{\mathfrak{m}_3}, \mathfrak{H}_{\mathfrak{f}_3})$ represent the set of male and female who prefer sports for their well- being who is 36-45 years of age;$(\mathfrak{H}_{\mathfrak{m}_4}, \mathfrak{H}_{\mathfrak{f}_4})$ represent the set of male and female who prefer Travelling for their well- being who is 46-55 years of age;$(\mathfrak{H}_{\mathfrak{m}_5}, \mathfrak{H}_{\mathfrak{f}_5})$ represent the set of male and female who prefer Reading/listening to music for their well- being who is Above 56 years of age.let $(\mathfrak{R}_{\mathfrak{m}_1}, \mathfrak{R}_{\mathfrak{f}_1})$ represent the set of male and female who choose a well-being for Alone time/Self Realization who is less than or 25 years of age;$(\mathfrak{R}_{\mathfrak{m}_2}, \mathfrak{R}_{\mathfrak{f}_2})$ represent the set of male and female who choose a well-being for Relaxation/Calmness who is 26-35 years of age;$(\mathfrak{R}_{\mathfrak{m}_3}, \mathfrak{R}_{\mathfrak{f}_3})$ represent the set of male and female who choose a well-being for Physical Fitness who is 36-45 years of age;$(\mathfrak{R}_{\mathfrak{m}_4}, \mathfrak{R}_{\mathfrak{f}_4})$ represent the set of male and female who choose a well-being for Exploring who is 46-55 years of age;$(\mathfrak{R}_{\mathfrak{m}_5}, \mathfrak{R}_{\mathfrak{f}_5})$ represent the set of male and female who choose a well-being for Mental wellness who is above 56 years of age.

The following table show the relation between male and female of all age category and their Reason for choosing a particular well-being.

The relation between both the male,female individuals and the attributes is represented in the form of neutrosophic binary sets in the table 4.

	$(\mathfrak{R}_{m_1}, \mathfrak{R}_{f_1})$	$(\mathfrak{R}_{m_2}, \mathfrak{R}_{f_2})$	$(\mathfrak{R}_{m_3}, \mathfrak{R}_{f_3})$	$(\mathfrak{R}_{m_4}, \mathfrak{R}_{f_4})$	$(\mathfrak{R}_{m_5}, \mathfrak{R}_{f_5})$
$(\mathfrak{m}_1, \mathfrak{f}_1)$	$< 0.44, 0.44, 0.55 >, < 0.44, 0.44, 0.55 >$	$< 0.33, 0.33, 0.66 >, < 0.11, 0.55, 0.33 >$	$< 0.11, 0.55, 0.33 >, < 0.22, 0.22, 0.77 >$	$< 0, 0, 1 >, < 0.11, 0, 0.88 >$	$< 0.11, 0.77, 0.22 >, < 0.11, 0.44, 0.44 >$
$(\mathfrak{m}_2, \mathfrak{f}_2)$	$< 0.5, 0.5, 0.5 >, < 0.12, 0, 0.87 >$	$< 0, 0, 1 >, < 0.12, 0.62, 0.25 >$	$< 0.5, 0.5, 0.5 >, < 0.12, 0.37, 0.5 >$	$< 0.5, 0.5, 0.5 >, < 0.25, 0.25, 0.75 >$	$< 1, 1, 0 >, < 0.5, 0.5, 0.5 >$
$(\mathfrak{m}_3, \mathfrak{f}_3)$	$< 0.25, 0.25, 0.75 >, < 0.11, 0.11, 0.88 >$	$< 0.5, 0.5, 0.5 >, < 0.11, 0.33, 0.55 >$	$< 1, 1, 0 >, < 0.11, 0.33, 0.55 >$	$< 0.25, 0.25, 0.75 >, < 0, 0, 1 >$	$< 0.75, 0.75, 0.25 >, < 0.22, 0.44, 0.33 >$
$(\mathfrak{m}_4, \mathfrak{f}_4)$	$< 0.11, 0.22, 0.66 >, < 0.2, 0.2, 0.8 >$	$< 0.33, 0.33, 0.66 >, < 0.2, 0.2, 0.6 >$	$< 0.22, 0.44, 0.33 >, < 0.4, 0, 0.6 >$	$< 0.22, 0.22, 0.77 >, < 0, 0, 1 >$	$< 0.11, 0.44, 0.44 >, < 0.2, 0.2, 0.6 >$
$(\mathfrak{m}_5, \mathfrak{f}_5)$	$< 0.16, 0.16, 0.83 >, < 0.25, 0.25, 0.75 >$	$< 0.16, 0.16, 0.83 >, < 0.25, 0.25, 0.75 >$	$< 0.16, 0.33, 0.5 >, < 0.25, 0.75, 0 >$	$< 0, 0, 1 >, < 0.25, 0.25, 0.75 >$	$< 0.33, 0.33, 0.33 >, < 0.75, 0.75, 0.25 >$

TABLE 4. Realtion between the male,female individuals and Attributes

	$(\mathfrak{H}_{\mathfrak{m}_1}, \mathfrak{H}_{\mathfrak{f}_1})$	$(\mathfrak{H}_{\mathfrak{m}_2}, \mathfrak{H}_{\mathfrak{f}_2})$	$(\mathfrak{H}_{\mathfrak{m}_3}, \mathfrak{H}_{\mathfrak{f}_3})$	$(\mathfrak{H}_{\mathfrak{m}_4}, \mathfrak{H}_{\mathfrak{f}_4})$	$(\mathfrak{H}_{\mathfrak{m}_5}, \mathfrak{H}_{\mathfrak{f}_5})$
$(\mathfrak{R}_{\mathfrak{m}_1}, \mathfrak{R}_{\mathfrak{f}_1})$	$< 0.25, 0.25, 0.75 >, < 0.25, 0.25, 0.75 >$	$< 0.25, 0.25, 0.75 >, < 0.25, 0.25, 0.75 >$	$< 0.25, 0.5, 0.25 >, < 0, 0, 1 >$	$< 0.25, 0.25, 0.75 >, < 0.5, 0.5, 0.5 >$	$< 0.5, 0.5, 0.5 >, < 0.25, 0.75, 0 >$
$(\mathfrak{R}_{\mathfrak{m}_2}, \mathfrak{R}_{\mathfrak{f}_2})$	$< 0, 0, 1 >, < 0.33, 0.33, 0.66 >$	$< 0, 0, 1 >, < 0.5, 0.5, 0.5 >$	$< 0, 0, 1 >, < 0, 0, 1 >$	$< 0, 0, 1 >, < 0.16, 0.5, 0.33 >$	$< 0, 0, 1 >, < 0.66, 0.66, 0.33 >$
$(\mathfrak{R}_{\mathfrak{m}_3}, \mathfrak{R}_{\mathfrak{f}_3})$	$< 0, 0, 1 >, < 0.25, 0.5, 0.25 >$	$< 0.75, 0.75, 0.25 >, < 0.25, 0, 0.75 >$	$< 0.25, 0.25, 0.75 >, < 0, 0, 1 >$	$< 0.5, 0.5, 0.5 >, < 0.25, 0.25, 0.75 >$	$< 0.75, 0.75, 0.25 >, < 0.5, 0.5, 0.5 >$
$(\mathfrak{R}_{\mathfrak{m}_4}, \mathfrak{R}_{\mathfrak{f}_4})$	$< 0.5, 0.5, 0.5 >, < 0, 0, 1 >$	$< 0.5, 0.5, 0.5 >, < 0, 0, 1 >$	$< 0.5, 0.5, 0.5 >, < 0, 0, 1 >$	$< 0.5, 0.5, 0.5 >, < 0, 0, 1 >$	$< 0.5, 0.5, 0 >, < 0, 0, 1 >$
$(\mathfrak{R}_{\mathfrak{m}_5}, \mathfrak{R}_{\mathfrak{f}_5})$	$< 0.25, 0.25, 0.5 >, < 1, 1, 0 >$	$< 0, 0, 1 >, < 0, 0, 1 >$	$< 0.5, 0.5, 0.5 >, < 0, 0, 1 >$	$< 0.25, 0.25, 0.75 >, < 0, 0, 1 >$	$< 0.75, 0.75, 0.25 >, < 1, 1, 0 >$

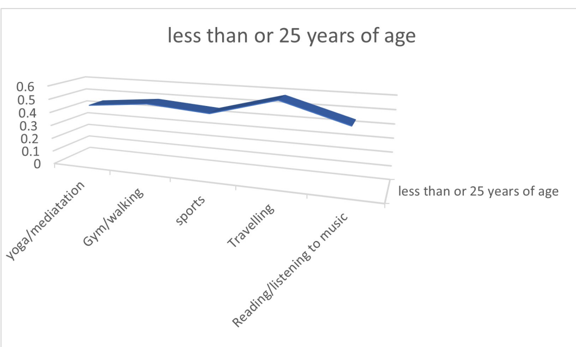
TABLE 5. The relation between the attributes and the alternatives is represented in the form of neutrosophic binary sets

	$(\mathfrak{H}_{\mathfrak{m}_1}, \mathfrak{H}_{\mathfrak{f}_1})$	$(\mathfrak{H}_{\mathfrak{m}_2}, \mathfrak{H}_{\mathfrak{f}_2})$	$(\mathfrak{H}_{\mathfrak{m}_3}, \mathfrak{H}_{\mathfrak{f}_3})$	$(\mathfrak{H}_{\mathfrak{m}_4}, \mathfrak{H}_{\mathfrak{f}_4})$	$(\mathfrak{H}_{\mathfrak{m}_5}, \mathfrak{H}_{\mathfrak{f}_5})$
$(\mathfrak{m}_1, \mathfrak{f}_1)$	0.4429	0.48675	0.45123	0.57821	0.44149
$(\mathfrak{m}_2, \mathfrak{f}_2)$	0.47304	0.4638	0.52207	0.53849	0.55578
$(\mathfrak{m}_3, \mathfrak{f}_3)$	0.41479	0.504125	0.44417	0.49541	0.46420
$(\mathfrak{m}_4, \mathfrak{f}_4)$	0.51916	0.60932	0.57515	0.6248	0.39888
$(\mathfrak{m}_5, \mathfrak{f}_5)$	0.63229	0.40724	0.39026	0.45778	0.4215

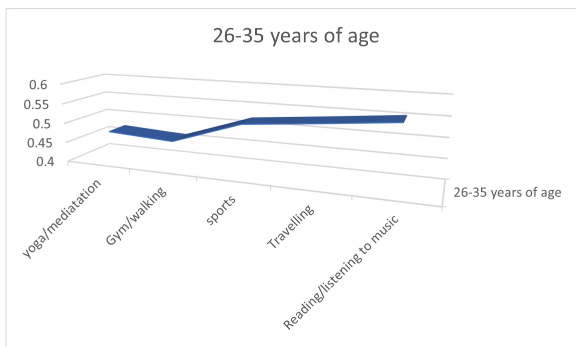
TABLE 6. The computation of Similarity measure between the employees and the investing sectors

Using table1,2,3 table4,5 and 6 is calculated. The highest similarity measure shows the preference of each individuals. From the above table6 it is seen that individuals (both male and female)who belong to age category less than or 25 years of age, 26-35 years of age, 36-45 years of age, 46-55 years of age and above 56 years of age prefer travelling,Reading/ listening to music,gym/walking,travelling and yoga/meditation respectively.

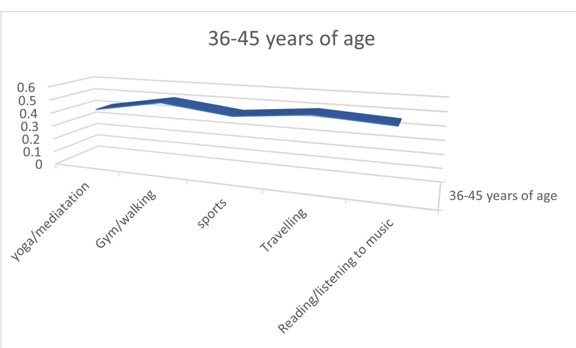
The Graphical representation of this shown in the Figure2



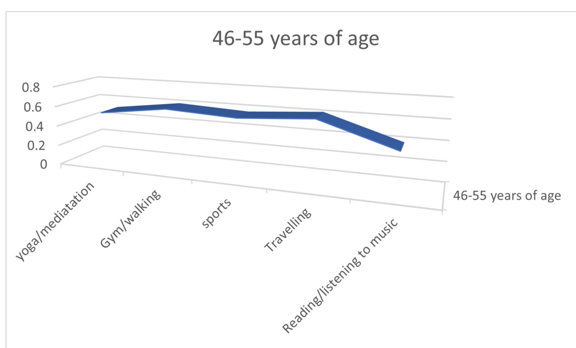
(A) Less than 25 years of age



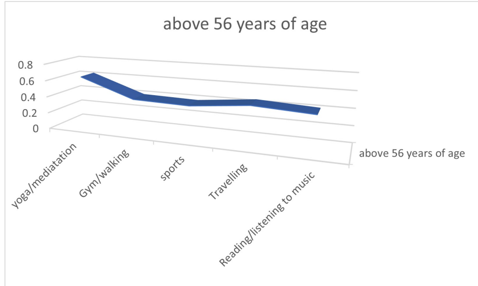
(B) 26-35 years of age



(C) 36-45 years of age



(D) 46-55 years of age



Above 56 years of age

FIGURE 2. Illustration of the Research

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