New Structure of Data Warehouse via Neutrosophic Techniqes

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Abstract. In business scenarios, where some of the data or the business attributes are neutrosophic, it may be useful to construct a warehouse that can support the analysis of neutrosophic data. In this paper, a neutrosophic data warehouse modelling approach is presented to support the neutrosophic analysis of the publishing house for books which allows integration of neutrosophic concept in dimensions and facts without affecting the core of a classical data warehouse. Also we describe a method is presented which includes guidelines that can be used to convert a classical data warehouse into a neutrosophic domain.

Keywords: Date warehouse, Neutrosophic Sets, Neutrosophic Data Warehouse.

1. Introduction

Accurate information about an organization's state is necessary in order to make strategic decisions. Information contains historical data derived from transaction data, but It usually include data from other sources such as relational databases, spreadsheets, mainframes, mail systems or even paper files Each of these data stores tends to serve a subset of the enterprise for decision making. An increasing number of heterogeneous information systems makes retrieving meaningful information more difficult. In order to gather, store and process this information, various information systems are used. The enterprise information system map shows often numerous, heterogeneous and complex information system constellations. Often, for operational use relational database systems are used and for analytical purposes a data warehouse is used.

Bill Inmon [1] is cited very often and seems to be the father of the term Data Warehouse. In fact, Inmon's definition goes back to the first edition of his book "Building The Data Warehouse" from 1993, Wolfgang Lehner [2], a researcher in data warehousing, has recently published a profound and comprehensive book on data warehouse systems in German. He references Bill Inmon, but his book also contains a more elaborate definition of data warehouse systems, In addition to a relational database, a data warehouse environment includes an Extraction, Transformation, and Loading (ETL) solution, an Online Analytical Processing (OLAP) engine, client analysis tools, and other applications that manage the process of gathering data and delivering it to business users. This analytical view on data finally enables the enterprise to have a more global sight on its business environment than operational systems can provide. Therefore, data warehouses are often used as systems for decision making [3].

Besides positive aspects of centralized processing of business information such as decision making support, difficulties occur in maintaining and analyzing data warehouses. The amount of data that has to be processed in a data warehouse increases every day and turns into challenging tasks for administration and analysis. Next to the problem of high quantity, data from operational systems are often incomplete, vague or uncertain. This quality issue cannot be completely eliminated in the preprocessing stage of the data. Consequently, a certain amount of vagueness directly impacts the analysis and decision making that is based on the information of a data warehouse [4]. In Many complicated problems like, engineering problems, social,

economic, computer science, medical science…etc, the data associated are not necessarily crisp, precise, and deterministic because of their vague nature. Most of these problem were solved by different theories. One of these theories was the fuzzy set theory discovered by Lotfi Zadeh in 1965 [5] to handle vagueness , uncertainty and imprecision ,In fuzzy logics the two-point set of classical truth values {0, 1} is replaced by the real unit interval [0, 1] each real value in [0, 1] is intended to represent a different degree of truth, ranging from 0, corresponding to false in classical logic, to 1, corresponding to true. . A fuzzy set A in M can be represented as an ordered set of tuples {(m , (m))}.

But for some applications it is not enough to satisfy to consider only the membership-function supported by the evident but also have to consider the non-membership-function against by the evident Atanassov [6] introduced another type of fuzzy sets that is called Intuitionistic Fuzzy Set (IFS) which is more practical in real life situations. Given a sentence G whose truth degree is P(G) = t $\in$ [0, 1], in fuzzy logic it is implicitly assumed that it also has a falsity degree given by 1 − t. This need not hold in general in intuitionistic fuzzy logic, a generalization of fuzzy logic introduced by Atanassov assume The falsity degree of each sentence is now explicitly represented by a second real value f $\in$ [0, 1] , An Intuitionistic Fuzzy Set (IFS) A in is defined as $A = \{\langle m, \mu_A(m), \vartheta_A(m)\rangle : m \in$,where the functions $\mu_A : M \longrightarrow [0$ define the degree of membership and $\vartheta_A : M \longrightarrow [0$ the degree of non-membership of the element $m \in$ respectively, and for every m $\in M$ in A $0 \leq \mu_A(m) + \vartheta_A(m) \leq$.

The main novelty of Atanassov's approach is that since one may have t + f < 1, a certain amount indeterminacy or incomplete information is allowed. The main novelty of neutrosophic logic, as we shall see, is that we do not even assume that the incompleteness or "indeterminacy degree" is always given by 1 − (t + f).

Smarandache and A.A.Salama [7,8] introduced another concept of imprecise data called neutrosophic sets. Neutrsophic set is a powerful general formal framework that has been recently proposed. Let N be a set defined as follows: N = {(T, I, F) : T, I, F $\subseteq$ [0, 1]}. where (T) the Truth degree, (F) the falsehood degree and (I) the indeterminacy degree, I $\subseteq$ [0, 1] may represent not only indeterminacy but also vagueness, uncertainty, imprecision, error etc. Note also that T, I, F, called the neutrosophic components [9].Several researchers dealing with the concept of neutrosophic set such as M. Bhowmik and M.Pal in [10], A.A.Salama in [11,12,13,14,15].

In this papers we aim to construct a data warehouse using the concept of the neutrosophic. The key benefit of integrating neutrosophic logic in data warehouse it allows analysis of data in both classical and neutrosophic manners. The use of the proposed approach is demonstrated through a case study of a published housing for books.

2. Data Warehouse Concept

A data warehouse is a database, which is kept separate from the organization's operational database. There is no frequent updating done in a data warehouse, It possesses consolidated historical data, which helps the organization to analyze ,organize, understand, and use their data to take strategic decisions. This analytical view on data finally enables the enterprise to have a more global sight on its business environment than operational systems can provide. Therefore, data warehouses are often used as systems for decision making . The term "Data Warehouse" was first coined by Bill Inmon. he describe the data warehouse as "subject-oriented, integrated, nonvolatile, and time-variant collection of data in support of management's decision support. the components of his definition in the following way:

2.1. Subject-Oriented: Subject-Oriented means that the main objective of data warehouse is to facilitate decision process of a data company, and within any company data naturally concentrates around subject areas, so information gathering in warehouse is aiming for a specific subject rather than for the functions of a company.

2.2. Integrated: Being integrated means that the data is collected within the data warehouse, that can come from different tables, databases or even servers, but can be combined into one unit that is relevant and logical for convenience of making strategic decision.

2.3. Non-volatile: Non-volatile means the previous data is not erased when new data is added to it. A data warehouse is kept separate from the operational database and therefore frequent changes in operational database is not reflected in the data warehouse.

2.4. Time-variant: The content of the data warehouse grows over time, where on regular basis snapshot of current data is entered into the data pool. The key structure of the data warehouse always contains time.

3. linguistic variables

Linguistic variables are collect elements into similar groups where we can deal with less precisely and hence we

can handle more complex systems. it's is an important concept in fuzzy logic and plays a key role in its applications, especially in the fuzzy expert system Linguistic variable is a variable whose values are words in a natural language , For example, “speed” is a linguistic variable, which can take the values as “slow”, “fast”, “very fast” and so on. Zadeh developed on top of the fuzzy set theory a means for mathematically representing natural language [16]. Therefore, he defined a linguistic variable values [17,18,19] . The values of the linguistic variable called linguistic terms, are projected on a universe of discourse. Fuzzy sets are used to define the degree of membership with which a value might belong to a linguistic term. Zadeh defines a linguistic variable as follows:

3.1. Definition (Linguistic variable [20]). A linguistic variable is a quintuple (X; T(X); G;M; F) defined as follows:

X is the name of the linguistic variable

T(X) is the set linguistic terms of X

G represents a syntactic rule that generates the set of linguistic terms

M is the universe of discourse

F is a semantic rule that defines for each linguistic term its meaning in the sense

of a fuzzy subset on U

4. Concept of Neutrosophic Sets

Smarandache and A.A.Salama [11,12] introduced another concept of imprecise data called neutrosophic sets. Neutrosophic set is a part of neutrosophy is new branch of philosophy that studies the origin, nature, and scope of neutralities. The main idea of Neutrosophic Sets is to characterize each logical statement in a 3D Neutrosophic Space, where each dimension of the space represents respectively the truth (T), the falsehood (F), and the indeterminacy (I) of the statement. Neutrosophic Logic (NL) is a generalization of Zadeh’s fuzzy logic (FL), and especially of Atanassov’s intuitionistic fuzzy logic (IFL), and of other logics For example, suppose there are 10 voters during a voting process In time t1, five vote \yes", three vote \no" and two are undecided, using neutrosophic notation, it can be expressed as (0.5, 0.2, 0.3) In time t2, four vote \yes", two vote \no", and three are undecided, it then can be expressed as (0.4 0.3, 0.2). the notion of neutrosophic set is more general and overcomes the aforementioned issues. In neutrosophic set, indeterminacy is quantified explicitly and truth-membership, indeterminacy- membership and falsity-membership are independent. This assumption is very important in many applications such as information fusion in which we try to combine the data from different sensors .

4.1. Definition [21,22]

A neutrosophic set A on the universe of discourse X is defined as:

$A = \langle T_A, I_A, F_A \rangle$, where $T_A, I_A, F_A : X \rightarrow [0,$ define respectively the degree of membership, the degree of indeterminacy, and the degree of non-membership of the element x∈ X to the set A with the condition $0^- \leq T_{A(x)} + I_{A(x)} + F_{A(x)} \leq .$

From philosophical point of view, the neutrosophic set takes the value from real standard or non-standard subsets of]−0,1+[. So instead of]−0,1+[we need to take the interval [0,1] for technical applications, because]−0,1+[will be difficult to apply in the real applications such as in scientific and engineering problems.

For software engineering proposals the classical unit interval [0, 1] is used.

For single valued neutrosophic logic, the sum of the components is:

case (1) $0 \leq$ t+i+f ≤ 3 when all three components are independent;

case (2) $0 \leq$ t+i+f ≤ 2 when two components are dependent, while the third one is independent from them.

case (3) $0 \leq$ t+i+f ≤ 1 when all three components are dependent.

5. Case Study

The case study discusses a The Publishing house for books , It currently offers a collection of books for purchase, Each customer is asked to rate the book when he read it, When the publishing house makes statistical survey To measure the performance of their business such that Publishing house for books analyzes the revenue of the books based on the age of the customers or stores or measure the performance based on rating of customers it is found that the proportion of persons did not give a specific answer (undecided). Their answer is not belong to a certain class or not notbeloning to this category, This percentage

has not been taken into account for it found that there is ambiguity in the data became unclear ,for example the book "Scientific Miracles in the Holy Quran " some of people classify this book to scientific category and some of people classify it to religious category and others not decided(not sure) if this book belong to scientific category or religious category. so they didn't give a specific answer. now we have three answers membership,Non Membership and Indeterminacy. Neutrosophic Sets to solve this ambiguity in the data and taking the opinion of indeterminacy into account and gave them the degree.

for example: theNeutrosophic set " scientific books " might contain the following tuples:" scientific books " = {" Scientific Miracles in the Holy Quran " , < 0.7,0.1,0.2 >}< 0.7,0.1,0.2,> which 0.7 is represented the membership degree of this book to scientific books genre, 0.2 is represented the non membership degree of this book to scientific books genre and 0.1 is represented the indeterminacy degree of this book to scientific books genre. so we must integration Neutrosophic concept to data warehouse.

6. Neutrosophic Data Warehouse

In order to create a neurosophic data warehouse, a method is presented that can guide the transformation of a classical data warehouse into a neutrosophic data warehouse. The input to the method is a classical data warehouse and the output is a neutrosophic data warehouse. This approach is allows integrating neutrosophic concepts without the need for redesigning the core of a data warehouse. By using this neutrosophic data warehousing approach, it is possible to extract and analyze the data simultaneously in a classical manner and in a neutrosophic manner.

For example, books might be classified into different genres. In the classical data warehouse, a book always belongs or not belong fully to one or more genres The numbers of the interval [0, 1] where 1 implies full belonging and 0 implies no belonging at all. In reality, books can often be categorized into several genres while belonging or not belonging more to one genre than to another with different degrees. A book " can be a scientific book, a religious book, a political book, a social book or a Literary book and so on. In this classification it belonging at the same time to one or more genre but with different degrees and it not belonging with different degrees ,and also has indeterminacy degree. In order to truly represent this ambiguity in classification the neutrosophic set theory can be applied Therefore, the Publishing house classifies the books with a neutrosophic concept. The following figure show convert classical data warehouse into neutroosophic data warehouse:

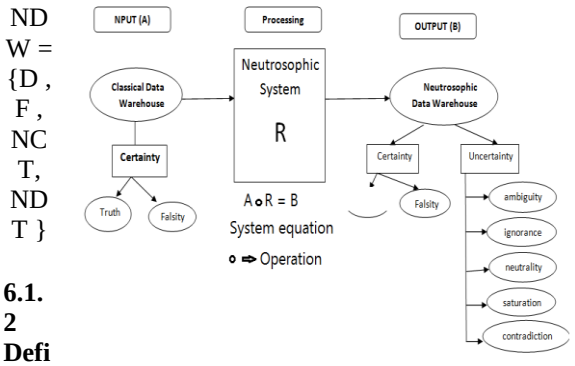


Figure 1: convert classical data warehouse into Neutrosophic Data warehouse

6.1. Basic Definitions of Neutrosophic Data Warehouse

In this section we introduce and study the following definitions of Neutrosophic Data Warehouse.

6.1.1 Definition (Neutrosophic Data Warehouse (NDW)).

A neutrosophic data warehouse model is a set of combination of four types of tables .these are (Dimension tables (D), Fact tables (F), Neutrosophic Classification Tables (NCT) and Neutrosophic Degree Tables (NDT)) and it is represented by NDW.

6.1.2 Definition (Neutrosophic Table (NT)).

Neutrosophic Table is the table which contain a neutrosophic target element and the table may be dimension table or Fact table.

6.1.3 Definition (Neutrosophic Target Element (NTE)).

Neutrosophic Target Element (NTE) is the elemet may be in in a Fact table or a dimension table which required to be classified in neutrosophic.

6.1.4 Definition (Class Neutrosophic Target Element (CNTE)).

A class neutrosophic Target element (CNTE) for a neutrosophic Target element (NTE), it's all possible values (linguistic terms) for a neutrosophic Target element.

6.1.5 Definition (Neutrosophic Degree (ND)).

All values for neutrosophic Target element belong to a certain neutrosophic degree to a class neutrosophic which neutrosophic Target element belong . The degree of belonging to a value to class neutrosophic is called neutrophic degree.

6.1.6 Definition (Neutrosophic Function (NF)).

A neutrosophic function of a class neutrosophic target element is used to calculate the neutrosophic degree of a neutrosophic target element to a class neutrosophic target element. it is represented by . = < μ_{Δ} , σ_{A} , > where is the membership degree of element to a set A , is the non membership degree of element to a set A and is the degree of indetemenancy element to a set A.

6.1.7 Definition (Neutrosophic Classification Table(NCT)).

A table that holds linguistic terms (neutrosophic classes and it consists of two attribute (a primary key of the table and a class neutrosophic target element which can be classified neutrosophic),

NCT ={PK , CNTE}

6.1.8 Definition (Neutrosophic Degree Table (NDT)).

A table that stores the degree of each linguistic term is called neutrosophic degree table,it has contain four attributes: (the primary key of the table, the foreign key of neutrosophic table which contain neutrosophic target, the foreign key of neutrosophic classification table and neutrosophic degree of each linguistic terms for linguistic variable (neutrosophic target)).

NDT= {PK , FK_NT , FK_NCT , FK_NDT }

6.2. Neutrosophic Date Warehouse Model

In addition to the classical analysis in a data warehouse, The Publishing house for books needs some features that are available using neutrosophic concepts. For integrating neutrosophic concepts into a data warehouse, one must first analyze which elements in the data warehouse should be classified neutrosophic. The element may be an element in the fact table or an element in a dimension table. An element that has to be classified neutrosophic is called the neutrosophic target element(NTE). the steps are the follow:

1) first step : identify what should be classified to identify the neutrosophic target element.

2) Second step : identify the set of linguistics terms that are used for classifying the neutrosophic target element. Repeat this step for all neutrosophic target elements.

3) Third step : define a neutrosophic function (represented by) for each linguistic term. Repeat this step for each linguistic term.

4) forth step : create Neutrosophic classification table which holds classes of neutrosophic target element (linguistic terms) and it contain two attribute one is the primary key of the table and second is the class neutrosophic target element.

5) fifth step : create Neutrosophic degree table which holds neutrosophic degrees fo each linguistic term and it contain four attribute which the first attribute is the primary key of the table, the second attribute is the foriegn key of the neutrosophic table, the third attribute is the foreign key of Neutrosophic classification table and the fourth attribute is the neutrosophic degree (ND) attribute for the neutrosophic target element ,The values of neutrosophic degree attribute are calculated by neutrosophic functions (represented by .< , , > where is the membership degree of element to a set A , is the non membership degree of element to a set A and is the degree of indetemenancy element to a set A.

6) sixth step : Relate neutrosophic table with neutrosophic classification table and neutrosophic degree table with each other.

The followind figure represented Neutrosophic Date Warehouse Model :

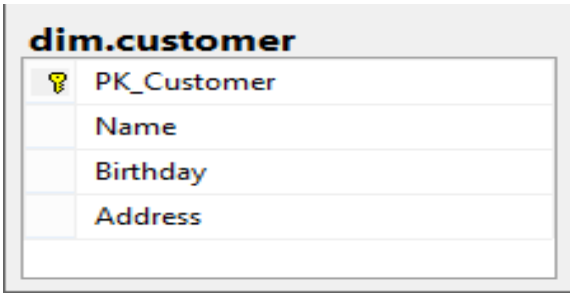
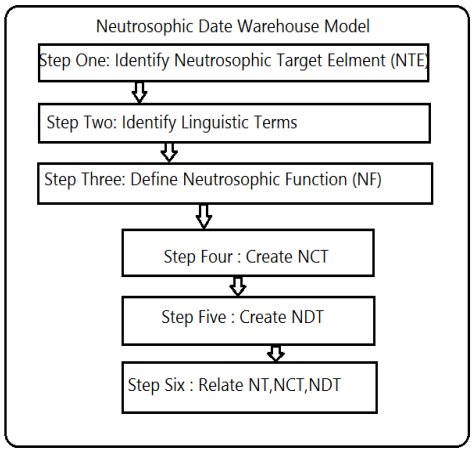


Figure 2: Neutrosophic Data Warehouse Model

6.2.1 Dimension Book

The books are classified into different genres. In the classical data warehouse, a book always belongs to interval [0,1] where 1 is implies to belonging degree of the book fully to one or more genres and 0 is implies to not belonging degree of the book to one or more genres. In reality, books can often be categorized into several genres while (belonging, idetermenacy, not belonging) more to one genre than to another at the same time. For Example, the book "Scientific Miracles in the Holy Quran" can be classified scientific and Religious, but more strongly scientific (membership) ,and can be classified not belonging to one or more genres by different degrees (non membership) and also the book have the indeterminacy degree. With the classification in the classical data warehouse approach, the lished house cannot classify the books into different genres. There fore, the published house classifies the books with a neutrosophic concept



- first the book genre is defined as neutrosophic target element.

- The second step is to identify the linguistic terms. In this case, the linguistic terms are the different genres to which the books belong. These genres can be extracted from the dimension category in the book dimension.

- In the third task is to identify the neutrosophic functions for each genre has to be defined

After identifying neutrosopic target element, linguistic terms and their neutrosophic functions,

- forth step is to create neutrosophic classification table holds the genres as class neutrosophic element.

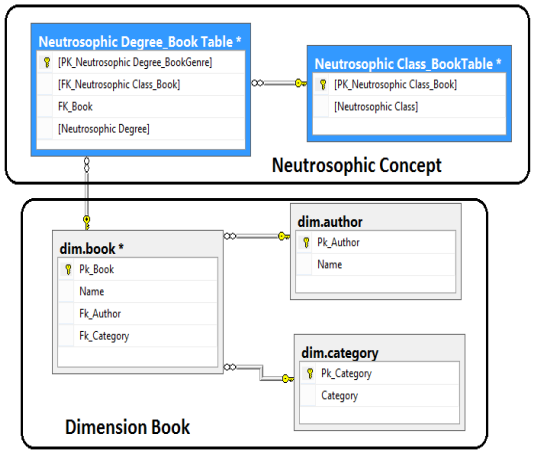
- fifth step is to create neutrosophic degree table contains neutrosophic degrees for each neutrosophic target element corresponding to class neutrosophic elements.

-finally,sixth step is to relate the neutrosophic classification table, the neutrosophic degree table and the neutrosophic table to each other. The following Figure show neutrosophic concept in book dimension :

Figure 3: Neutrosophic Concept BooK Genre

The following figure show result sets of apply neutrosophic concept in book dimension

Figure 4: Result Set of Apply Neutrosophic Concept Book



Genre

6.2.2 Dimension Customers

A data warehouse contains the dimension customer ,Each customer has the attributes name, address and birthday. From the attribute birthday, the age of the customer can be calculated using the function today birthday.

Book ID	Name	Neutrosophic Class	Membership Degree
1	Scientific Miracles in the Holy Quran	scientific	< 0.6, 0.1, 0.3>
1	Scientific Miracles in the Holy Quran	religious	< 0.5, 0.2, 03 >
2	Political Islam and the coming battle	political	< 0.7, 0.1, 0.2 >
2	Political Islam and the coming battle	religious	< 0.6, 0.1, 0.3 >
3	perhaps you laugh	social	< 0.4, 0.3, 0.3 >
3	perhaps you laugh	Comic	< 0.6, 0.2, 0.2 >
5	Soft hands	romantic	< 0.7, 0, 0.3>
5	Soft hands	Comic	< 0.3, 0.2, 0.5 >
6	Astronomical calculations and scientific applications in the service of Islamic law	scientific	<0.7, 0.1, 0.1 >
6	Astronomical calculations and scientific applications in the service of Islamic law	Fiction	<0.4, 0.1, 0.5 >

Figure 5: Dimension Customer

The published housing is interested in analyzing the revenue based on customers ages Therefore, the publishing house classifies the customers ages with a neutrosophic concept in the following steps:

- the first step "The neutrosophic target element is the customer age.

- The second step is to identify the linguistic terms for customer age . In this case, the linguistic terms for linguistic variable (customer age) are (old , middle , young)

whrer old :customers more than 60

Middle :customers between 20 and 60

Young :customers less than 20

- the third step is to identify the neutrosophic functions for each linguistic term.

the publishing house defines the neutrosophic function that transform the age of customer into neutrosophic degrees by calculating neutrosophic function which represented by $\mathcal{N}_A$ < μ_A, σ_A>

where is the membership degree (belonging degree)

and is the indeterminacy degree

and is the non membership degree(not belonging)

the membership function depends on the customer age is the following

For example, if the customer age is 26 years old, it is transformed to term Young $\mathcal{N}_{yo}$(26) = <0.4,0.3 ,0.3> and term Middle $\mathcal{N}_{mid}$ (26) = <0.6,0.2 ,0.2> and term Old $\mathcal{N}$ (26) = <0, 0.1, 0.9 >

- membership degree of age 26 years old to

linguistic term young as fellow μ_{yo}(26) = 0.4

and linguistic term Middle μ_{mid}((26) = 0.6

and linguistic term Old (26) = 0.0

- Non membership degree of age 26 years old to

linguistic term young as fellow ϑ_{yo}(26) = 0.3

and linguistic term Middle ϑ_{mi}(26) = 0.2

and linguistic term Old (26) = 0.9

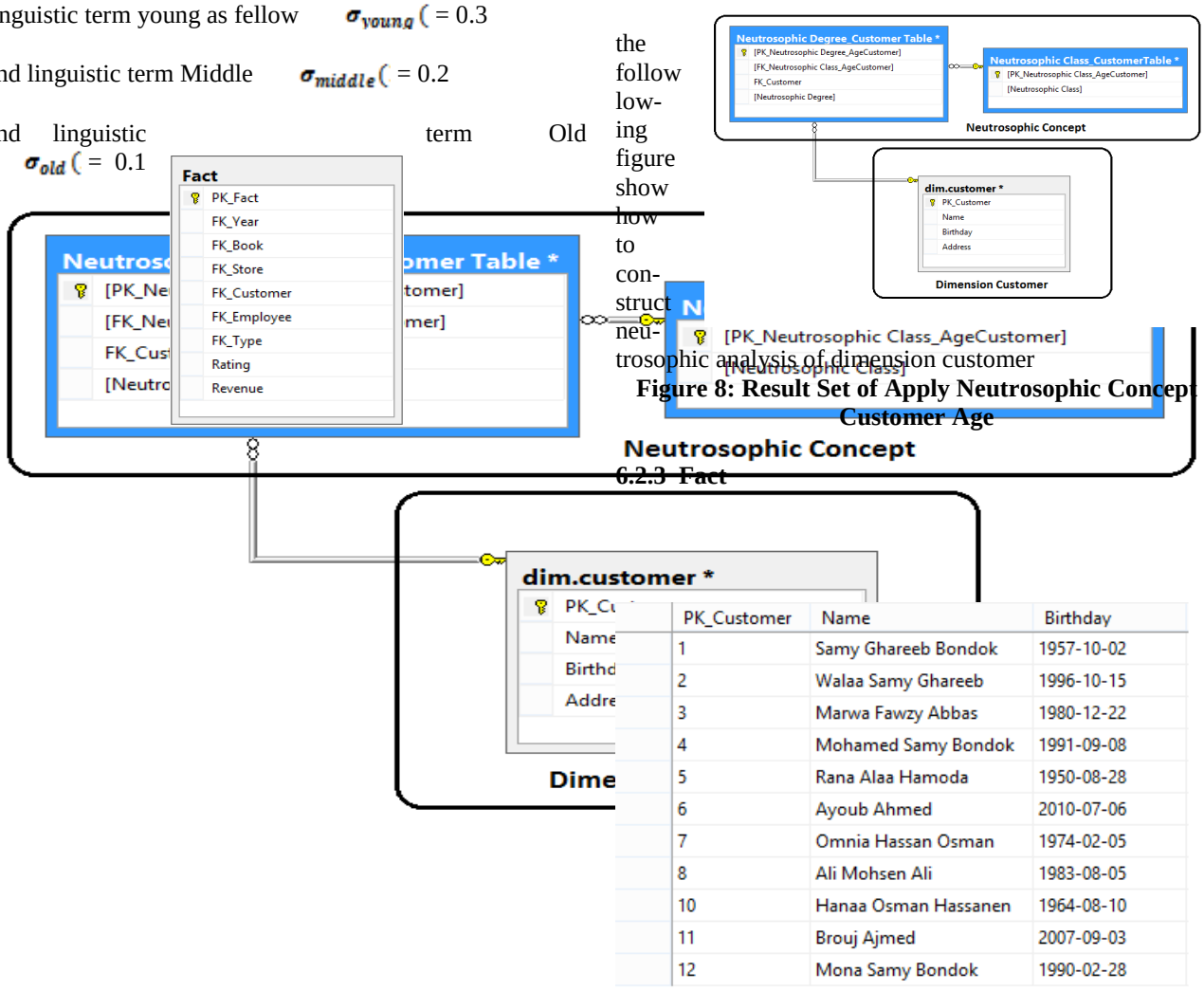
- indeterminacy degree of age 26 years old to

linguistic term young as fellow σ_{young} (= 0.3

and linguistic term Middle σ_{middle} (= 0.2

and linguistic term Old σ_{old} (= 0.1

the follow low-ing figure show how to con-struct neu-trosophic analysis of dimension customer



PK_Customer	Name	Birthday
1	Samy Ghareeb Bondok	1957-10-02
2	Walaa Samy Ghareeb	1996-10-15
3	Marwa Fawzy Abbas	1980-12-22
4	Mohamed Samy Bondok	1991-09-08
5	Rana Alaa Hamoda	1950-08-28
6	Ayoub Ahmed	2010-07-06
7	Omnia Hassan Osman	1974-02-05
8	Ali Mohsen Ali	1983-08-05
10	Hanaa Osman Hassanen	1964-08-10
11	Brouj Ajmed	2007-09-03
12	Mona Samy Bondok	1990-02-28

Figure 8: Result Set of Apply Neutrosophic Concept Customer Age

6.2.3 Fact

Figure 6: Neutrosophic Concept Customer age

the following figure show the input data in customer di-mension in classical data warehouse

Customer ID	Customer Name	Age	Class"Old"	Class"Middle"	Class"Young"
1	Samy Ghareeb Bondok	59	< 0.9 , 0.1 , 0>	< 0.1 , 0.2 , 0.7>	< 0 , 0.3 , 0.7>
2	Walaa Samy Bondok	20	< 0.0 , 0.1 , 0.9>	< 0 , 0.2 , 0.8>	< 1 , 0 , 0>
3	Marwa Fawzy Abbas	36	< 0 , 0.5 , 0.5>	< 1 , 0 , 0>	< 0 , 0.3 , 0.7>
4	Mohamed Samy Bondok	25	< 0 , 0.1 , 0.9>	< 0.5 , 0.2 , 0.3>	< 0.5 , 0.3 , 0.2>
5	Rana Alaa Hamoda	66	< 1 , 0 , 0>	< 0 , 0.2 , 0.8>	< 0 , 0.1 , 0.9>
6	Ayoub Ahmed	6	< 0 , 0.1 , 0.9>	< 0 , 0.2 , 0.9>	< 1 , 0 , 0>
7	Omnia Hassan Osman	42	< 0 , 0.5 , 0.5>	< 1 , 0 , 0 >	< 0 , 0.3 , 0.7>
8	Ali Mohsen Ali	33	< 0 , 0.5 , 0.5>	< 1 , 0 , 0 >	< 0 , 0.3 , 0.7>
9	Brouj Ahmed	9	< 0 , 0.1 , 0.9>	< 0 , 0.2 , 0.8>	< 1 , 0 , 0>

Figure 7: Input Date in Classical Data Warehouse in Di-mension Customer

Figure 9: Fact Table

Customers are asked to rate every book when they read it. The rating of the book in the fact table As the rating is always between 0 and 10. The published housing for books uses this customer rating to evaluate the books into good, bad books. For this neutrosophic concept,the steps are the following:

the first step "The neutrosophic target element is the rating attribute in the fact table.

The second step is to identify the linguistic terms. In this case, the linguistic terms for customer rating are (good , bad) rate .

In the third task is to identify the neutrosophic functions for each linguistic term.

the publishing house defines the neutrosophic function as follows:

For example, if a customer rate a certain book 6 from 10 transformed to term good $\mathcal{N}_a$ = < 0.6 , 0.1 , 0.3 > and term bad $\mathcal{N}$ = < 0.4 , 0.2 , 0.4 > and

Membership degree of rate (6) to

linguistic term good as fellow $\mu_a(26) = 0.6$

and linguistic term bad $\mu(26) = 0.4$

Non membership degree of rate (6) to

linguistic term good as fellow $\vartheta_a(6) = 0.1$

and linguistic term bad $\vartheta(6) = 0.2$

indeterminacy degree of rate (6) to

linguistic term good as fellow $\sigma_{good} = 0.3$

and linguistic term bad $\sigma_{bad} = 0.4$

After identifying neutrosophic target element, linguistic terms and their neutrosophic functions,

one neutrosophic classification table which holds the linguistic terms as class neutrosophic target element (good , bad) is created then The neutrosophic degree table contains neutrosophic degrees for each neutrosophic target element corresponding to class neutrosophic elements. For final step, the neutrosophic classification table, the neutrosophic degree table and the neutrosophic table have to be related to each other. The following figure show how to apply neutrosophic concept in fact table:

Figure 10: Neutrosophic Concept Fact Rating

The following figure show input data in fact table in classical data warehouse

Figure 11: Input Data In Classical Data Warehouse in Fact Table

the following figure show result set of apply neutrosophic concept in Fact table:

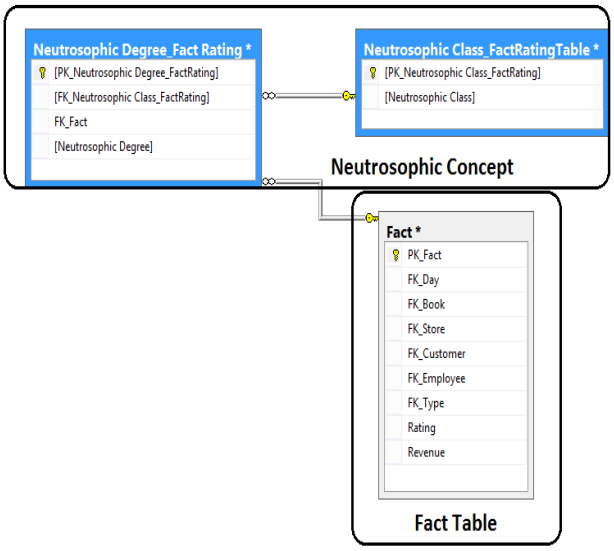


Figure 12: Result Set of Apply Neutrosophic Concept in Fact Rating

	Book ID	Book Name	Category	Rating
	1	Scientific Miracles in the Holy Quran	scientific	9.00
	2	Political Islam and the coming battle	political	7.00
	3	perhaps you laugh	Comic	5.00
	4	Genius Omar	religious	8.00
	5	Soft hands	romantic	2.00
▶	6	Astronomical calculations and scientific applications in the service of Islamic law	scientific	3.00

7. Conclusion

Using a neutrosophic approach in data warehouse concepts improves information quality for the business process. this approach include neutrosophic concept into structure of dimensions or into fact tables of the data warehouse model,then we construct truth degree,falsity degree and indeterminacy degree which close to natural language.

Book ID	Book Name	Rating	Class"Good"	Class"Bad"
1	Scientific Miracles in the Holy Quran	9	⟨1,0,0⟩	⟨0,0.1,0.9⟩
2	Political Islam and the coming battle	7	⟨0.8,0.1,0.1⟩	⟨0.2,0.2,0.8⟩
3	perhaps you laugh	5	⟨0.4,0.1,0.5⟩	⟨0.6,0.2,0.2⟩
5	Soft hands	2	⟨0,0.1,0.9⟩	⟨1,0,0⟩
6	Astronomical calculations and scientific applications in the service of Islamic law	3	⟨0,0.1,0.9⟩	⟨1,0,0⟩

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