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Data Cube Representation for patient Diagnosis System Using Fuzzy Object-Oriented Database

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ABSTRACT

In the current scenario, everyone wants to store and fetch the information in an easy and faster way. Therefore, the data cube is one of the leading tools in these days that facilitate the user to store and retrieve the decision support information in a faster manner with ease. In this paper the patient diagnostic system (PDS) is proposed for the patient who is suffered from the several types of fever and modeling of fuzzy object-oriented database. An attempt is made to design a three dimensional data cube for the fuzzy object-oriented database for storing the vague or imprecise information in it. A class, sequence and activity diagrams are also designed for the graphical representation of the proposed work through the well known modeling language i.e. Unified Modeling Language (UML).

Keywords: UML, Activity Diagram, Class Diagram, Fuzzy Object-Oriented Database, Data Cube.

1 Introduction

Modeling is one of the tools to understand the process and flow of input and output of any system. Therefore, the Object Management Group (OMG) has released a well known modeling language i.e. Unified Modeling Language (UML) for designing the huge and complex problems. The word fuzzy defines the vague values or non crisp information; it deals with uncertainty in the information or values which are produced by the human. There are several researchers who produced the data cube for retrieving the desired information within a fraction of time. Let us first describe the previous research done. Saxena et al. [1] have proposed a UML model for the patient registration system and designed a three dimensional data cube for faster searching & storing of patient registration database. Dev and Mishra [2] have presented a decision support in banking sector which link up the strengths of both OLAP and Data Mining for improving the efficiency and to check the emergence & Creation of innovative ways in this field. The DAWA algorithm, standing for a hybrid algorithm of Dct for Data and discrete WAvelet transform, is proposed by Hsieh et al [3] to approximate the cube streams. Li et al. [4] have introduced two techniques called addset data structure and sliding window to deal with this problem. Malvestuto [5] has introduced: (1) a merge operator combining the contents of a primary data cube with the contents of a proxy data cube, (2) merge expressions for general combination schemes, and (3) an equivalence relation between merge expressions having the same pattern. Doka et al. [6] have presented the Brown Dwarf, a distributed system designed to efficiently store, query and update multidimensional data over an unstructured Peer-to-Peer overlay, without the use of any proprietary tool. Morfonios et al. [7] have focused on Relational-

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OLAP (ROLAP), following the majority of the efforts so far. We review existing ROLAP methods that implement the data cube and identify six orthogonal parameters/dimensions that characterize them. Zhao et al. [8] have introduced Graph Cube, a new data warehousing model that supports OLAP queries effectively on large multidimensional networks. Chen et al. [9] have showed that OLAP techniques can be performed within a modern DBMS without external servers or the exporting of datasets, using standard SQL queries and UDFs. Roy and Susiu [10] have introduced a principled approach to provide explanations for answers to SQL queries based on intervention: removal of tuples from the databases that significantly affect the query answers. Nandi et al. [11] have detailed real-world challenges in cube materialization and mining tasks on Web-scale datasets. Pacifically identify an important subset of holistic measures and introduce MR-Cube, a MapReduce based framework for efficient cube computation and identification of interesting cube groups on holistic measures. Hung et al. [12] have proposed approximate Greedy algorithms GR, 2GM and 2GMM, which are shown to be both effective and efficient by experiments done on a census data set and a forest-cover-type data set.

2 Experimental Study

2.1 Activity Diagram

A UML activity diagram is designed to represent the process of hospital-based patient diagnostic system step by step which is shown in the fig 1. The diagram depicts that the patient arrived at the hospital's OPD section and filled the registration form after fulfilling the registration eligibility like the patient referred by the doctor, the concerned department and concerned specialist doctor is available otherwise the patient is not registered. The patient treatment file is created and an identity card is issued to the patient for all the further treatments. The patient file is send to the Master of Social Work (MSW) section where the social worker screens the patient file and primarily diagnose the patient and social worker send the primary diagnostic report to the specialist doctor where the doctor diagnoses the patient in details and prescribed the patient to admit in the department which is depending on the condition on the patient. If the doctor recommended the patient to admit in the ward, then the patient is admitted into the concerned word with an allotment of bed and the detailed treatment of the patient is started. If the patient is not recommended by the doctor for admission into the ward the patient take the doctor's prescription and purchase the medicine from the pharmacy and take it as prescribed. After getting well the patient go home from the hospital and the activity diagram is terminated.

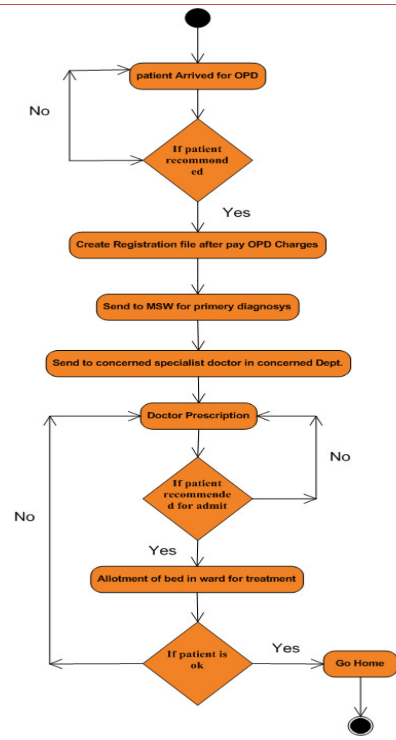

Figure 1. Activity Diagram for Patient Diagnostic System.

2.2 UML Class Diagram

A Complete process of patient diagnostic system is explained in detail through UML class diagram. There are several major classes like Patient, Registration_Desk, Doctor, Departments, Ward and Patient_Discharge represented in the figure 2. The class Patient has single associations with the Registration_Desk and multiple associations with Doctor and Patient_Discharge while the Registration_Desk has multiple associations with the Department class. The Patient_Admit and Patient_Discharge classes have multiple associations with Doctor, Ward and indirectly associated with patient via Doctor Class. The class Ward is further generalizing in Private_Ward and General_Ward.

Therefore, the UML class diagram depicts the complete process of patient diagnostic system in which the patient has arrived at the registration section where the concerned person checks the eligibility (like patient referred by the other doctor, concerned department and doctor is available etc.) of patient for registration. If eligible then the concerned person registers the patient and creates a patient registration file and issued a registration card also. As the patient has registered the MSW sends the patient to the concerned department after primary diagnosis. The patient is detailed diagnosed by the concerned doctor and the patient is admitted in to the ward if the doctor recommended otherwise the doctor prescribed some medicine to the patient and patient go home. The patient who is admitted into the wards goes home after the doctor declared fit.

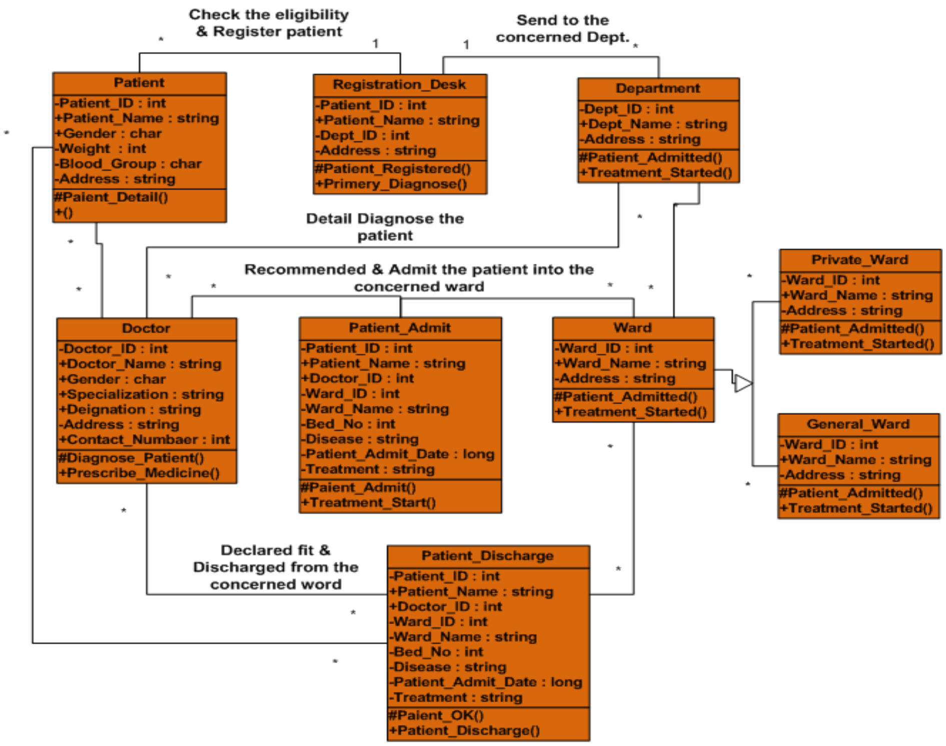

Figure 2. UML Class Diagram for Patient Diagnostic System.

2.3 Fuzzy Object-Oriented Database

Unclear and inconsistent information is handled by the most promising database i.e. the fuzzy database. An extension of the fuzzy database is fuzzy object-oriented database (FOOD) that also deals with the vague or imprecise information as well as it supported the object-oriented programming concepts for storing and interrogating the vague information and turned this vague information into crisp one. Therefore, a fuzzy object-oriented database is designed for the patient diagnostic system (PDS) of **"dengue fever"** with its range value and is represented in the Table 2. Some fuzzy queries are performed, for that the fuzzy query approach is based on the fuzzy logic.

Table 1. Sample Fuzzy Object-Oriented Database for Patient Diagnostic System (PDS).

	P_ID	Name	Gender	Age	Weight	Blood Group	Disease
1	1004	MASTER JAINUL	Male	23	60	A	Dangue
2	1006	BABY RADHA	Male	12	15	O+ve	Dangue
3	1007	MR. JITIN WADHWANI	Male	69	55	AB	Dangue
4	1008	MRS. KIRAN	Female	25	45	AB+	Dangue
5	1011	MRS. NIRMALA	Female	35	46	AB+	Dangue
6	1012	MISS. SHAHEEN BANO	Female	25	45	B+	Dangue
7	1014	MR. RAMESH	Male	37	66	O+	Dangue
8	1016	MR. RAM SWAROOP	Male	30	63	AB+	Dangue
9	1017	MRS. PYARA	Female	17	36	O+	Dangue
10	1018	MR. TULAI GAUTAM	Male	18	38	B+	Dangue
11	1019	MRS. SHAYRA	Female	12	20	AB+	Dangue

2.4 Designing of Data Cube

One of the major tools for decision support system is data cube that represent the desired information or data along with some desired measures. The data cube has some attributes on its each dimension from the database and each cell represents the desired measure values. Many users want to retrieve the desired information they perform several kinds of queries on the data cube and retrieve decision support information.

Let us consider the UML activity diagram to design the three dimensional data cube for the patient diagnostic system (PDS) which contains the three major attributes are considered i.e. Patient_Name lying on (x-axis), Disease lying on (y-axis) and Range_Value (fuzzy value) lying on (z-axis). The axis representation of attributes is shown in the figure 3.

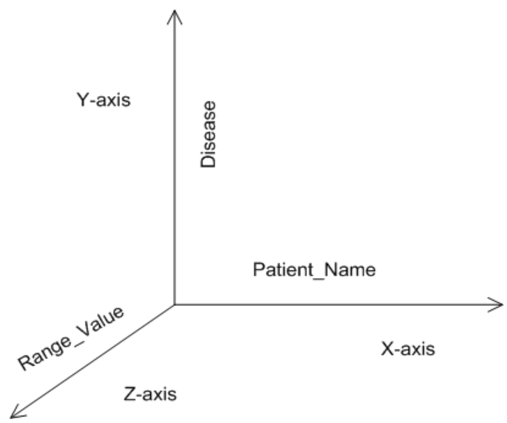

Figure 3. 3-D Axis Representation of Attributes

Therefore, according to the 3-D axis representation of attributes the three domains is taken from the designed fuzzy object-oriented database (FOOD) to design the 3D data cube for the patient diagnostic system (PDS). The database contains the numbers of records of patients which is represented in the table 3.

Table 1. Sample PDS Database with Fuzzy Range_Values

A	B	C
P_NAME	**DISEASE**	MEMBER FUNCTION (RANGE VALUE)
MR. ANURAG SHARMA	Virul Fever	98.0<101
MR. JAGDISH	Virul Fever	98.0<101
MRS. CHANDAWATI	Maleria	98.0<107
MASTER JAINUL	Dangue	18.0<22.0
MR. SANTOSH KUMAR	Virul Fever	98.0<101
BABY RADHA	Dangue	18.0 < 22.0
MR. JITIN WADHWANI	Dangue	18.0 < 22.0
MRS. KIRAN	Dangue	18.0 < 22.0
MRS. USHA MISHRA	Virul Fever	98.0<101
MISS. SUHASI	Typhoid fever	103<104
MRS. NIRMALA	Dangue	18.0 < 22.0
MISS. SHAHEEN BANO	Dangue	18.0 < 22.0
MISS. ROHINI	Typhoid fever	103<104
MR. RAMESH	Dangue	18.0 < 22.0
MASTER ANKIT	Virul Fever	98.0<101
MR. RAM SWAROOP	Dangue	18.0 < 22.0
MRS. PYARA	Dangue	18.0 < 22.0
MR. TULAI GAUTAM	Dangue	18.0 < 22.0
MRS. SHAYRA	Dangue	18.0 < 22.0
MR. SHIV DULARE	Virul Fever	98.0<101

Let us now consider the data bank represented into the table 1 for designing the 3-D data cube for patient diagnostic system with fuzzy range values. Each cell of data cube has the combination of three major attributes which are represented into the three domain of the table 1. The sample data cube for the patient diagnostic system who suffered from viral and dengue fever is represented in the figure 4(a) & 4(b) respectively. Each cell represents the attribute values requested by the user. The main objective of designing the data cube is to retrieve the information that can use in making decision in a faster manner. There are some queries are performed to retrieve the necessary information which is shown in the different phases of the data cube.

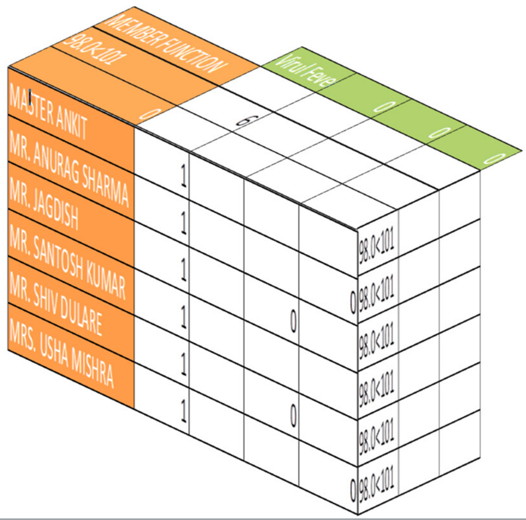

Figure 4(a). Data Cube Shows the Patients Suffering from Viral Fever

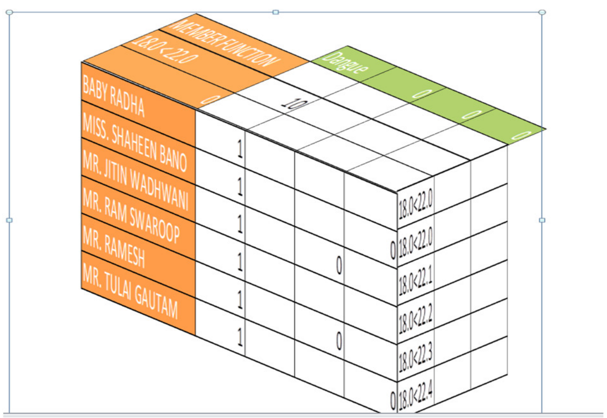

Figure 4(b). Data Cube Shows the Patients Suffering from Dengue Fever

3 Conclusion

There is a large scope to study the various kinds of data cube that provides the facility to the users to access the desired information within the fraction of seconds. Therefore, the present work is an attempt to design a 3D data cube for the designed fuzzy object-oriented database so that one can get the desired information in an easy and faster manner.

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