Relational Information in Medicine: A Challenge

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Abstract

Nowadays, a sizable amount of information is available in all areas medical domain including radiology. An important provocation is represented by the organization of these huge amounts of medical information, tasks that are essential in order to be used. The present paper presents a proposal of a relational structure for the organization of medical information using key terms and a Visual FoxPro application for structure management.

Keywords: Information management, Information storage, Database management system, Evidence-based medicine

Introduction

Nowadays, a sizable amount of information is available in all areas domain including medicine. The medical world has been included in the transformation of society's communication, and more than 15000 official medical sites which contain huge amounts of knowledge are available presently [1]. The number of medical application is increasing day-by-day and the medical databases was exploding in number and contents, including radiological and imaging information and evidence. The radiological complexity today is given by the development of many revolutionary imaging and interventional technologies during the past 30 years. Today, the challenge is to keep up to rapidly expanding of the radiological knowledge and to learn to access,

interpret, and apply this knowledge [2] and to integrate the radiological evidence in day-by-day activities practicing evidence-based medicine [3].

An important provocation is represented by the organization of these huge amounts of medical information, tasks that are essential in order to be used. Organized medical information is not a new problem in medicine. Maybe the first preoccupations in organising medical information could be looked at the beginning of information technologies century. A huge step in organising medical information was made by the National Library of Medicine which since 1966 they started to standardized medical terminology and creating Medical Subject Headings (MeSH) [4]. They created the MeSH thesaurus, a controlled vocabulary for subject indexing and searching of journal articles in MEDLINE [5], which is annual update [6]. If we look how the medical information is organized in MeSH we found a tree structure as the one from figure 1.

```
Neoplasms [C04]
    Neoplasms by Histologic Type [C04.557]
        Neoplasms, Germ Cell and Embryonal [C04.557.465]
            Neuroectodermal Tumors [C04.557.465.625]
                Neoplasms, Neuroepithelial [C04.557.465.625.600]
                    Glioma [C04.557.465.625.600.380]
                        Astrocytoma [C04.557.465.625.600.380.080]
                            Glioblastoma [C04.557.465.625.600.380.080.335]
                            Optic Nerve Glioma [C04.557.465.625.600.380.080.667]
```

Figure 1. The tree structure of the MeSH term classification (From MeSH official web site)

We can say that the medical information is presented here as a tree structure based on indexed key. Starting from this idea, this paper presents a proposal of a relational structure for the organization of medical information using key terms.

Material & Method

Organising medical information can be made on based of standardised key terms. From our point of view, these key terms can be organised into a graph relational structure. Let's take an example. Suppose that our key term is `Lymphoma, Large-Cell` (figure 2).
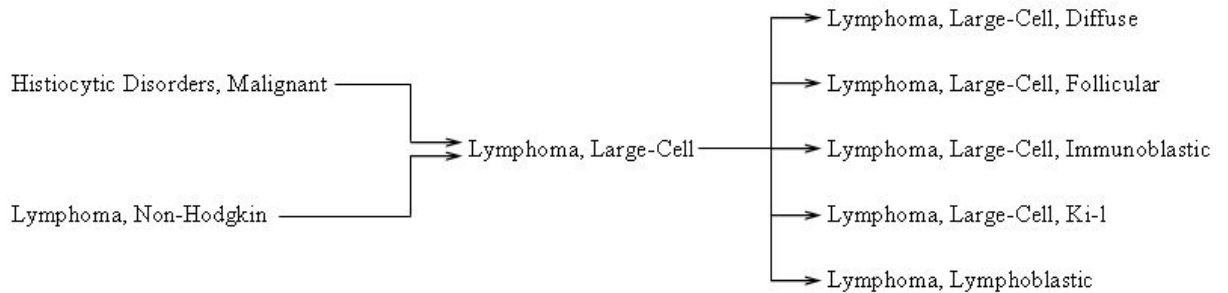

Figure 2. Graph relations between key terms

As we can see from the figure 1, the key term `Lymphoma, Large-Cell`, which can be named a 'node' had two arches on the left side, represented by the `Histiocytic disorders, malignant` and `Lymphoma, Non-Hodgkin`, and five arches on the right, `Lymphoma, Large-Cell, Diffuse`, `Lymphoma, Large-Cell, Follicular`, `Lymphoma, Large-Cell Immunoblastic`, `Lymphoma, Large-Cell, Ki-l`, and `Lymphoma, Lymphobalastic`. The structure of the key term, on the other point of view, can de seen a cycle (figure 3).
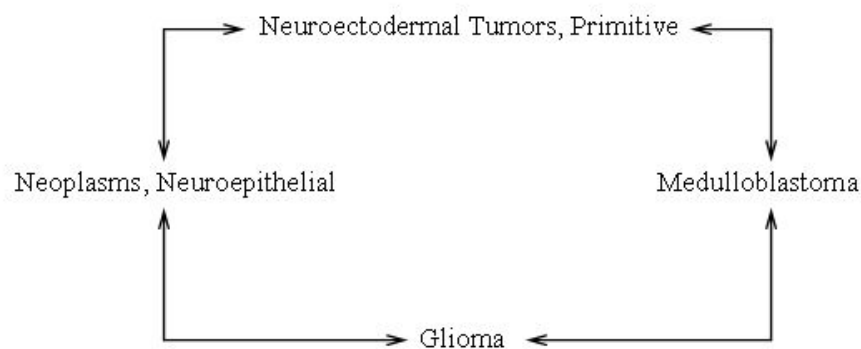

Figure 3. A cycle structure in the key term structure

If we looked at the `Medulloblastoma` as a key work we can find it on the arch of `Neuroectodermal Tumors, Primitive` or on the `Glioma` arch. The `Neuroectodermal Tumors,

Primitive` node as well as the `Glioma` node is on `Neoplasms, Neuroepithelial` arches, creating with `Medulloblastoma` a cycle.

As a method, we choose to worked with a rapid application development (RAD) because allows usable systems to be built in as little as 60-90 days and because with conventional methods, there is always a log delay before to gets to see any results and in all medical fields had changed all the time as a short period of time. After a log debate in our team, we decided to develop our application with Microsoft Visual FoxPro. We presented the structure of the medical information described above, structure which was put across on a relational database. The structures of database which was created can be seen in figure 4. The database were contained of a number of eight tables `pnX` (from X = 1 to X = 8) which stored the levels of terms abstractization, a table named `rel` where was created in order to stored the relations between different levels of terms abstractization and a `ghid` table that stored the guideline information.
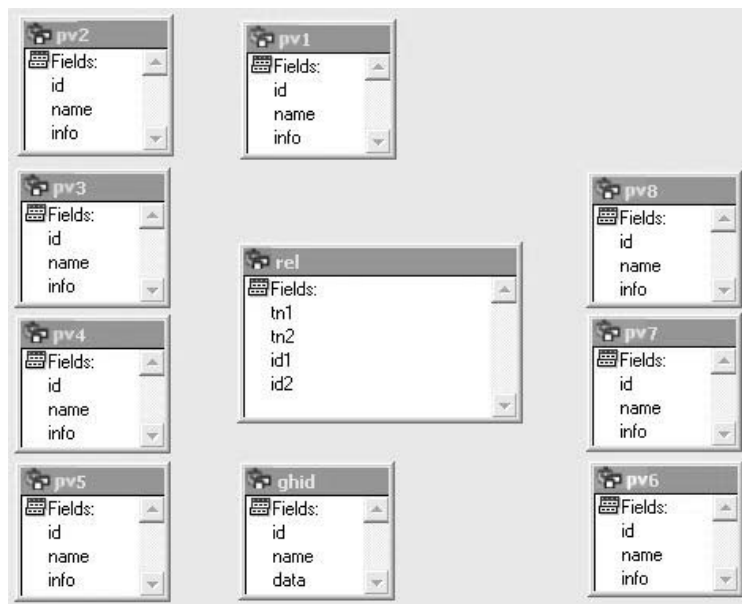

Figure 4. The (proposed) structure of relational medical information terms database

The tables are related between them. The relationship between the *'pn...'* tables and the *'rel'* table were given in the figure 5.
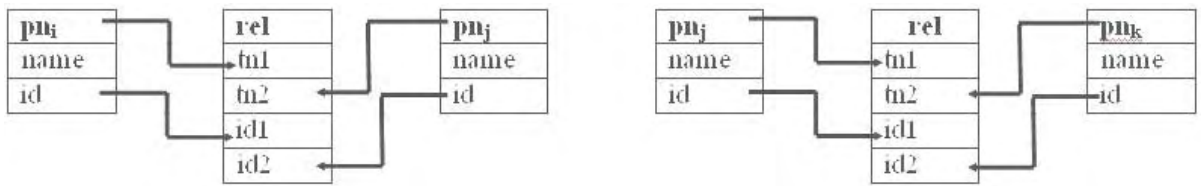
Figure 5. The relationship between tables (where i < j < k)

At first looked, the relationship between the `$pn_i$` table and the `$rel$` table looked like a one-to-many relationship but in ensembles, the `$rel$` table stoked up a many-to many relationship (he had a *1* to *n* relationship with the `$pn_i$` table and a *1* to *m* relationship with the `$pn_j$` table; where *j>i*). Thus, in reality the `$rel$` table relationship was not a bidimensional one, in fact was a cvadridimensional one (for example, the 42th term from the table `$pn_2$` was related with 39th term from the table `$pn_3$` which was related with 25th term from the `$pn_4$`).

Results

The program created had a simple and nice interface (figure 6). The main form's name is Browse. From the main form, we can access every table from the database, by click on the table abbreviation, including the table which stored the relations between different key terms (the *'rel'* table). The main form had also allowed quitting the application (Quit button).
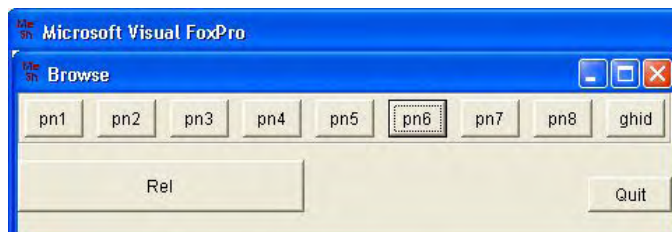

Figure 6. The main form from the program interface

Let's see who the application works. Suppose that we want to include into the database a relationship for the key term `Glioma` from the figure 1. First key term which we included into database was `Neoplasms`. For that, we opened the `$pn1$` form (figure 7),

Figure 7. The 'pn1' form

filled the `id` entry and typing the key term, `Neoplasms`. All forms had two status windows, one which allows editing the information and another one to save the information. After we had edited the key term by click on `Edit` button, we can save the information included into database by click on `Save` button. Any of `pn_i` forms can be browsed using the `<<` (it go to the first record) button, `<` (it go to the previous record), `>` (it go to next record), and `>>` (it go to the last record). The next step was to include the next key level `Neoplasms by Histological Type`, into the `pn2` form. In order to create the link between the two terms included into the database, first we select the levels of key term, `pn1` and `pn2` forms (1 < 2), and the ten open the `rel` form (figure 8). Note that if the interface of the program is nice and easy to use, but even then the work to fill and to create links between key terms is time consuming.
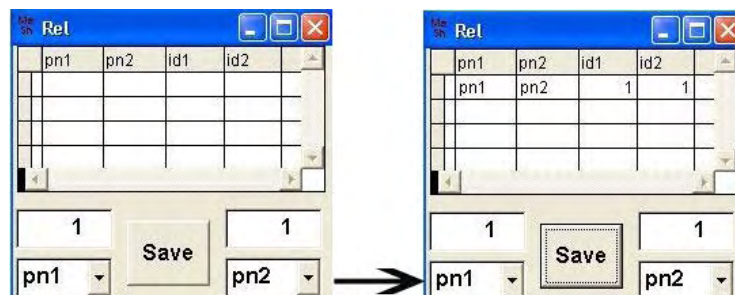

Figure 8. Linking the key terms

Discussions

MeSH is the best-standardised medical terminology database that is used by many medical databases as indexes. Using the MeSH databases in medical search strategies is easy and gives the

possibilities to use many "mapped" terms, presenting explode capacities (subject categories with more specific terms arranged beneath broader terms) and broaden the search strategies [7]. Even if MeSH has been fully or partially translated into many languages we cannot await to come about to happen in ours countries and meantime do nothing. The National Library of Medicine began in 1986 to research and developed the Unified Medical Language System (UMLS®) [8]. The main purpose of the UMLS was to create a system that helps health professionals and researcher retrieve and integrate electronic medical information from a variety of sources. The system had four knowledge Sources: the Metathesaurus®, the SPECIALIST Lexicon, a Semantic Network and an Information Sources Map which are periodically updated and supported financially witch $ 1-3 million per year [8]. The great disadvantages of these applications are represented by the conceptual and interface language, represented by English language. A big problem appear in the states where the majority of physicians do not had the English language knowledge at a high level, at the level of understanding correctly the medical information.

Our project, created using Visual FoxPro want to give a solution for those countries who want to organize theirs ones medical information, which to contain the national terminology. Why we choose Visual FoxPro? First reason was because Visual FoxPro provides the environment and tools we need to create and manage high-performance database applications and allows also integrating the Internet into the application which was our main object of the project. Microsoft Visual FoxPro [9] gives us more of everything we have come to expect in a database management system – speed, power, and flexibility, properties which are necessary in medical application, helping us to create fast and modify application easily. Another reason by choosing Microsoft Visual FoxPro was that allows sharing data with other applications, a useful task for our aim.

Our program interface is quite easy to use and allows to all types of users to work with it. The work to organized medical information in it is time-consuming. The best host for the application it will be a server. An Internet interface of our application can be made using a

Microsoft Open Database Connectivity - a widely accepted application-programming interface (API) for database access - (ODBC) [10]. This will allows connecting to the database any time and from anywhere.

For the moment, the key words structured the medical information in our database. In order to rapidly access the information it will be very useful to create for every key term a list of entry terms, creating a new table linked with the existent structure; this tasks could be will be the next step of our research.

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