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SEMANTIC INTEROPERABILITY AND HEALTH RECORDS

Hugo Peixoto
Informatics Department
E-mail: hpeixoto@di.uminho.pt

ABSTRACT

Nowadays the exchange and share of clinical knowledge among medical information systems is an important feature to improve healthcare systems, quality of the diagnosis and quality in patient treatment. Unfortunately, information emerges from an assortment of sources, from informatics applications, medical equipments and physicians' knowledge introduced in the Electronic Health Record (EHR). Gathering this information and present it in a readable way to physicians and machines, it's an interesting task. The uprising technology for achieving this task is called Interoperability and one way to achieve it is to implement a Semantic Web approach and its rules in terms of the EHR.

On one hand guarantee an homogeneous information system in a health care unity will produce enormous benefits to the institution. Reduction in diagnosis and appointments time since information about a patient is available at one time in the same place would give doctors more time to treat patients better. Less medical errors would be expected due to better quality of information (Miranda 2009).

On the other hand Semantic Web is an uprising technology and many developments are still to come, although a lot of progress have been made in the last few years not only to the world wide web but it also can be applied to health care too.

The presented project aims to build upon an intelligent engine of analysis of rules over an interface according to W3C standards (W3C online). The engine will need to assimilate the rules intelligently and build with it a database that will be evaluated by a committee decision that will make the rules final or not. Along side, the construction of an engine audit would challenge you about the relevance of the alarm which was previously placed is to be executed.

The main base of this project is an Agency for the Integration, Diffusion, and Archive (AIDA) of medical information, which allows interoperability with different HIS, and a EHR system. AIDA and the EHR are now being used in some major Portuguese hospitals (Rigor et al. 2008).

Integration of the information from the different departments and services within healthcare institutions in order to make it available for the EHR system is also an important requisite for an efficient EHR. If the generated information is not organized in order to prevent inconsistencies and gaps, the information entropy generated will draw back the efficiency and quality properties enabled by the EHR.

Advances in new Methodologies for Problem Solving and Information Technology enables a fundamental redesign of health care processes based on the use and interoperability of data and/or knowledge at all levels, in a health care environment. Indeed, new communication technologies may support a transition from institution centric to patient-centric based applications, i.e., the health care system is faced with a series of challenges, namely those concerning quality-of-information and the cost-effectiveness of such processes.

The identification of the nature of an abnormal factor by deletion or by analytical procedures is called diagnosis. For a good clinical diagnostic knowing all factors involved is of undeniable importance and the decision taken will be much better depending on the quality of information available when the it is made (Peixoto and Alves 2009).

Search engines of diseases based on these technologies are already under development, for example IOC - Clinical Observations Interoperabillity, which incorporates a set of search criteria to search for identical patients in the same clinical situation. Other systems are open on the Internet and can be accessed and used as a test (Stephens available online). DERI Galway conducting research using the SPARQL language to genetic databases (Samwald 2007).

The aim is to go further and allow the construction of these criteria automatically, intelligent and based on previous knowledge of situations that led to a certain outcome. Use this knowledge to draw conclusions and

decisions can be central to a health service with better quality. The quality of information should be an important factor and will be evaluated throughout the process of building rules.

The objective is to go trough work producing prototypes that will help develop the final work. These prototypes are based on information that is being harvested along with the project consultants involved. Initially basic rules will be produced, which can possible be negligible at the end but will only contribute to the continuous improvement of the model and the results achieved.

• The first step is to build the Electronic Semantic Health Record (ESHR) according the standards of the W3C consortium in order to follow what will soon become the standard of the Internet and Web-based applications.

• After obtaining the ESHR is necessary to begin to assess what the most relevant parameters and that can really help health care professionals to consolidate their diagnosis or prescription, or assist nurses in providing care to the patient.

• Surge at this stage a new project area, construction of a portal for validation rules that will be available to a community given by the institution that will receive this system.

Finally, one can make its conclusions based on the results obtained during the investigation. For this research model to be followed, five complementary stages have been defined, which will allow us to achieve the planned objectives, being given in the form:

1. Constant and incremental update and review of the state of the art;
2. Idealization and gradual and interactive development of the proposal model;
3. Experimentation and implementation of the solution throughout the development of a prototype;
4. Result analysis and formulation of conclusions; and
5. Constant diffusion of knowledge, results obtained and experiences with the scientific community.

Computational Science is the newest modern science, made possible by the tremendous improvements in both computer hardware and software over the past thirty years. Computational Science, sometimes known as Modeling and Simulation or Scientific Computing, is used in Medicine, and benefits from knowledge in a large amount or scale. On the other hand, semantic web, a key word in our work, refers to a computational paradigm that allows for interoperability, enabling intelligent ubiquitous computation and communications in order to increase quality of information and decision support. Indeed, doctors gather dissimilar types of information about patients for clinical practices. Different types of tests are visited in a user-friendly, including physical exams, imaging tests (e.g. XR, CT or MRI), laboratory tests (e.g. blood, urine, fluids or tissues), or pathology and surgical reports, i.e. in Computational Science, the scientific problem must be expressed mathematically, known as the Algorithm. Using semantic web, the algorithm is translated into one or more computer programs and implemented on one or more types of hardware. In our work, the combination of software and hardware is referred to as the Computational Architecture, the AIDA agency referred to above. It is shown that user-friendlier interfaces have a high number of visits, reducing costs and increasing the quality-of-care.

REFERENCES

Miranda, M.; Duarte, J.; Abelha, A.; Machado, J. and Neves, J. 2009. "I*nteroperability and Healthcare*". In Proceedings of the ESM 2009. Leicester, UK..

Peixoto, H. and Alves, V. 2009. "*Computer-Aided Diagnosis in Brain Computed Tomography Screening*", in Advances in Data Mining. Apllications and Theoretical Aspects. Springer Berlin/Heidelberg. p. 62-72.

Rigor, H., Machado, J., Abelha, A., Neves, J. and Alberto, C. 2008. "*A Web-based system to reduce the nosocomial infection impact in healthcare units*". In: Webist. Madeira.

Stephens, S. "*Semantic Web for Health Care and Life Sciences Interest Group*". (available online).

Samwald, M. 2007. "*Semantic Web for Health Care and Life Sciences*". Workshop at 17th International World Wide Web Conference.

W3C consortium. http://w3c.org (available online).

AUTHORS' BIOGRAPHIES

HUGO PEIXOTO is currently pursuing doctoral studies in Medical Informatics, at the University of Minho, focused on semantic interoperability and health records in healthcare units. Before, he had also graduated with a master degree in Biomedical Engineering at the same university with a thesis on Computer Aided Diagnosis in Brain CT. He is now working at Centro Hospitalar Tâmega e Sousa where he is a software developer.