Quality of Life through Quality of Information
J. Mantas et al. (Eds.)
IOS Press, 2012

doi:10.3233/978-1-61499-101-4-1203

Decision Support System Based Semantic Web for Personalized Patient Care

Nassim DOUALI [a,1] , Jos DE ROO[b], Marie-Christine JAULENT [a]
[a] *INSERM UMR_S 872, Eq 20, Medicine Faculty – Pierre and Marie Curie University (Paris 6), France.*
[b]*Agfa HealthCare, Agfa HealthCare NV, Moutstraat 100, 9000 Gent, Belgium*

Abstract. Personalized medicine may be considered an extension of traditional approaches to understanding and treating diseases, but with greater precision. A profile of a patient's genetic variation can guide the selection of drugs or treatment protocols that minimize harmful side effects or ensure a more successful outcome. In this paper we describe a decision support system designed to assist physicians for personalized care, and methodology for integration in the clinical workflow. A reasoning method for interacting heterogeneous knowledge and data is a necessity in the context of personalized medicine. Development of clinical decision support based semantic web for personalized patient care is to achieve its potential and improve the quality, safety and efficiency of healthcare.

Keywords. Personalized medicine, decision support system, genomic, case based fuzzy cognitive maps, semantic web

Introduction

Personalized medicine may be considered an extension of traditional approaches to understanding and treating disease, but with greater precision [1]. A profile of a patient's genetic variation can guide the selection of drugs or treatment protocols that minimize harmful side effects or ensure a more successful outcome [2].

Genetic profiles can better discern different subgroups of breast cancer, guiding physicians to select the best treatment protocol or, in some cases, forego the expense and risks of chemotherapy altogether; tests detecting variation in the way individuals metabolize the blood thinning drug warfarin can help predetermine the right dose for a patient, navigating the narrow therapeutic passage between reducing risk of clots, and triggering internal bleeding [3].

Technological developments have allowed us to take advantage of personalized medicine, including computerization of patient data and bioinformatics. The explosion of data and medical knowledge is a major problem for reuse and integration of knowledge in the system of Clinical Decision Support System (CDSS) to provide personal assistance to practitioners at the point of care on different devices. In this paper we describe a decision support system designed to assist physicians for personalized care, and methodology for integration in the clinical workflow.

[1] Corresponding Author. Nassim Douali, e-mail: nassim.douali@crc.jussieu.fr

1. Methods

The aim of this study is to develop a CDSS using a Semantic Web tools based on Case Based Fuzzy Cognitive Maps [4] (CBFCM), following steps:

- Modeling of the clinical system
- Formalization of validated knowledge
- Access to heterogeneous databases (Semantic web technology)
- Use of innovative methods of distributed reasoning
- Use of mobile devices for integration into the clinical workflow.

The framework is developed with Semantic Web tools, integrating an inference engine Euler Sharp [5] and all knowledge bases are coded in N3 [6] based fuzzy rules.

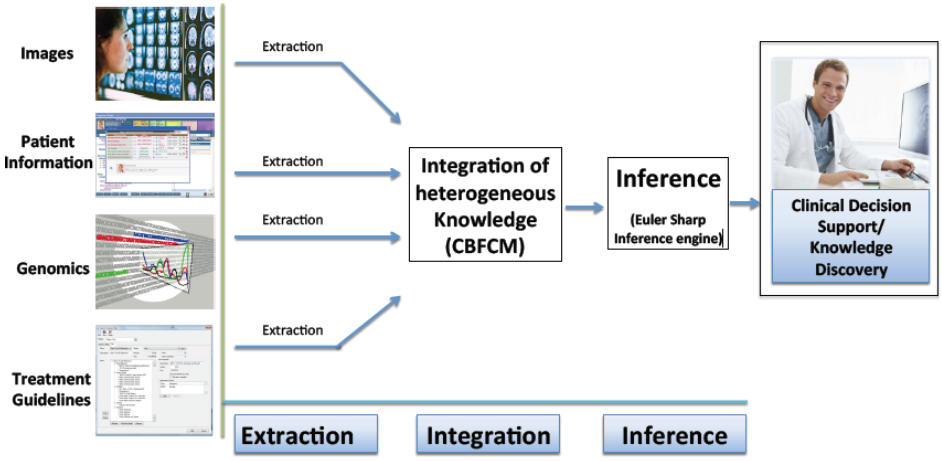

Figure 1. Diagram represents the semantic decision support system

The first step of our approach is finalized and consists to:

- Formalize the knowledge from CPG, data mining
- Use CBFCM for the integration of knowledge and reasoning
- Using Semantic Web Tools for managing heterogeneous databases
- Use of mobile multiplatform solutions for the implementation of the final solution for physicians

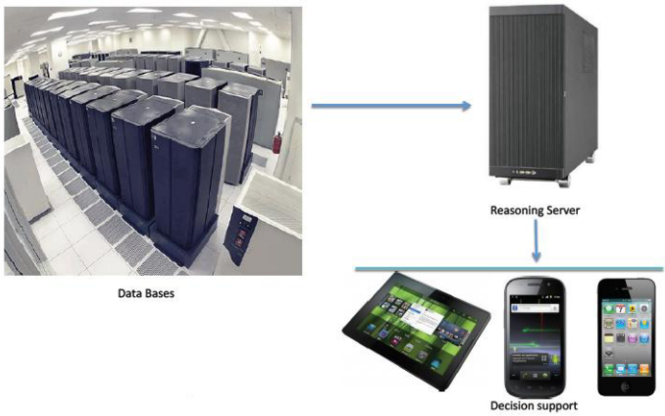

Figure2. Graphic representation of destributed reasoning based CBFCM

2. Discussion and conclusion

A reasoning method for interacting heterogeneous knowledge and data is a necessity in the context of personalized medicine. We modeled the CBFCM method and we have tested in several application areas including urology and lung disease. The results were encouraging and they are published [4], the work of integrating knowledge and data in the same framework represents the first steps to achieving a CDSS specialized in personalized medicine. Our goal is to build a medical knowledge base validated (CPG...) and the use of personal data (clinical, biological, genetic...) to allow profiling of patients for better personalized care whether diagnostic or therapeutics.

We implemented the knowledge bases, rules and databases in the same environment (N3, Euler etc.) without compatibility constraints. This is one of the advantages of using Semantic Web tools. The first results of integration of heterogeneous knowledge are very encouraging and we continue on this path to achieve a CDSS for personalized care based on patient profiling. Development of clinical decision support for personalize patient care is to achieve its potential and improve the quality, safety and efficiency of healthcare.

References

[1] Hamburg M,Collins F.The Path to Personalized Medicine. N Engl J Med 2010; 363:301-304
[2] Landau R, Bollag L. A, Kraft J. C. Pharmacogenetics and anaesthesia: the value of genetic profiling. Journal of Anaesthesia 17 JAN 2012
[3] Ginsburg G, Huntington F. Willard. Genomic and personalized medicine: foundations and applications. Translational Research Journal 2009;154(6):277-287
[4] Douali N, Papageorgiou E, De Roo J, Jaulent MC. Case Based Fuzzy Cognitive Maps: New method for medical reasoning – Fuzzy systems, Proceed. Fuzz-IEEE 2011.
[5] De Roo J. Eye note. http://eulersharp.sourceforge.net/2003/03swap/eye-note.txt. (last accessed on January 9th, 2011).
[6] Berners-Lee T, Connolly D, Kagal L, Scharf Y. "N3Logic: A Logical Framework For the World Wide Web". Theory and Practice of Logic Programming 2008, 8:249-269 Cambridge University Press Copyright © Cambridge University Press 2008