

## 임상 의사 결정에서 온라인 지식 자원의 역할

무하마드 아프잘, 마크불 후세인, 와자하트 알리 칸, 타디르 알, 이승룡  
경희대학교 컴퓨터 공학과,

e-mail : { muhammad.afzal, maqbool.hussain, wajahat.alikhan, taqdir.ali, sylee }@oslab.khu.ac.kr

## Role of Online Knowledge Resources in Clinical Decision Making

Muhammad Afzal, Maqbool Hussain, Wajahat Ali Khan, Taqdir Ali and Sungyoung Lee  
Dept. of Computer Engineering, Kyung Hee University, Korea

### Abstract

*The need of Clinical Decision Support System (CDSS) in healthcare setup is increasing day by day. EHR Meaningful Use advocates CDSS as an important component of EHR/EMR systems. CDSS can be ranged from a simple to a very sophisticated system. The more complex CDSS systems need more attention to develop because of many reasons including its Knowledge Base (KB) structure/maintenance/evolution, inference capabilities and usability. Above all the KB maintenance and evolution is very crucial and important from the perspective of useful decision capabilities. Also the richness of the KB is important to cover the decision gaps handling a particular situation in the course of patient care. It cannot be expected from the clinicians to remember everything in regard to patient diagnosis and treatment. Similarly, it is also crucial for clinicians to keep themselves updated with the new research in the area. That is the reason they frequently require accessing to the online knowledge resources. Literature proved that online knowledge resources are capable providing answers to questions that might not be answered rely only on clinician wisdom and experience. This paper provides the theme of meaningful utilization of online knowledge resources in the context of diagnosis and treatment process for cancer patients more specifically Head and Neck cancer.*

### 1. Introduction

Global focus on healthcare is growing these days. More spending are noticed in very recent times around the world. This is all because of the fact that healthcare is closely associated with human life. So, more focus in this area is appreciable. This focus discovered new dimensions in the healthcare domain. Now we talk about a typical health system e.g. EMR, it implicitly means interoperable, secure and standardized. However meaningful use [1] is one of the important criteria to measure the usefulness of a health system. One of the meaningful criteria point is CDSS integration in the clinical workflows [2]. The CDSS should assist the physicians in the course of patient care rather to replace them. CDSS can be utilized for various purposes including disease diagnosis, adverse reactions and treatments options. But this paper focuses on Head and Neck (H&N) Cancer patient diagnosis and treatment recommendations.

The reason of choosing H&N cancer is the data availability and doctor support. Our lab (UC Lab, Kyung Hee University (KHU), South Korea) has close collaboration with Shaukat Khanum Memorial Cancer Hospital & Research Center (SKMCH&RC), Pakistan. The work strategy and initial architecture of the work has been published in [3]. However, different modules of the architecture are under

progress for research and development. The focus of this work is to discuss the role of online knowledge resources in the KB maintenance and evolution.

KB is maintained and evolved either by knowledge engineers or by clinicians themselves [4]. The first approach is highly expensive as knowledge engineers availability in the long run is costly. The second approach is, however, more appealing. This needs easy to use interface to enter new or modify the existing knowledge in the KB. But it is not the complete solution for the problem. There is enormous research going in the domain especially in cancer domain where clinicians want to know about that. Clinicians want to know about the new research published in practice changing papers but they have no established channels for it. When asked in a survey, clinician responded that there is no established way however, we try to find research papers having more citation. Sometimes we came to know through conferences and events like that but such opportunities are rare to avail due to many-fold barriers. Based on the importance of the knowledge available in online resources, this paper is focused to describe the possible approaches of how to get into the right resource for required information.

## 2. Proposed Approach and Architecture

The KB of CDSS created with the help of clinicians and knowledge engineers needs to be updated with the current research findings. Current research findings are found in credible research publications. The most appealing approach is to make a contextual input request from within the workflow of Health Information System to an online resource like MEDLINE and find the latest research findings based on the input parameters provided. There are two main functions connecting to a resource and getting the required information i.e. input request and output response formulation.

Both of these functions include further steps to achieve the objective. We need a knowledge manager module that manages the input request and output response. Details of these functions are described in following sections.

### 2.1. Input Request Formulation

This function performs to set the query parameters required to fetch relevant information from the appropriate online knowledge resource. It takes the input request with contextual information from the workflow of health system where CDSS is deployed and filter the unnecessary information. By unnecessary information means that has no importance to be used as a query parameter when the input request runs at the resource side. At the same stage, new elements will be added if required in order to make the input more useful. Sometimes the information coming from within the workflow of health system are not enough so in that case we add more information in order to get into the right information. Upon the completion of data the input request is transformed into a standard format called Context Aware Knowledge Retrieval (Infobutton) [5]. The reason why we are taking this extra step of converting request into standard format is to reduce the chance of customization for every new resource added in the future. Once we have the input in standard format, it is linked to a right resource or resources based on the best match strategy.

### 2.2. Output Response Formulation

Extracting required knowledge from the output response needs some mining techniques. With the help

of these techniques the final response is prepared. This step can be fully automatic or semi-automatic. Sometimes it is very difficult to automate all the steps due to diverse nature of the information extracted from the resources. Rather we can use semi-automatic approach to assist the clinicians structuring the information in required format. After structuring, the response is converted into Arden Syntax [6] which is directly usable by the Smart CDSS system.

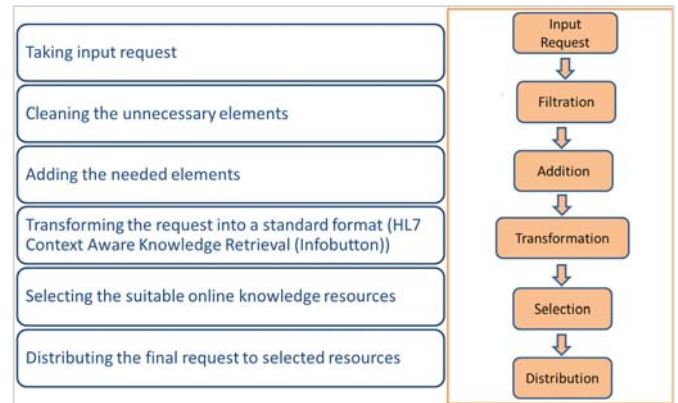


Figure 2: Input Request Formulation

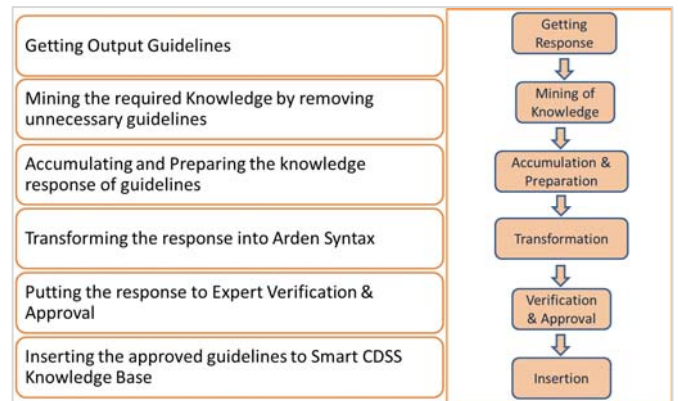


Figure 3: Output Response Formulation

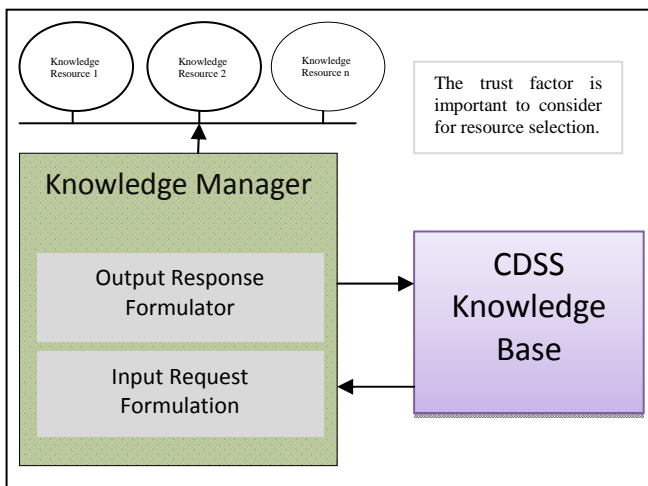


Figure 1: Proposed Approach

## References

- [1] Meaningful Use, <http://www.healthit.gov/policy-researchers-implementers/meaningful-use>, Accessed: Oct 9, 2012.
- [2] Health Information Technology, [http://www.healthit.gov/sites/default/files/pdf/BaseEHR\\_8-18-12\\_Final.pdf](http://www.healthit.gov/sites/default/files/pdf/BaseEHR_8-18-12_Final.pdf), Accessed: Oct 9, 2012.
- [3] M. Hussain, W. A. Khan, M. Afzal, and S. Lee, "Smart CDSS for Smart Homes," ICOST (Italy), 2012
- [4] Nathan C. Hulse et al., "KAT: A Flexible XML based Knowledge Authoring Environment," Journal of the Medical Informatics Association, August 2005.
- [5] Howard Strasberg MD MS, "Infobuttons for Clinical Decision Support," October, 2010, accessed March 2012.
- [6] George Hripcsak et al., "Rationale for Arden Syntax," Computers and Biomedical Research, January 1994.