A Prototype Documenter System for Medical Grand Rounds

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ABSTRACT
This paper demonstrates our ongoing experience on a documenter system for medical grand rounds. The system captures and synchronizes the set of material presented and corresponding physicians’ interactions, automatically relates clinical cases of patients, and then generates web-accessible documents with all information captured. The resulting documentation can be used for several purposes such as teaching, research and presurgical decision taking.

Categories and Subject Descriptors
J.3 [Life and Medical Sciences]: Medical Information Systems; H.5.4 [Information Interfaces and Presentation]: Hypertext/Hypermedia—Navigation

General Terms
Documentation, Design

Keywords
Pervasive healthcare, documentation, extension

1. INTRODUCTION
In the realm of pervasive computing, capture and access applications automatically register information from everyday experiences in order to preserve records and memories so that humans can search, retrieve, visualize, or extend them at some point in the future.

Recently, we have been exploiting the capture and access paradigm in a quotidian physicians’ activity, called medical grand round [2]. During a grand round, physicians collaboratively discuss clinical cases of patients based on individual experiences and clinical and scientific evidence-based knowledge. As a result, physicians should decide about presurgical procedures with respect to a particular patient.

In this paper we present a prototype documenter system for medical grand rounds. We demonstrate how the system works from the preparation of a grand round with patients’ clinical data until the automatic generation of documents containing:

- the material presented (e.g. clinical history, medical reports, image-based examinations, etc.);
- physicians’ interactions with that material (e.g. navigation and delimitation of regions of interest upon image-based examinations);
- the computed set of clinical cases of patients related to the cases discussed [1].

Using markup languages and stylesheets, all material captured is then transformed and formatted as Web accessible documents for later access.

From our observations, the resulting documentation may enhance and simplify physicians’ tasks including the review of particular clinical cases for teaching, research or legal purposes, presurgical decision taking, and surgical procedures.

2. DESCRIPTION OF THE APPLICATION
Before a grand round starts, every clinical case material is stored on a particular XML document representation, which is in turn sent to an association module in order to find similarities between previously captured clinical cases. Each material of a clinical case is represented as a document tag.

During a grand round, a team member presents his material through the interface of our prototype (Figure 1). He can trace digital inks and types textual notes upon medical images to delimit and describe regions of interest. Images, text and inks are recorded in separate layers to preserve their contents for later processing.

As a user browses on a series of medical images, it is created a Visit object, which is described by:

- the identification of the current image visited;
- the time duration of the visit;
- the XML encoding of digital inks (XY coordinates, and trace color and thickness), textual notes (font name, color, size and style), measurement tools (color, XY coordinates, and angle value) and manipulation tools (brightness and contrast levels, inverse color effect, and zoom in/out levels).
Figure 1: From capture to access: documents are uploaded into the system (1); digital inks are traced upon medical images being visited and clinical cases are interrelated (2–5); stylesheets transform and format all information captured into Web-accessible documents (6–7).

Every visit to a particular medical image is then registered on the XML document of the corresponding clinical case. Thus, the Visit object is the mechanism that we have implemented to capture and record users interactions with clinical case material.

Still during a grand round, a team member can request clinical cases related to the case being discussed. It is then returned a list of cases with the respective brief description, summary and similarity level (percentage).

After discussing each clinical case, a physician makes his own textual assessment using an embedded text editor. Finally, a particular physician registers the conclusion of a clinical case after all physicians make their own assessments about the current case.

When a grand round finishes, different layers of materials (e.g. image backgrounds and digital inks) are combined into an one-layer image, when applicable. The XML document of a grand round is then stored on prototype’s database and automatically transformed and formatted into Web-accessible documents both for desktop and mobile access.

Users can access grand rounds documentation through an index web page automatically generated, which includes links to XHTML web pages and corresponding PDF documents with user-controlled slideshow.

In order to re-calculate all relationships between clinical cases, it is extracted the XML document of every clinical case presented in the most recent grand round (including textual assessments and diagnoses). All XML documents of clinical cases are then re-sent to the association module.

3. CONCLUSIONS

This demonstration shows a possible solution for the lack of a proper documentation of medical grand rounds. However, we are aware that the current version of our prototype does not provide a full-fledged solution for grand rounds.

For instance, the prototype still should be able to interoperate with large medical imaging and patient databases (e.g. using the DICOM imaging protocol).

In a near future, we aim to extend the prototype by capturing multimedia data streams (e.g. physicians’ voice or a video-electroencephalographic exam) so that new services can be provided. For instance, the prototype could be able to relate clinical cases of patients through the transcription of physicians’ voices.

Besides, we also plan to develop document templates for different purposes (e.g. research database) and user profiles (e.g. surgeons and residents).

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5. REFERENCES
