Web-Based Collaborative Building of Medical Knowledge Bases

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INTRODUCTION

The dissemination of medical information has become critically dependent on the Internet and the World Wide Web, which enables distributed access to information in a platform-independent manner. However, not only the dissemination of information has been revolutionized by the rise of the World Wide Web but also novel opportunities for sharing data via the Internet have been created.

In the midth 90s, a number of research groups started to develop tools for collaborative construction of medical knowledge bases by using Internet technologies. One of the most popular systems is the CHORUS (Collaborative Hypertext of Radiology) system created by Kahn et al.[1] CHORUS is designed to facilitate a collaborative development of a computer-based radiology handbook. The system allows physicians without computer expertise to contribute knowledge and review the system's content by using a simple graphical user interface. However, the knowledge as acquired by CHORUS is not intended to become part of a knowledge base of an expert system in the sense that it is used to support a computation of diagnostic hypotheses or therapeutic recommendations.

METHODS

In our laboratory, we have developed a Web-based knowledge acquisition tool, that is specific to the task of building fuzzy medical knowledge bases. The main goal has been to develop a toolkit that supports and guides the medical experts in creating medical knowledge bases for the fuzzy rule-based medical consultation system MedFrame/CADIAG-IV.[2] Ideally, the medical experts should be enabled to perform this task without support from a mediating knowledge engineer.

Special emphasis has been laid on the design of a conceptual system model that reflects the analysis of the tasks and concepts that are involved in the knowledge acquisition process.[3] The conceptual model comprises an intuitive step-by-step procedure for the definition and refinement of medical relationships, a model of how to employ fuzzy set theory to the interpretation of medical facts, and several other aspects of fuzzy-based knowledge modelling.

The actual implementation has been programmed in Java and allows a collaborative building of medical knowledge bases by multiple experts via the Internet. It can be run on every computer that supports the TCP/IP-protocol and JDK™1.1.3 (Java Development Kit). It turned out that the ubiquitous availability is especially important since many of our experts are located at different sites.

However, since large parts of the knowledge that is obtained from the individual experts are judgemental in nature, the inter-expert agreement on the quantitative assessment of medical relationships has been proven to be rather poor. Hence, we use a modified Delphi-method approach for consensus finding.[4] E.g., several experts build 'disease profiles' of a certain medical domain and assess the respective rules and relationships. The profiles, that have been developed in this manner, are gathered on a remote host. Subsequently, the different proposals are compiled and 'concensus disease profiles' are established. In a second run, the experts are asked to revise their original assessments based on these concensus profiles.

DISCUSSION

The knowledge acquisition tool is currently tested by building knowledge bases in diagnostic radiology and hepatology. The ubiquitous access via the Internet has resulted in an improved acceptance by the experts. The building of knowledge bases has been accelerated and the maintenance cycles of existing knowledge bases could have been shortened.

References

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