

MedFrame/KBuilder: A Web-Based Knowledge Acquisition System for Medical Expert Systems

K. Boegl, K.-P. Adlassnig

Department of Medical Computer Sciences, Section on Medical Expert and Knowledge-Based Systems, University of Vienna Medical School, Spitalgasse 23, A-1090 Vienna, Austria
e-mail: karl.boegl@univie.ac.at

Background

Knowledge acquisition is a central concern in the development of medical expert systems. Beside the fact that the elicitation and acquisition of expert knowledge is a difficult and time-consuming task (even more so when unfamiliar representations like fuzzy membership functions are to be acquired), one of the major difficulties in building medical knowledge bases are the lack of time and the limited availability of medical experts.

Objective

The goal of this project was to develop a knowledge acquisition tool, the MedFrame/KBuilder Toolkit, that allows a collaborative construction of medical knowledge bases by multiple experts via the Internet [1,2]. The experts should be enabled to perform this task in a collaborative manner and without support by a mediating knowledge engineer.

Material and Methods

The MedFrame/KBuilder Toolkit is a Java application that is integrated in the MedFrame system, which is a common platform for a variety of medical consultation systems that are designed to support diagnostic and therapeutic decision making in various medical domains.

Prominent features of MedFrame are its client-server architecture, its fuzzy- and rule-based knowledge representation and inference framework, and its object-oriented database management system and data model.

The MedFrame/KBuilder Toolkit supports all subtasks of knowledge acquisition: The definition of medical concepts (findings, diseases, therapies), of (fuzzy) logical rules, of 'disease profiles', of data-to-entity conversion rules (translation of 'raw' observational and measured quantitative data into symbolic—but fuzzy—concepts), the encoding of medical concepts (SNOMED, ICD-10), and many others (Fig. 1).

Special emphasis was 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. Among others, this 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 for the interpretation of quantitative medical data, and several other aspects of fuzzy knowledge modelling. Based on the conceptual system model, the actual implementation offers a suite of tools that enable the experts not only to build knowledge bases but also to update and refine the knowledge bases continuously during knowledge acquisition.

Results

The MedFrame/KBuilder Toolkit was tested at the Department of Radiodiagnostics of the Vienna General Hospital [3]. Knowledge bases in the fields of diagnostic radiology were established. It was shown that the experts were able to transfer their knowledge into a 'computerized' form with little or no support by a knowledge engineer.

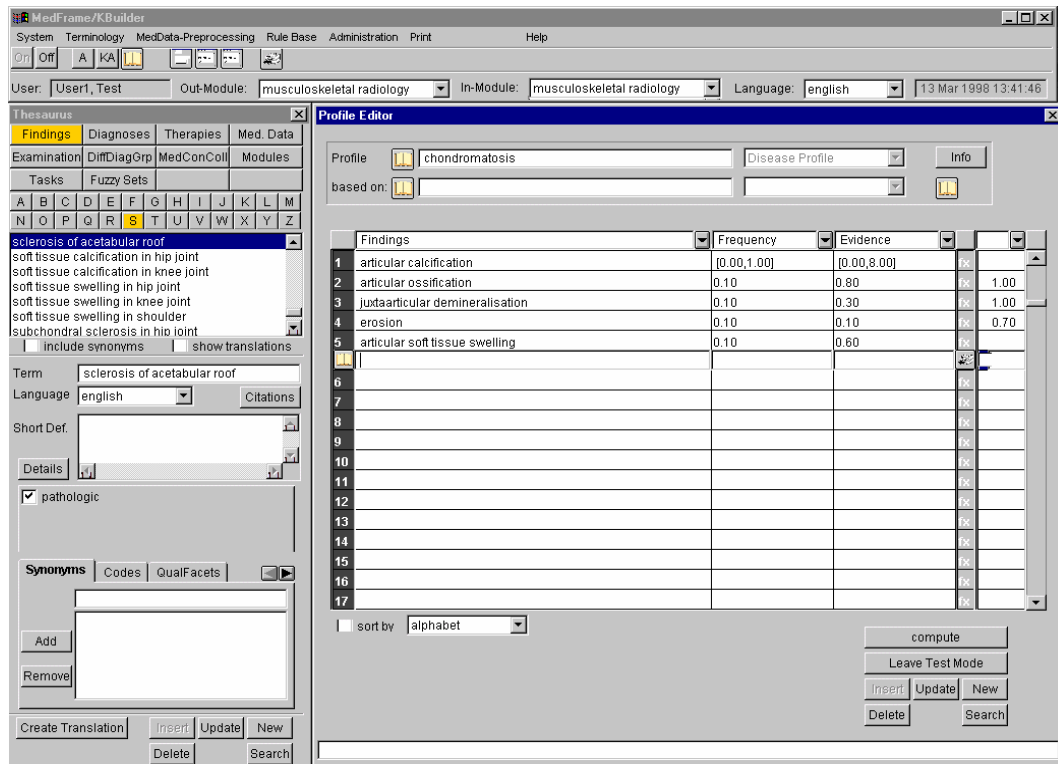


Fig. 1: MedFrame/KBuilder Thesaurus and Disease Profile Editor

Technical Specification

MedFrame/KBuilder was programmed in Java (Java Development Kit (JDK) 1.1.7) and was tested on Windows95/NT and UNIX platforms.

Conclusion

Our preliminary results indicate that we are able to reach a significantly higher acceptance rate by the involved experts as compared to previous projects where most of the knowledge acquisition task has been performed in a paper-based manner. The availability of the program via Internet and the intuitive and easy-to-handle graphical user interface are highly appreciated by the medical experts. As a result, building medical knowledge bases is accelerated and the maintenance cycles of existing knowledge bases can be shortened.

References

- [1] Boegl, K. (1997) Design and Implementation of a Web-Based Knowledge Acquisition Toolkit for Medical Expert Consultation Systems. *Dissertation*, Technische Universität Wien, Österreich.
- [2] Boegl, K. & Adlassnig, K.-P. (1998) A Web-Based Approach to Collaborative Knowledge Acquisition for Medical Expert Consultation Systems. In Bajić, V.B. (Ed.) *Advances in Systems, Signals, Control and Computers*, II, IAAMSAD and ANS, South Africa, 244-247.
- [3] Boegl, K., Kainberger, F., Gahleitner, A. & Adlassnig, K.-P. (1998) Web-Based Knowledge Acquisition: An Attempt at Collaborative Building of Radiological Knowledge Bases for a Medical Expert Consultation System. In Lemke, H.U., Vannier, M.W., Inamura, K. & Farman, A.G. (Eds.) *Computer-Assisted Radiology CAR'98*, Elsevier Science B.V., Amsterdam, 415-420.