Verification of Medical Guidelines

Medical guidelines are systematically developed statements to assist practitioners and patient decisions about appropriate healthcare for specific clinical circumstances. Medical guidelines summarize best practices to standardize health care and to keep physicians up-to-date. It has been shown that medical errors diminish when physicians follow medical guidelines. Nevertheless, the quality of medical guidelines often varies greatly and the quality of medical guidelines can be improved upon.

Verification of medical guidelines is one of the research themes of the research done in Nijmegen that focuses on the borders between computer science and the medical domain. By translating a formal representation language for medical guidelines (e.g., Asbru) into a formal language suitable for formal verification (e.g., KIV) it has been made possible to verify properties about medical guidelines.

In particular, research in Nijmegen has focussed on the formulation of criteria of separate treatments and on the formulation of general principles of good practice medicine. Furthermore, of particular interest has been the adaptation of medical background knowledge into the verification process as guideline recommendations are based on the latest available medical evidence and knowledge [1,2,4,5,8].

This research has resulted in a general framework for the verification of medical guidelines with respect to properties following from medical background knowledge. The framework has been applied to guidelines for the treatment of diabetes and breast cancer and has been found suitable for the verification of specified quality criteria. We were able to automate many steps of the verification process.

Besides using theorem proving we have also looked at other verification tools (e.g., model checking [6,7]) for verifying criteria. Furthermore, various tasks have been studied in which formal models of guidelines may be helpful (e.g., critiquing the treatment plan of a physician [3]).

References


Background

Health care is in a phase of transition. The role of basic biological sciences in health care, for example, has increased considerably. Furthermore, there is an mounting pressure on health care organisations to improve the efficacy and cost-effectiveness, without sacrificing the quality of care. Information Technology is and will be a major factor in steering these developments.

The Nijmegen Health Care Computing Initiative is a NWO funded HUBFOM program (2005–2007) that gave the means to recruit one postdoc for focusing on the intersection of computer science and health care. The goal was to broaden the expertise within the ICIS department of the Radboud University Nijmegen to the health care domain by setting up new research collaborations with other organizations (e.g., Radboud University Hospital, Nictiz, Philips, etc.). Some of the research topics focussed on are:

• Verification of medical guidelines using background knowledge.
• Classification of breastcancer from mammographic data.
• Application of scale-space smoothing techniques for preprocessing micro-array data and Bayesian networks for analysis to retrieve protein interactions.
• Analysis of patient data confidentiality issues of the electronic health care record.

Publications

Breed Cancer Detection


Bioinformatics


Knowledge Representation


Collaborations

The NWO HUBFOM project has lead to a FOCUS project (B-SCREEN) together with the Radiology department of the UMC St. Radboud in which we combine Bayesian models and expert knowledge for classifying breastcancer from mammographic image data.

Contacts

A number of contacts have been set up with various groups active in the health care domain. For example, various departments of the UMC St. Radboud such as Radiology, Human Genetics, and Obstetrics; The Netherlands Cancer Institute; The Advanced Computation Laboratory, Cancer Research UK; CBO Nictiz.

Publications

4 journal articles, 12 conference articles, 1 edited proceeding, and 8 posters.

Results

Success indicators for the Nijmegen Health Care Computing Initiative are to be measured in the collaborations set up with other research groups, the successful grant applications obtained, and number of publications.