Generation of Knowlege with Self-Learning Methods for Ophthalmic Data

Authors : Klaus Peter Scherer, Daniel Knöll, Constantin Rieder

Abstract : Problem and Purpose: Intelligent systems are available and helpful to support the human being decision process, especially when complex surgical eye interventions are necessary and must be performed. Normally, such a decision support system consists of a knowledge-based module, which is responsible for the real assistance power, given by an explanation and logical reasoning processes. The interview based acquisition and generation of the complex knowledge itself is very crucial, because there are different correlations between the complex parameters. So, in this project (semi)automated self-learning methods are researched and developed for an enhancement of the quality of such a decision support system. Methods: For ophthalmic data sets of real patients in a hospital, advanced data mining procedures seem to be very helpful. Especially subgroup analysis methods are developed, extended and used to analyze and find out the correlations and conditional dependencies between the structured patient data. After finding causal dependencies, a ranking must be performed for the generation of rule-based representations. For this, anonymous patient data are transformed into a special machine language format. The imported data are used as input for algorithms of conditioned probability methods to calculate the parameter distributions concerning a special given goal parameter. Results: In the field of knowledge discovery advanced methods and applications could be performed to produce operation and patient related correlations. So, new knowledge was generated by finding causal relations between the operational equipment, the medical instances and patient specific history by a dependency ranking process. After transformation in association rules logically based representations were available for the clinical experts to evaluate the new knowledge. The structured data sets take account of about 80 parameters as special characteristic features per patient. For different extended patient groups (100, 300, 500), as well one target value as well multi-target values were set for the subgroup analysis. So the newly generated hypotheses could be interpreted regarding the dependency or independency of patient number. Conclusions: The aim and the advantage of such a semi-automatically self-learning process are the extensions of the knowledge base by finding new parameter correlations. The discovered knowledge is transformed into association rules and serves as rule-based representation of the knowledge in the knowledge base. Even more, than one goal parameter of interest can be considered by the semi-automated learning process. With ranking procedures, the most strong premises and also conjunctive associated conditions can be found to conclude the interested goal parameter. So the knowledge, hidden in structured tables or lists can be extracted as rule-based representation. This is a real assistance power for the communication with the clinical experts.

Keywords : an expert system, knowledge-based support, ophthalmic decision support, self-learning methods