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The Kasimir Project: Knowledge Management in Cancerology

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The aim of the Kasimir project is the knowledge management for the cancer treatment, applied in the framework of the organisation of this treatment in Lorraine (a region of France). It gathers researchers in computer science and in ergonomics, experts in cancerology and an association federating physicians from Lorraine involved in cancerology.

I. KASIMIR/RBR

For each cancer localisation, the treatment is based on a protocol. This protocol is built according to evidence-based medicine principles [1]. It is used literally for 70% of cancer cases. It can be seen as a set of rules whose premisses describe conditions on patients and whose conclusions are descriptions of treatments.

The system KASIMIR/RBR implements the protocol for breast cancers without metastasis. It proposes treatments thanks to rule-based reasonings (RBR). Its implementation uses an object-based representation and hierarchical classification (see, e.g. [2] and [3] respectively). The acquisition of the protocol representation –the KASIMIR/RBR knowledge base– has been based on the protocol written on paper sheets (which is the traditional tool to help physicians in their decision-making) and on the help of experts to make the knowledge explicit and non-ambiguous. Figure 1 shows an extract from the hierarchy of the treatments (which are primitive concepts in KASIMIR/RBR knowledge base).

KASIMIR/RBR development is based on genericity: the knowledge base and the specification of the interface are described in XML files. So, the adaptation of this system for other cancer localisations is quite simple, from an implementation viewpoint. A version for the prostate cancer has already been developed.

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Fig. 1. A part of the KASIMIR/RBR knowledge base.

A future work aims at making this system operational for physicians of ONCOLOR. A validation study of KASIMIR/RBR has already been carried out. The aim of this study was to see whether the use of this system would involve an improvement in health care quality. A sample of 30 physicians of ONCOLOR had to propose treatments for patients with the help of the protocol written on paper sheets and/or with the help of KASIMIR/RBR. A statistically significant improvement of health care quality thanks to KASIMIR/RBR was shown.

An evolution of KASIMIR/RBR to a knowledge server according to the semantic web principles [4] (access to the informations by their contents) is under study.

Figure 2 shows a session of KASIMIR/RBR.

II. KASIMIR/CBR

For the “out of the protocol” cases (30% of the cases), cancerologists try to adapt the protocol during the meetings of the so-called breast therapeutic decision committee (BTDC) that gathers some experts of the domains linked with breast cancerology (e.g., chemotherapy, radiotherapy and surgery). A case is “out of the protocol” if either the protocol does not provide a complete answer or the solution proposed by the protocol raises some difficulties (contraindication, impossibility of applying completely a treatment, etc).

In this context, the development of the system KASI-
**Fig. 2.** A session of KASIMIR/CBR. On the left part: acquisition of the problem (on the bottom, acquisition of the current patient characteristics and, on the top, acquisition of the question raised about this patient). On the right part: detailed description of a solution.

**MIR/CBR is planned [5].** This system will be based on case-based reasoning principles (CBR [6]): it will select a rule and adapt the treatment associated with this rule in order to suggest a treatment for the current patient.

The conception of KASIMIR/CBR is a work in progress. A knowledge acquisition and modelling work needed for this system has been realised [7]. It is based on discussions with the experts about summaries of the BTDC meetings. It has shown several types of adaptation actually performed during BTDC meetings. For example, adaptation based on the available knowledge about therapeutic index is useful in particular to take into account contraindications (this index is the ratio of therapeutic benefits and negative effects of a treatment for a patient). The use of the so-called caution principle ("When one does not know, one should do as in the worst situation.") is used when crucial informations about the patient are missing. This study has finally shown the need to take into account the impression of the thresholds used for the decision for the size of the tumour, the age of the patient, etc. (threshold effect). A first version of KASIMIR/CBR has been implemented which addresses the threshold effect issue thanks to a fuzzy hierarchical classification [8]: when a characteristic of the patient is in the fuzzy zone around a threshold, the two treatment alternatives corresponding to "under" or "above" the threshold are proposed to the user. Figure 3 shows a session of this first version of KASIMIR/CBR.

These adaptation schemas involve some new needs in knowledge representation: the problems, the solutions and the links between them have to be made more precise, and the adaptation operators have to be represented. Answering these needs is a work in progress.

**III. PROTOCOL EVOLUTION SUGGESTIONS**

The adaptations can be used to propose evolutions of the protocol thanks to its confrontation with real cases. The idea is then to make some protocol evolution suggestions based on frequently performed adaptations. This has been studied from an ergonomic viewpoint [9]. Studying how a computer system could make such suggestions is a future work.
still under conception. Works to be done are continuation of the adaptation knowledge acquisition, representation of knowledge linked with adaptation and implementation of an adaptation engine (based in particular on the fuzzy and smooth classification algorithms described in [8]). Finally, if the research about protocol evolution is well-advanced from an ergonomic viewpoint, almost everything has to be done for it from a computer science viewpoint.

REFERENCES


