

Case-Based Reasoning Investigation of Therapy Inefficacy

Rainer Schmidt, Olga Vorobieva

ISOR is a Case-Based Reasoning system for long-term therapy support in the endocrine domain and in psychiatry. It performs typical therapeutic tasks, such as computing initial therapies, initial dose recommendations, and dose updates. Apart from these tasks ISOR deals especially with situations where therapies become ineffective. Causes for inefficacy have to be found and better therapy recommendations should be computed. In addition to the typical Case-Based Reasoning knowledge, namely former already solved cases, ISOR uses further knowledge forms, especially medical histories of query patients themselves and prototypical cases (prototypes). Furthermore, the knowledge base consists of therapies, conflicts, instructions etc. So, retrieval does not only provide former similar cases but different forms and steps of retrieval are performed, while adaptation occurs as an interactive dialog with the user. Since therapy inefficacy can be caused by various circumstances, we propose searching for former similar cases to get ideas about probable reasons that subsequently should be carefully investigated. We show that ISOR is able to successfully support such investigations.

1 Introduction

In medical practice, therapies prescribed according to a certain diagnosis sometimes do not give desired results. Sometimes therapies are effective for some time but suddenly stop helping any more. There are many different reasons. A diagnosis might be erroneous, the state of a patient might have changed completely or the state might have changed just slightly but with important implications for an existing therapy. Furthermore, a patient might have caught an additional disease, some other complication might have occurred, or a patient might have changed his/her lifestyle (e.g. started a diet) etc.

For long-term therapy support in the endocrine domain and in psychiatry, we have developed a Case-Based Reasoning system, named ISOR, that not only performs typical therapeutic tasks but also especially deals with situations where therapies become ineffective. Therefore, it first attempts to find causes for inefficacy and subsequently computes new therapy recommendations that should perform better than those administered before. An earlier presentation of ISOR can be found in [1].

ISOR is a medical Case-Based Reasoning system that deals with the following tasks: Choose appropriate (initial) therapies, compute doses for chosen therapies, update dose recommendations according to laboratory test results, establish new doses of prescribed medicine according to changes in a patient's medical status or lifestyle, find out probable reasons why administered therapies are not as efficient as they should, test obtained reasons for inefficacy and make sure that they are the real cause, and suggest recommendations to avoid inefficacy of prescribed therapies. ISOR deals with long-term diseases, e.g. psychiatric diseases, and with diseases even lasting for a lifetime, e.g. endocrine malfunctions.

For psychiatric diseases some Case-Based Reasoning systems have been developed, which deal with specific diseases or problems, e.g. with Alzheimer's disease [2] or with eating disorders [3]. Since we do not want to discuss various psychiatric problems but intend to illustrate ISOR by understandable examples, in this paper we focus mainly on some endocrine and psychiatric disorders, namely on hypothyroidism and depressive symptoms. Inefficacy of pharmacological therapy

for depression is a widely known problem (e.g. [4, 5]). There are many approaches to solve this problem. Guidelines and algorithms have been created (e.g. [6, 7]). ISOR gives reference to a psychopharmacology algorithm [6] that is available on the website <http://mhc.com/Algorithms/Depression>.

2 System architecture

ISOR is designed to solve typical problems, especially inefficacy of prescribed therapies that can arise in different medical domains. Therefore most algorithms and functions are domain independent. Another goal is to cope with situations where important patient data is missing and/or where theoretical domain knowledge is controversial.

ISOR does not generate solutions itself. Its task is to help users by providing all available information and to support them to find optimal solutions. Users shall be doctors, maybe together with a patient. In addition to the typical Case-Based Reasoning knowledge, namely former already solved cases, ISOR uses further knowledge components, namely medical histories of query patients themselves and prototypical cases (prototypes). Furthermore, ISOR's knowledge base consists of therapies, conflicts, instructions etc. The architecture is shown in figure 1. The implementation of ISOR is in Delphi 7.

In this section we explain the components and in the next chapter we present examples to show how the main knowledge components work together.

2.1 Medical case histories

Ma and Knight [8] have introduced a concept of case history in Case-Based Reasoning. Such an approach is very useful when we deal with chronic patients, because often the same complications occur again, former successful solutions can be helpful again, while former unsuccessful solutions should be avoided. The case history is written in the patient's *individual base* as a sequence of records. A patient's base contains his/her whole medical history, all medical information that is available: diseases, complications, therapies, circumstances of his/her life etc. Each record describes an episode in a patient's medical history. Episodes often characterise a specific problem. Since the *case base* is problem oriented, it contains just