

Chapter XI

Two Case-Based Systems for Explaining Exceptions in Medicine

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ABSTRACT

In medicine, a lot of exceptions usually occur. In medical practice and in knowledge-based systems, it is necessary to consider them and to deal with them appropriately. In medical studies and in research, exceptions shall be explained. In this chapter, we present two systems that deal with both sorts of these situations. The first one, called ISOR-1, is a knowledge-based system for therapy support. It does not just compute therapy recommendations, but it especially investigates therapy inefficacy. The second system, ISOR-2, is designed for medical studies or research. It helps to explain cases that contradict a theoretical hypothesis. Both systems are working in close co-operation with the user, who is not just considered as knowledge provider to build the system but is incorporated as additional knowledge source at runtime. Within a dialogue between the doctor and the system solutions respectively explanations are searched.

INTRODUCTION

Very often doctors are confronted with exceptions. This does not only happen in medical practise but also in medical research. Systems that are intended to support doctors have to take such situations into account. This does not hold only for knowledge-based systems but also for systems for supporting medical research studies. In knowledge-based systems exceptions have to be considered and dealt with appropriately. In rule-based systems this can lead to a huge amount of exceptional rules. In medical studies, statisticians are usually quite happy when a statistical test significantly supports a hypothesis. However,

when the number of cases contradicting the hypothesis is rather big, physicians are often not satisfied with significant test results but additionally wish to get explanations for the exceptional cases.

In this chapter, we present two systems that deal with both sorts of these situations. The first one, called ISOR-1, especially investigates therapy inefficacy in the course of a dialogue with the user. The second system, ISOR-2, helps to explain cases that contradict a theoretical hypothesis.

These two systems are presented separately in this chapter, one after the other, first ISOR-1, subsequently ISOR-2.

ISOR-1: INVESTIGATING THERAPY INEFFICACY

In medical practice, therapies prescribed according to a certain diagnosis sometimes do not give desired results. Sometimes therapies are effective for some time but then suddenly stop helping any more. There are many possible 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, a patient might have changed his/her lifestyle (e.g. started a diet) and so on.

For long-term therapy support, especially in the endocrine domain and in psychiatry, we have developed a Case-Based Reasoning (CBR) system, named ISOR-1, which not only performs typical therapeutic tasks but also especially deals with situations where therapies have 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.

ISOR-1 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 be
- Test obtained reasons for inefficacy and make sure that they are the real cause
- Suggest recommendations to avoid inefficacy of prescribed therapies

ISOR-1 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 (Marling and Whitehouse 2001) or with eating disorders (Bichindaritz 1994). Since we do not want to discuss various psychiatric problems but intend to illustrate ISOR by understandable examples, in this chapter we mainly focus 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. Hirschfeld, 2002; Cuffel, 2003). There are many approaches to solve this problem. Guidelines and algorithms have been created (e.g. Alacorn, 20008; Osser, Patterson, 1998). ISOR gives reference to a psychopharmacology algorithm (Osser, Patterson, 1998) that is available on the website <http://mhc.com/Algorithms/Depression>.

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