Foundations of Soft Case-Based Reasoning, Sankar K. Pal and Simon C.K. Chiu, Wiley, 2004, ISBN 0 471 08635 0.

Traditional approach to reasoning is based on logical *rules* of the type "if A then B". The main idea behind case-based reasoning is that when we need to make a decision in a new situation, we do not look for decision-making rules. Instead, we look for similar previous situations (*cases*) in which someone has already made a decision, and that decision worked well. If such cases are found, it is reasonable to make a similar decision in our new situation.

This idea sounds very reasonable, so, at first glance, this reasoning should make decision-making systems more efficient. However, in practice, very few successful decision-making systems use case-based reasoning. The main reason: it is very difficult to describe the intuitive notion of similarity in a way that a computer can understand. Similarity is a very informal, very fuzzy notion; so, to describe it adequately, it is reasonable to use the formalisms like fuzzy logic (and soft computing in general) whose main emphasis is on representing and processing such "soft", informal knowledge.

The book shows that soft computing can indeed lead to an efficient use of case-based reasoning in automated decision-making systems.

Chapter 1 introduces the basic ideas behind case-based reasoning and behind soft computing techniques (such as fuzzy logic) that the authors use to formalize the corresponding notion of similarity.

The rest of the book describes the techniques that are needed to design an efficient soft case-based reasoning system.

By definition, case-based reasoning means finding similar cases. So, to make this reasoning efficient, we must use efficient algorithms that search for similar cases; to make efficient search possible, we must develop efficient schemes for storing cases. Efficient case-storing schemes are described in Chapter 2, and the resulting efficient algorithms for case selection and retrieval are described in Chapter 3. In both problems, many soft computing techniques turn out to be very efficient:

- techniques from fuzzy logic, like fuzzy clustering, that formalize the expert's informal clustering rules;
- techniques from (Bayesian) statistics that use frequency of different situations;
- neural networks techniques that enable us to learn, i.e., to adjust our schemes as new cases are added, and
- genetic algorithms that help us optimize our choices.

Once we selected similar cases, we must now adjust the corresponding solutions to the new situation. This adjustment – called *case adaptation* – is described in Chapter 4.

After we applied the prescribed solution and got good results, we must add this situation to the list of cases on which we base our reasoning. We have already mentioned that the cases are not simply listed, they are organized so as to make search for similar cases most efficient. As a result, adding a new case to the corresponding efficient structure can be very time-consuming; often, it is more efficient to wait until we have several cases before restructuring the case base. The corresponding case-based maintenance algorithms are described in Chapter 5.

Finally, Chapter 6 describes example of working soft case-base reasoning systems. The domains of these systems range from web mining to medical diagnostics to legal reasoning (of course) to shoe design.

The book is well-written and self-contained. For readers who are not familiar with the basic soft computing techniques, fuzzy, neural, general, and rough set techniques are described in special appendices. Every chapter (and each appendix) has a list of helpful references.

This book can be used by students who want to learn the new techniques, it can be used by practitioners who want to design new decision-making systems, and it can be used by researchers who want to study the existing techniques – so that they will be able to come up with better ones.

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