Peter Funk
Pedro A. González Calero (Eds.)

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Advances in Case-Based Reasoning

7th European Conference, ECCBR 2004
Madrid, Spain, August/September 2004
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Lecture Notes in Artificial Intelligence 3155

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Preface

The 7th European Conference on Case-Based Reasoning (ECCBR 2004) was held from August 30 through September 2, at the Complutense University of Madrid, Spain. ECCBR was born in Aberdeen, UK (2002), after a series of European workshops held in Trento, Italy (2000), Dublin, Ireland (1998), Lausanne, Switzerland (1996), Paris, France (1994), and Kaiserslautern, Germany (1993). ECCBR is the premier international forum for researchers and practitioners of case-based reasoning (CBR) in the years interleaving with the biennial international counterpart ICCBR, whose 5th edition was held in Trondheim, Norway in 2003.

The CBR community has shown for years a deep interest in the application of its research to real-world problems. As a result, the first day of both ECCBR and ICCBR has been traditionally dedicated to presenting industrial CBR applications. ECCBR 2004 Industry Day was co-chaired by Mehmet Göker and Francisco Martín who invited professionals from different fields to describe their fielded CBR systems. The second day of the conference was dedicated to four workshops focusing on the following research interests: CBR in health sciences, explanation in CBR, computational creativity, and CBR applied to time series prediction. We are grateful to the Workshop Program co-chairs, Pablo Gervás and Kalyan Moy Gupta, for their efforts in coordinating these workshops, along with the individual workshop chairs and participants. Materials from the Industry Day and the workshops were published separately and can be obtained from the ECCBR 2004 website, http://www.idt.mdh.se/eccbr/.

This volume comprises the papers presented at the conference organized into three sections: two invited papers are followed by 31 research papers and 25 application papers. Especially relevant is the number of applied research papers in wide-ranging application areas, such as traffic control, Web search, music generation, object recognition, medicine, and software engineering. The quality of the submitted papers was unusually high this year, and of the total of 85 submissions, the program committee selected 24 papers for oral presentation and 32 papers for poster presentation. Papers presented as posters were classified by the reviewers to be more suitable for a limited interacting audience and three time slots of the conference were dedicated to poster sessions.

The chairs would like to thank all those who contributed to the success of ECCBR 2004. Particular thanks goes to all the program committee and additional reviewers without whose time and effort this volume of selected papers would not exist. We also wish to thank the invited speakers, Agnar Aamodt and Mehmet Göker, and all session chairs. A special thanks goes to Luis Hernández-Yáñez and Mercedes Gómez-Albarrán for local arrangements, Pablo Beltrán-Ferruz and Federico Peinado-Gil for preparing the proceedings, and Ning Xiong for his assistance in the paper selection process. Finally, we gratefully acknowl-

edge the generous support of the sponsors of ECCBR 2004 and of Springer-Verlag for its continuing support in publishing this volume.

June 2004

Peter Funk
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Knowledge-Intensive Case-Based Reasoning in CREEK

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Abstract. Knowledge-intensive CBR assumes that cases are enriched with general domain knowledge. In CREEK, there is a very strong coupling between cases and general domain knowledge, in that cases are embedded within a general domain model. This increases the knowledge-intensiveness of the cases themselves. A knowledge-intensive CBR method calls for powerful knowledge acquisition and modeling techniques, as well as machine learning methods that take advantage of the general knowledge represented in the system. The focusing theme of the paper is on cases as knowledge within a knowledge-intensive CBR method. This is made concrete by relating it to the CREEK architecture and system, both in general terms, and through a set of example projects where various aspects of this theme have been studied.

1 Introduction

A knowledge-intensive case-based reasoning method assumes that cases, in some way or another, are enriched with explicit general domain knowledge [1,2]. The role of the general domain knowledge is to enable a CBR system to reason with semantic and pragmatic criteria, rather than purely syntactic ones. By making the general domain knowledge explicit, the case-based reasoner is able to interpret a current situation in a more flexible and contextual manner than if this knowledge is compiled into predefined similarity metrics or feature relevance weights. A knowledge-intensive CBR method calls for powerful knowledge acquisition and modeling techniques, as well as machine learning methods that take advantage of the general knowledge represented in the system.

In the CREEK system [3,4,5], there is a strong coupling between cases and general domain knowledge in that cases are submerged within a general domain model. This model is represented as a densely linked semantic network. Concepts are inter-related through multiple relation types, and each concept has many relations to other concepts. The network represents a model of that part of the real world which the system is to reason about, within which model-based reasoning methods are applied. From the view of case-specific knowledge, the knowledge-intensiveness of the cases themselves are also increased, i.e. the cases become more "knowledgeable", since their features are nodes in this semantic network.

The focusing theme of this paper is cases as knowledge within a knowledge-intensive CBR method. This will be made concrete by relating it to the CREEK architecture and system, both in general terms, and through a set of example projects where various aspects of this theme have been studied. To give an initial hint at the

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main issue, Fig. 1 characterizes some aspects of CBR methods along what may be called the knowledge-intensiveness dimension. The early nearest-neighbour-based methods are at the one end of the scale, while the CREEK system is illustrated closer the other end. Some typical characterizations of knowledge-intensive CBR methods (right part) and knowledge-empty or knowledge-lean methods (left part), are listed.

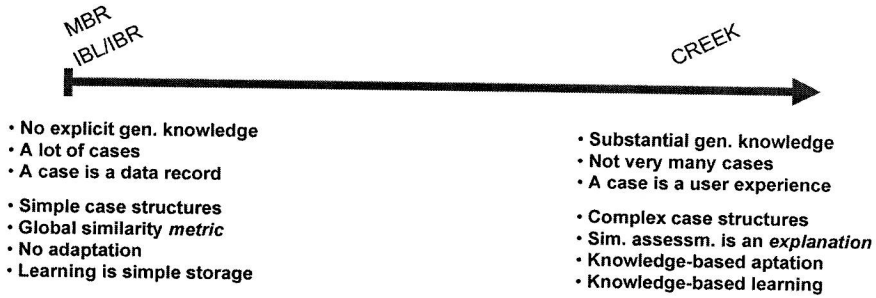

Fig. 1. The knowledge-intensiveness dimension of CBR methods

As Fig. 1 indicates, the notion of knowledge-intensiveness is not an either/or issue. CBR systems may be more or less knowledge-intensive. The meaning of the term "knowledge-intensive" may also vary, depending on what viewpoint to the concept of knowledge that an author or research group has. Further, when we look at the contents of a case, what some people refer to as knowledge may be referred to as information by others – or even as data. This is not surprising, since a data structure, such as a case, can serve several roles in a system. In order to get a better understanding of the concept of knowledge, as it is interpreted in CREEK, we will therefore start by clarifying what we see as the main distinction between knowledge, information, and data, related to the different roles a case may have. The next chapter defines the three terms from that perspective.

Explicit models of knowledge call for effective knowledge modeling methods and tools, both for manual model development and automated methods, i.e. machine learning. To support systems development within the CREEK architecture, some assumptions on the nature of knowledge modeling has been made, and an assisting tool has been developed to assist the knowledge modeling process. This is the topic of chapter 3. In chapter 4 the CREEK architecture and system is summarized, emphasizing knowledge content and how it is processed. Chapter 5 illustrates the architecture and system through a summary of recent and ongoing research projects. The paper is summarized and concluded in the final chapter.

2 What Is Knowledge in a CBR System?

There is, in general, no known way to distinguish knowledge from information or data on a purely representational basis. Attempts to make distinctions based on size or complexity are therefore likely to fail. Another option - and the one underlying the CREEK architecture - is to identify how and for what purpose the structures are used, i.e. what the various *roles* of data, information, and knowledge are in a case-based