Héctor Muñoz-Avila
Francesco Ricci (Eds.)

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Case-Based Reasoning Research and Development

6th International Conference
on Case-Based Reasoning, ICCBR 2005
Chicago, IL, USA, August 2005, Proceedings

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Preface

The International Conference on Case-Based Reasoning (ICCBR) is the preeminent international meeting on case-based reasoning (CBR). ICCBR 2005 (`http://www.iccbr.org/iccbr05/`) was the sixth in this series of biennial international conferences highlighting the most significant contributions to the field of CBR. The conference took place during August 23–26, 2005 at the downtown campus of DePaul University, in the heart of Chicago's downtown "Loop." Previous ICCBR conferences were held in Trondheim, Norway (2003), Vancouver, Canada (2001), Seeon, Germany (1999), Providence, Rhode Island, USA (1997), and Sesimbra, Portugal (1995).

Day 1 of ICCBR 2005 was Industry Day, which provided real-world experiences utilizing CBR in fielded applications. Day 2 featured various workshops on CBR in the health sciences, textual case-based reasoning, computer gaming and simulation environments, and similarities – Processes – Workflows. Days 3 and 4 comprised presentations and posters on theoretical and applied CBR research, as well as invited talks from three distinguished scholars: Derek Bridge, University College Cork, Craig Knoblock, University of Southern California, and Colleen Seifert, University of Michigan.

The presentations and posters covered a wide range of CBR topics, including adaptation, applications, case base maintenance, computer games, creative reasoning, knowledge representation, interactive systems, knowledge management, knowledge acquisition, multiagent collaborative systems, similarity, tutoring systems, bioinformatics, and textual CBR.

This volume comprises papers for all of the presentations and posters. These 45 papers were chosen after a highly selective process. Of a total of 74 submissions, the Program Committee selected 19 papers for oral presentation and 26 papers for poster presentation. Each submission was identified as being in one of three categories and judged using the following criteria: 1. Theoretical/methodological research paper (scientific significance; originality; technical quality; and clarity). 2. Applied research paper (significance for scientific research or innovative commercial deployment; originality; technical quality; and clarity). 3. Deployed application paper (demonstrated practical, social, environmental or economic significance; originality; treatment of issues of engineering, management and user acceptance; and clarity).

Many people participated in making ICCBR 2005 a success. Robin Burke, DePaul University, served as Local Chair, with Héctor Muñoz-Avila, Lehigh University, and Francesco Ricci, ITC-irst, as Program Co-chairs. We would especially like to thank Stefanie Brüninghaus, University of Pittsburgh, for serving as Workshop Coordinator, and Mehmet H. Göker, PricewaterhouseCoopers, and Bill Cheetham, GE Research, for chairing Industry Day. We thank the Program Committee and the additional reviewers for their thoughtful and timely

participation in the paper selection process. Finally, we gratefully acknowledge the generous support of the sponsors of ICCBR 2005 and of Springer for its continuing support in publishing the proceedings of ICCBR.

May 2005

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Table of Contents

Invited Talks

Scientific Papers

The Virtue of Reward: Performance, Reinforcement and Discovery in Case-Based Reasoning

Derek Bridge

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Agents commonly reason and act over extended periods of time. In some environments, for an agent to solve even a single problem requires many decisions and actions. Consider a robot or animat situated in a real or virtual world, acting to achieve some distant goal; or an agent that controls a sequential process such as a factory production line; or a conversational diagnostic system or recommender system. Equally, over its life time, a long-lived agent will make many decisions and take many actions, even if each problem-solving episode requires just one decision and one action. In spam detection, for example, each incoming email requires a single classification decision before it moves to its designated folder; but continuous operation requires numerous decisions and actions.

Reasoning and acting over time is challenging. A learner's experiences may prove unrepresentative of subsequent problems; a changing environment can render useless the system's knowledge. A system that tries to solve hard combinatorial problems, for example, may find, through exploration in the space of solutions, that earlier training examples are suboptimal. Concept drift in spam detection is another example: spammers send new kinds of unwanted email or find new ways of disguising spam as ham. Agents must be highly adaptive if, over time, they are to attain and maintain high standards of, for example, accuracy, coverage and efficiency.

To address these challenges in case-based agents, I have been drawing ideas from another field, that of *classifier systems*. Classifier systems, first proposed by John Holland, are rule-based systems. They comprise a performance component, a reinforcement component and a discovery component. The performance component chooses the agent's actions. The other two components enable classifier systems to exhibit two kinds of plasticity, parametric plasticity and structural plasticity. The reinforcement component uses feedback from the environment to update rule quality parameters. The discovery component uses genetic operators and other techniques to propose new rules, which may displace existing rules.

I will describe my attempts to build a case-based counterpart to Stewart Wilson's XCS, which is one of the most popular, modern classifier systems. I will describe each of its three components. In discussing the reinforcement component, I will offer reflections on the relationship between Case-Based Reasoning and reinforcement learning. In discussing the discovery component, I will offer reflections on automatic case discovery and case base maintenance.

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