The Third International Conference on Case-Based Reasoning (ICCBR'99)

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Abstract

The Third International Conference on Case-Based Reasoning was held at the Seeon Monastery, Bavaria, July 27—30, 1999. About 120 researchers from 21 countries attended. The conference included four workshops, three invited talks, 24 technical presentations, a poster session, and an "Industry Day," where the focus was on mature technologies and applications in industry.

Case-Based Reasoning

Case-based reasoning (CBR) is a problem-solving paradigm that uses exemplars or previous solutions to solve new problems [Aamodt and Plaza, 1994, Kolodner, 1993]. Three characteristics of CBR account for its growing popularity. First, CBR can reduce search. Solution reuse is compatible with a wide range of problem-solving methods, so a CBR component can be used in many types of problem-solving systems. When similar problems recur, CBR can significantly improve performance. This performance improvement can be particularly significant for problems with large search spaces, such as planning and design [Koton, 1988, Veloso, 1994, Branting and Aha, 1995, Bergmann and Wilke, 1996].

The second characteristic is that CBR permits problem solving even when the underlying domain theory is incomplete. This is beneficial in domains, such as medicine [Porter et al., 1990] and law [Ashley, 1990, Skalak and Rissland, 1992], in which reasoning depends on vague or context-dependent concepts, such as "reasonable care" or "probable cause." The ability to yield useful results in the absence of a complete domain theory also means that CBR systems can begin to provide useful performance while still under construction [Acorn and Walden, 1992, Varma, 1999].

Finally, CBR can facilitate knowledge acquisition. Although human experts can seldom articulate general problem-solving rules, they can often explain the solutions to particular problems. Thus, knowledge engineering tends to be easier for CBR systems. Moreover, many governmental and commercial institutions have vast repositories of reports on repairs, accidents, and other incidents. CBR provides a mechanism for converting these repositories into useful help-desk, lessons-learned, or advisory systems much more quickly and inexpensively than alternative approaches [Bergmann et al., 1999, Aha and Weber, 2000].

Current activity within the CBR community tends to fall into two broad strands. One area of activity emphasizes theoretical issues in representation, indexing and retrieval, and adaptation. Often the target domains are characterized by complex representations, large search spaces, or incomplete domain theories. The second area of activity emphasizes the pragmatic issues of implementation, integration into business processes, and system maintenance. The target domains often involve help-desks or sales.

Prior to 1995, there was relatively little interaction between the North American and European CBR communities. The first International Conference on Case-Based Reasoning [Veloso and Aamodt, 1995], held in Sesimbra, Portugal, brought these communities together. Subsequent ICCBRs have been on alternate sides of the Atlantic. The Third International Conference on Case-Based Reasoning [Leake and Plaza, 1997] was held at the Seeon Monastery, Bavaria, July 27–30, 1999. Continuing an ICCBR tradition of having chairs from both sides of the Atlantic, the ICCCR'99 conference chair was Ralph Bergmann (University of Kaiserslautern), and Klaus-Dieter Althoff (Fraunhofer Institute for Experimental Software Engineering) and L. Karl Branting (University of Wyoming) were program co-chairs.

Industry Day

The conference began with an Industry Day, chaired by Brigitte Bartsch-Spörl (from BSR Consulting Munich) and Wolfgang Wilke (from tec:inno GmbH, Kaiserslautern). The Industry Day presentations illustrated a number of successful commercial applications of CBR in the US and Europe.

In his invited talk, Ian Watson reviewed several applications in the United States (Lockheed, Compaq, and Broderbund) and showed how CBR can successfully be commercialized. He concluded that the future of CBR is in online applications, such as product selection and self-service in e-commerce.

Four successful commercial applications then were presented. The first presentation described the use of CBR for a service hotline at Mercedes Benz. The second talk illustrated the use of CBR for knowledge management by Nuon, a Dutch energy provider, which re-engineered its entire customer service process around a CBR model. The next two presentations dealt with the application of CBR to e-commerce. Quoka uses CBR for the retrieval of advertisements and provides a natural language user interface. Finally, 'Let on the Net,' a CBR-based on-line market for the rental of houses and apartments, made Hooke and Macdonald the market leaders in the new-homes sector in Ireland.

In a concluding talk on the key factors for the success of CBR in practice, Brigitte Bartsch-Spörl stressed the importance of non-technical issues in application projects, such as profitability calculations and social and psychological factors.

Industry Day was accompanied by an exhibition of commercial CBR tools and demonstrations of successful applications.

Workshops

Four concurrent workshops were held on the morning of the second day of the conference. Two focused on business applications: "Integration of CBR in Business Processes" and "Practical CBR Strategies for Building and Maintaining Corporate Memories." The other two workshops focused on theoretical issues: "Formalisation of Adaptation in CBR" and "Hybrid CBR Systems."

"Integration of CBR in Business Processes" addressed the organizational processes involved in development and maintenance of CBR systems. Discussion focused on the life-cycle of cases and the impact of CBR systems on organizations. "Practical CBR Strategies for Building and Maintaining Corporate Memories" also concerned the business environment, but focused instead on methodologies for knowledge management.

"Formalisation of Adaptation in CBR" addressed the most complex aspect of CBR: adaptation of prior solutions to solve new problems that differ in some significant respect. Adaptation is typically required for synthesis tasks, such as planning, design, or configuration, because solutions have a complex structure that must be modified to apply to new problems. This workshop addressed the elusive goal of developing a domain-independent model of adaptation.

As mentioned above, CBR is compatible with a wide range of problem-solving methods. A variety of CBR hybrids are therefore possible. "Hybrid

CBR Systems" focused on the synergies that can be obtained from integration of CBR with other problem-solving paradigms.

Invited Talks

CBR is an increasingly popular technique for electronic commerce. The first invited talk, "Intelligent Systems in Electronic Commerce" by Padraig Cunningham, discussed the relationship between CBR and alternative approaches to product selection, such as collaborative filtering or constraint-based retrieval. Several promising applications were discussed.

Boi Faltings presented the second invited talk, entitled "Case Adaptation - New Perspectives for CBR." Faltings stressed the centrality of adaptation to CBR, arguing that without adaptation CBR is no different from information retrieval. This view generated some controversy, since many commercial systems perform no adaptation. This controversy mirrored the underlying division between motives for using CBR: reduction of search in complex domains vs. fast knowledge acquisition in commercial domains.

The final invited talk, by Kevin Ashley, was on "Text-Based CBR." CBR involves reuse of prior experiences, and prior experiences are recorded in textual form by many commercial and governmental institutions. Constructing CBR systems for domains with textual cases can therefore be automated using some combination of information extraction, machine learning, and natural language processing techniques. However, the precise combination of techniques that yield the best results for a given domain is frequently unclear. Research in text-based CBR is still in its early stages, e.g. [Lenz and Ashley, 1998], but the long-term benefits of this line of research are likely to be very great.

Paper Presentations

The 24 technical paper presentations and 20 posters covered topics ranging from the sublime (expressive musical performance) to the mundane (locomotive diagnosis). Themes that seemed more popular in ICCBR'99 than in previous ICCBRs included maintenance and integration. CBR system maintenance includes such issues as policies for updating case libraries to remove cases that have become outdated, editing case libraries to select the most predictive cases, and selecting new cases for inclusion. Integration, mentioned above, consists of techniques for combining CBR with other, complementary, problem-solving paradigms so that each technique compensates for weaknesses of the other.

As in past ICCBRs, numerous papers addressed theoretical issues concerning retrieval (probability based metrics, annotated case summaries, footprint-based retrieval) and adaptation (evolutionary approaches, a knowledge-level task model of adaptation). Further topics covered included planning (coordination of search and rescue operations, flexibly interleaving processes, interactive case-based HTN planning), design (engineering design support, footwear design, reusability in system design), diagnosis (case-oriented tutoring, locomotive diagnostics, welding robot diagnosis), and vision (image segmentation architecture, reuse of image processing knowledge).

The numerous successful applications described in ICCBR'99 papers illustrate that CBR has matured into a technology well-suited for a wide range of practical problems. The broader lesson for AI is that the effectiveness CBR demonstrates the power of a tight integration of machine learning with problem solving.

Further Information

For additional information on ICCBR'99, see `http://www.iccbr.org/iccbr99`. The conference proceedings of ICCBR'99 are published in

> Klaus-Dieter Althoff, Ralph Bergmann, and L. Karl Branting (Eds.) Case-Based Reasoning Research and Development, LNAI 1650. Springer Verlag, 1999, ISBN 3-540-66237-5.

On the occasion of ICCBR, the international journal *Engineering Applications of Artificial Intelligence* published a special issue, guest-edited by Ralph Bergmann, which contains extended versions of the best ICCBR papers describing Engineering Applications of CBR :

> Engineering Applications of Artificial Intelligence, 12 (6) 1999, Elsevier.

Workshop proceedings are available from the University of Kaiserslautern:

Sascha Schmitt and Ivo Vollrath (Volume Eds.) Challenges for Case-Based Reasoning: Proceedings of the ICCBR'99 Workshops. Report LSA-99-03E, Centre for Learning Systems and Applications, University of Kaiserslautern.

ICCBR'01 will be held in Vancouver, Canada, immediately prior it IJCAI-01. The conference chair is Qiang Yang and the programme chairs are David Aha and Ian Watson.
For further information contact `http://www.iccbr.org/iccbr01`.

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