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Guest editors' introduction: special issue on case-based reasoning

David B. Leake[1] · **Barry Smyth**[2] · **Rosina Weber**[3]

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This Special Issue contains three articles providing samples of current case-based reasoning (CBR) research. Case-based reasoning systems perform problem-solving and interpretation based on a library of prior cases, called the case base. Given a new problem, CBR systems generate solutions by retrieving the most relevant prior case(s) in the case base, and adapting their solutions to fit new circumstances. Each new solution then becomes the basis of a new case, available to be stored. The capture of new cases can provide speedup learning by making available new cases, which require less adaptation for similar problems. In addition, the capture of new cases can increase competence if the application of a solution reveals flaws, which are then corrected to form a new case avoiding the problems. By leveraging readily-available prior experiences, rather than relying on extracting complex (and hard to come by) domain knowledge, case-based reasoning has enjoyed success in many application contexts and has been widely applied, giving rise to numerous fielded applications.

The articles in this issue illustrate three important directions in CBR research. The primary locus of "reasoning" in CBR is the case adaptation step, but a classic problem for CBR is how to acquire the knowledge required to perform that case adaptation. One of the responses of the CBR community has been to apply machine learning methods to generating case adaptation knowledge. "Enhancing Case-Based Regression with Automatically-Generated Ensembles of Adaptations," by Jalali and Leake, shows how the ability to generate adaptation rules can be leveraged by the application of rule ensembles.

✉ David B. Leake
leake@indiana.edu

Barry Smyth
barry.smyth@ucd.ie

Rosina Weber
rosina@drexel.edu

[1] School of Informatics and Computing, Indiana University, Bloomington, IN, USA

[2] Insight Centre for Data Analytics, School of Computer Science, University College Dublin, Dublin, Ireland

[3] College of Computing and Informatics, Drexel University, Philadelphia, PA, USA

As CBR systems learn new cases, increased case base size may result in increased retrieval times. A substantial current of CBR research studies case base maintenance, and especially how to guide strategic deletion of cases to yield compact competent case bases. A challenge is that the most suitable approaches may depend on the characteristics of the particular case base. The article "Case-base Maintenance with Multi-Objective Evolutionary Algorithms," by Lupiani, Massie, Craw, Juarez, and Palma, frames case base maintenance as a multi-objective optimization problem and presents a domain-independent approach providing effective maintenance across a range of domain variations.

One of the highest impact CBR applications areas is recommender systems. In addition to their practical challenges, they provide a rich vein of research challenges, especially related to determining product similarity. The article "Combining Similarity and Sentiment in Opinion Mining for Product Recommendation," by Dong, O'Mahony, Schaal, McCarthy, and Smyth, addresses the particularly challenging problem of recommendation when conventional product descriptions are unavailable or incomplete, by mining the unstructured and noisy information available in user reviews, including user sentiment.

Each of the articles has been framed to be accessible to those with limited background knowledge of case-based reasoning. For those who wish to discover more about CBR, the fundamentals of the CBR process are described in a number of articles (e.g., (Aamodt and Plaza 1994; Leake 1996a; de Mántaras et al. 2005)) and books (e.g., (Riesbeck and Schank 1989; Kolodner 1993; Leake 1996b; Watson 1997; López 2013; Richter and Weber 2013)). ICCBR is an international conference on case-based reasoning, which is held annually.

References

Aamodt, A., Plaza, E. (1994). Case-based reasoning: Foundational issues, methodological variations, and system approaches. *AI Communications*, *7*(1), 39–52 http://www.iiia.csic.es/People/enric/AICom.pdf.

Kolodner, J. (1993). *Case-Based Reasoning*. San Mateo: Morgan Kaufmann.

Leake, D. (1996). CBR in context: The present and future. In Leake, D., (ed.), *Case-based reasoning: Experiences, lessons, and future directions* (pp. 3–30). Menlo Park: AAAI Press http://www.cs.indiana.edu/~leake/papers/a-96-01.html.

Leake, D. (Ed.). (1996b). *Case-Based Reasoning: Experiences, Lessons, and Future Directions*. Menlo Park: AAAI Press/MIT Press.

López de Mántaras, R., McSherry, D., Bridge, D., Leake, D., Smyth, B., Craw, S., Faltings, B., Maher, M., Cox, M., Forbus, K., Keane, M., Aamodt, A., Watson, I. (2005). Retrieval, reuse, revision, and retention in CBR. *Knowledge Engineering Review*, *20*(3).

López, B. (2013). *Case-Based Reasoning: A concise introduction*. San Mateo: Morgan Kaufmann.

Richter, M., & Weber, R. O. (2013). *Case-Based Reasoning: A Textbook*. Berlin: Springer.

Riesbeck, C., & Schank, R. (1989). *Inside Case-Based Reasoning*. Hillsdale: Lawrence Erlbaum.

Watson, I. (1997). *Applying Case-Based Reasoning: Techniques for Enterprise Systems*. San Mateo: Morgan Kaufmann.