Integrating diverse information resources in a case-based design environment

David B. Leake, Larry Birnbaum, Kristian Hammond, Cameron Marlow, and Hao Yang

a Computer Science Department, Indiana University, Lindley Hall, 150 S. Woodlawn Ave, Bloomington, IN 47405, USA
b Intelligent Information Laboratory, Computer Science Department, Northwestern University, 1890 Maple Avenue, Evanston, IL 60201, USA
c The Media Laboratory, Building E15, Massachusetts Institute of Technology, 77 Massachusetts Ave, Cambridge, MA 02139, USA
d PDC, MD 270, GB-D68, Vehicle Operations, Ford Motor Co., 21500 Oakwood Blvd, Dearborn, MI 48124, USA

Received 1 December 1998; accepted 1 August 1999. Available online 2 December 1999.

Abstract

The success of case-based design aids depends both on the case-based reasoning processes they apply and on effectively integrating those processes into the larger task context: on making the case-based reasoning component present case information at the right time and in the right way, on exploiting additional information resources as needed to supplement the case library and to guide case application, on capturing useful information from current reasoning and providing it to up- and down-stream designers, and on unobtrusively learning new cases during the design process. This article presents a set of principles and techniques for integrated case-based design support systems and illustrates their application through a case study of the Stamping Advisor, a system to support feasibility analysis for sheet metal automotive parts.

Author Keywords: Case-based reasoning; Design; Information integration; Information retrieval; Just-in-time retrieval; Knowledge management

Article Outline

1. Introduction
2. The Stamping Advisor domain
3. Principles for integrated intelligent design support
3.1. Realizing these principles
4. The Stamping Advisor’s architecture
5. Representing feasibility analysis cases
6. Coordinating case presentation with the reasoning of feasibility engineers
7. The case-retrieval process
8. Integrated information access
References


Corresponding author. Tel.: +1-812-855-9756; fax: +1-812-855-4829; email: leake@cs.indiana.edu

**Vitae**

Leake: **David Leake** is an Associate Professor of Computer Science and member of the Cognitive Science faculty at Indiana University. He received his Ph.D. in Computer Science from Yale University in 1990. His primary research interests are case-based reasoning, goal-driven learning, and strategic information search. He Co-Chaired the Second International Conference on Case-Based Reasoning (ICCBR-97) and edited the book *Case-Based Reasoning: Experiences, Lessons, and Future Directions* (AAAI Press, 1996). He is the Editor of *AI Magazine*.

Birnbaum: **Larry Birnbaum** is Chair of the Computer Science Department and Associate Professor of Computer Science and the School of Education and Social Policy at Northwestern University. He received his Ph.D. in Computer Science from Yale University in 1986. His research interests include interface design and intelligent interfaces; computers and education; natural language understanding; computer vision; and machine learning.
Hammond: **Kristian Hammond** is a Professor of Computer Science at Northwestern University. He received his Ph.D. in Computer Science from Yale University in 1986. Through 1998 he was the Director of the Artificial Intelligence Laboratory at The University of Chicago, where he led projects investigating intelligent agents in a wide range of domains. He recently founded the Intelligent Information Laboratory to focus on issues of information access and management arising out of the high-speed computer connectivity of the modern world. The Info Lab charter is to invent and creatively exploit new information technologies that respond to and support human goals within complex computer environments.

Marlow: **Cameron Marlow** is a doctoral student at the MIT Media Laboratory. He received a B.S. degree at The University of Chicago in 1999. His primary research interests involve methods for using context to better satisfy users’ information needs, intelligent indexing, and integrating case-based reasoning with information retrieval.

Yang: **Hao (Howie) Yang** is a process development engineer at the Vehicle Operations division of the Ford Motor Company. He received a Ph.D. in Mechanical Engineering from the University of Missouri-Rolla in 1994. His research interests are in the areas of CAD/CAM, feature-based design, intelligent design and manufacturing systems, case-based reasoning, and knowledge management.