

The Omnipresence of Case-Based Reasoning in Science and Application

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Knowledge-Based Systems
1998

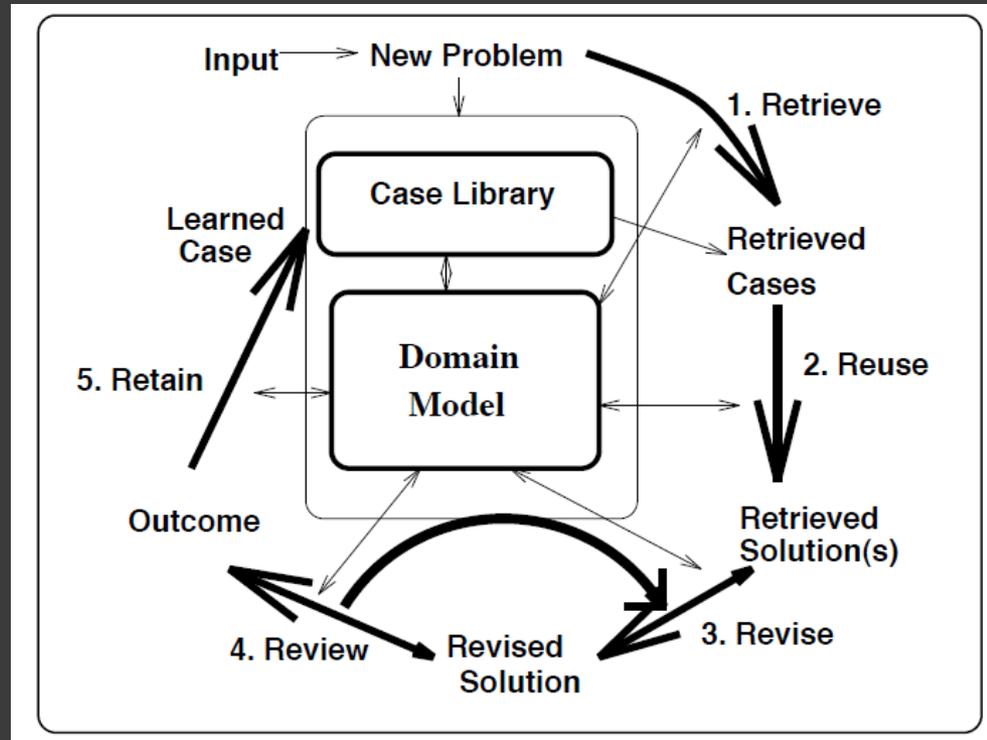
Presented by Rui Liu

Overview

- ⦿ Companion paper based on an invited talk at Seventeenth SGES, 1997
- ⦿ Introduction of CBR
- ⦿ The Omnipresence of CBR
 - Omnipresence in Science
 - Omnipresence in Application
- ⦿ Successes VS Failures
- ⦿ Predictions for CBR

Introduction of CBR

- Five top-level steps



CBR Problem Solving Cycle (Adapted from (David,1998))

- Cognitive view (Schank & Abelson,1977)

The Omnipresence of CBR

Omnipresence



What? Why? Where?

The Omnipresence of CBR

- **What?**
- Rather than complete CBR problem-solving cycle, but lazy problem solving

- **3Ds**

Defer

Data-driven

Discard

- Example: k-nearest neighbour classifier
- Contrast: eager algorithms
 - Example: Greedily induce decision trees (Quinlan, 1993a)

The Omnipresence of CBR

- ◎ **Why?**
- ◎ **Benefits:**
 - Elicitation
 - Problem Solving Bias
 - Incremental Learning
 - Disjunctive Solution Spaces
 - Precedent Explanations
 - Sequential Problem Solving
 - **Most compelling reason: highly intuitive**
- ◎ **Some more later...**

The Omnipresence of CBR

◉ Where?

Table 1: Some Research Areas Related to Lazy Problem Solving

Research Area	Topic
Cognitive Psychology	Exemplar models
Pattern Recognition	Edited k -nearest neighbor classifiers
Machine Learning	More than just instance-based approaches
Cognitive Science	CBR, Analogy
Information Retrieval	Document retrieval
Statistics/Robotics	Locally weighted regression
Data Structures	Recent variants on k -d trees
Software Engineering	Software reuse
Process Planning	Variant process planning

CBR related research (Adapted from (David,1998))

◉ Details in first three later...

Omnipresence in Science

◉ **Where cont.**

- Cognitive Psychology
 - Combine process model to representation
- Pattern Recognition
 - Benefit from studies on case deletion
- Machine Learning
 - Eager realizations of lazy approaches
 - Lazy realizations of eager approaches
 - Loose integrations of lazy and eager approaches

Omnipresence in Science

- **Is CBR a good choice for poker-bot?**
 - Incremental learning
 - Highly disjunctive spaces
 - Sequence-based reasoning
 - Query-specific reasoning
 - Training speed
 - Missing values
 - Precedent explanation
- A pros vs. Cons before making your decision

Omnipresence in Application

- ⦿ Details see (Watson, 1997)
- ⦿ Navy CBR applications
 - Feature selection
 - Using case-based classifier for feature evaluator and classifier
 - Robotic Navigation
 - Tolerate sensor failures
 - Interactive Troubleshooting
 - Conversational CBR

Successes and Failures of CBR

⦿ Successes

- Interactive Troubleshooting
- Recommenders
- Internet Commerce

⦿ Failures

- Corporate Support
 - Killed future CBR applications at Nestle/UK
- Knowledge Acquisition
 - Abandon CBR application due to case authoring task
- Scope of Applicability
 - Mismatching the capabilities of CBR and tasks

Predictions for CBR

- Continuing Current Trends
- Information Retrieval
- System Monitoring
- Knowledge Management
- One more: increase in interdisciplinary research(applications)

Thank you!

Questions?