The Omnipresence of Case-Based Reasoning in Science and Application

David W. Aha

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?

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<tr>
<td>Cognitive Psychology</td>
<td>Exemplar models</td>
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<td>Pattern Recognition</td>
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<td>Machine Learning</td>
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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?