Adaptation Knowledge Discovery from a Case Base

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① Adaptation in Case-Based Reasoning

<table>
<thead>
<tr>
<th>src</th>
<th>( \Delta pb )</th>
<th>tgt</th>
</tr>
</thead>
<tbody>
<tr>
<td>sol(src)</td>
<td>( \Delta sol )</td>
<td>sol(tgt)</td>
</tr>
</tbody>
</table>

- Transformational approach
- \( \Delta pb \), AK \( \rightarrow \Delta sol \), AK: Adaptation Knowledge
- AK: Adaptation Knowledge Acquisition

② [Hanney and Keane, 1996]’s AKA

- Idea: learning adaptation knowledge from variations within the case base

③ Our Proposal: CabamakA

- Reuse of Hanney and Keane’s main principles
- Use of Knowledge Discovery in Databases (KDD) principles and techniques
- The KDD process is iterative and interactive (with the help of the analyst: a domain expert).

KDD Steps

- Preparing the data: Formatting and Filtering
  - Formatted data
  - Information elements
- Data Mining
  - Knowledge units
- Interpretation
  - Each FCI may be interpreted as an adaptation rule.
  - The analyst validates/corrects/generalizes the adaptation rule.

④ Application to the CBR System Kasimir [Lieber et al., 2002]

A problem: a description of a patient with breast cancer
A solution: a therapeutic decision

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<tr>
<th>src</th>
<th>sol(src)</th>
<th>tgt</th>
</tr>
</thead>
<tbody>
<tr>
<td>patient with 45 (age:&lt;70), margins: 0.5 cm, Nutrine, having had a radical mastectomy, radiation therapy with a dose of 50Gy</td>
<td>{radiotherapy, 50Gy}</td>
<td></td>
</tr>
</tbody>
</table>

⑤ Formatting Step 1

Transformation into boolean properties (with deductive closure given the domain ontology)

\( \Phi(\text{src}) = \{\text{age} \geq 30, \text{age} \leq 70, \text{margins} > 0.5, \text{Ntrue}\} \)

⑥ Formatting Step 2

\( T_{ij} \)

⑦ Filtering Step

- Noise reduction
- Focus the knowledge discovery task on special subsets of objects and/or attributes

⑧ Data-Mining Step: Frequent Closed Itemset (FCI) Extraction

- Item: boolean property
- Transactions \( T_{ij} \)
- A frequent itemset \( I \) such that

\[
\text{support}(I) = \frac{\text{number of } T_{ij} \text{ such that } T_{ij} \supseteq I}{\text{number of } T_{ij}} \geq \text{given threshold}
\]

\( L = \{\text{margins} < 0.5\}, \{\text{margins} > 0.5\}\) 

References


