Ontology Management with the Prompt Plugin

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The Ideal World

- The same language
- No overlap in coverage
- No new versions
- A single extension tree
- Small reusable modules
The Real World

- The same language
- No overlap in coverage
- No new versions
- A single extension tree
- Small reusable modules
What We Need

- Find similarities and differences between ontologies
  - ontology mapping and merging
- Compare versions of ontologies
  - ontology evolution
- Extract meaningful portions of ontologies
  - ontology views
Mapping and Merging

Existing ontologies
- cover overlapping domains
- use the same terms with different meaning
- use different terms for the same concept
- have different definitions for the same concept
"Basically, we're all trying to say the same thing."
iPrompt: An Interactive Ontology-Merging Tool

- **iPrompt provides**
  - Partial automation
  - Algorithm based on
    - concept-representation structure
    - relations between concepts
    - user’s actions
- **iPrompt does not provide**
  - complete automation
iPrompt Algorithm

Make initial suggestions

Select the next operation

Perform automatic updates

Find inconsistencies and potential problems

Make suggestions
iPrompt: Initial Suggestions
<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Cardinality</th>
<th>Other Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>has_employes--cmu</td>
<td>String</td>
<td>multiple</td>
<td>classes={Person}</td>
</tr>
<tr>
<td>age--cmu</td>
<td>Integer</td>
<td>multiple</td>
<td></td>
</tr>
<tr>
<td>name--cmu</td>
<td>String</td>
<td>multiple</td>
<td></td>
</tr>
<tr>
<td>friend--umd</td>
<td>Instance</td>
<td>multiple</td>
<td>classes={Person}</td>
</tr>
<tr>
<td>father--umd</td>
<td>Instance</td>
<td>multiple</td>
<td>classes={Person}</td>
</tr>
<tr>
<td>doctoralDegreeFrom--umd</td>
<td>Instance</td>
<td>multiple</td>
<td>classes={University-}</td>
</tr>
</tbody>
</table>
Example: Merge Classes

Activity

subclass of subclass of

Meeting

subclass of subclass of

Meeting

subclass of subclass of

Meeting

subclass of subclass of

Work Activity
Example: Merge Classes (II)

- Activity
  - subclass of
    - Person
    - Employee

Meeting

- attendees
  - present
- attendees
AnchorPrompt: Analyzing Graph Structure
Similarity Score

- Generate a set of all paths (of length < L)
- Generate a set of all possible pairs of paths of equal length
- For each pair of paths and for each pair of nodes in the identical positions in the paths, increment the similarity score
- Combine the similarity score for all the paths
AnchorPrompt: Example
### AnchorPrompt: Example

<table>
<thead>
<tr>
<th>TRIAL</th>
<th>Trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERSON</td>
<td>Person</td>
</tr>
<tr>
<td>CROSSOVER</td>
<td>Crossover</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROTOCOL</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRIAL-SUBJECT</td>
<td>Person</td>
</tr>
<tr>
<td>INVESTIGATORS</td>
<td>Person</td>
</tr>
<tr>
<td>POPULATION</td>
<td>Action_Spec</td>
</tr>
<tr>
<td>PERSON</td>
<td>Character</td>
</tr>
<tr>
<td>TREATMENT-POPULATION</td>
<td>Crossover_arm</td>
</tr>
</tbody>
</table>
The Messy Picture
General Problem: Ontology Matching

○ Compare ontologies
○ Find similarities and differences
  - Merging: similarities
  - Mapping: similarities
  - Versioning: differences

○ Ontology Versioning
  - If things look similar, they probably are
  - A large fraction of ontologies remains unchanged from version to version
Ontology Versioning

- Ontology development became a dynamic, collaborative process
  - Need to maintain different ontology versions

- CVS-type systems
  - Repository of versions
  - Check-in/check-out mechanisms
  - Version comparison (diff)
Structural Diff

Version 1

Wine

maker Winery

color String

White wine

Blush wine

Red wine

Merlot

Chianti

Version 2

Wine

produced_by Winery

White wine

Rosé wine

Red wine

Merlot

Chianti

tannin String
PrompDiff Algorithm

- Consists of two parts
  - A set of heuristic matchers
  - A fixed-point algorithm to combine the results of the matchers

- Can be extended with any number of matchers
PromptDiff Heuristic Matchers

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PromptDiff Interface

Joint work with Michel Klein and Sandhya Kunnatur
The Messy Picture
Ontology Views

- Extract a self-contained subset of an ontology
- Ensure that all the necessary concepts are defined in the sub-ontology
- Specify the depth of transitive closure of relations
Defining a View
Saving a View

- Save a view as a Protégé ontology
- Replay the view on a new version
- Determine if a view is "dirty"
Dealing with a Messy World