Ontosphere3D

A multidimensional visualization tool for ontologies

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Summary / Agenda

• The context
• 3D representation and Visual cues
• Ontosphere3D
  – Scenes
  – Interactions
• Future trends
• Conclusions
The context

- Ontologies are becoming more and more in use
- Ontology engineering is a rather complex task
- Domain experts shall not necessarily be ontology engineers
- Ontology visualization / inspection shall be "accessible" to not experts
Requirements

- Ontology domain must be easy to grasp
- Ontology representation must be as “natural” as possible
- Visualization must be focused on specific areas of interest
- Visualization shall be clear and easy to manipulate
- Logic views may help
Solutions

• Root concepts are often sufficient to understand the ontology domain

• “Natural” representation (shared by many approaches):
  – Hierarchy → trees
  – Loops → circles
  – Concepts → spheres
  – Other relations → arrows and lines
  – Instances → may be cubes?
Solutions II

- Visualization must be focused on specific areas of interest
  - User-definable logic views, including only a subset of the ontology concepts and relations may help
Solution III

- Visualization clear and easy to manipulate
  - 3D (one more dimension available)
  - Visual cues (size, color, transparency)
  - Rotation, Pan, Zoom operators
  - Hide / Show facilities
  - Different scenes for different tasks
3D representation

• One more dimension (with respect to 2D)
  – Lay outing is easier
  – Manipulation is “simple”

• Visual paradigm:
  – Concepts $\rightarrow$ Spheres
  – Relations $\rightarrow$ Arrows
  – Instances $\rightarrow$ Cubes
3D representation (II)

- **Visual cues**
  - **Color**
    - Different colors for different levels in the isA hierarchy
    - White means collapsed
    - Black indicates the focus
    - Green means incoming
    - Red means outgoing
  - **Size**
    - Grows with the number of subsumed / aggregated entities
3D representation (III)

- Visual cues
  - Transparency
- Means inheritance
Ontosphere3D

• It is a protégé plug-in
  – But can work as standalone application as well as Eclipse plug-in (with different ontology access APIs)

• It is based on scenes
  – 6 scenes
    • Overview
    • Hierarchy browsing
    • Concept focus
    • Instance overview
    • Facts
    • Dependency tree
Overview scene

- Shows root concepts projected on a sphere
- Allows the definition of logical views
- Shows the relations between the selected concepts
Hierarchy browsing

- Allows to browse a hierarchy of concepts
- Implements dynamic collapsing mechanisms
- Shows all the relations involving the concepts on the scene
- Relations to concepts outside the shown tree can be hidden
- The presence of direct instances is rendered by means of an “aura”
Concept focus

- Shows all the relations in which a concept is involved
  - Direct
  - Inherited
- Shows only the direct ancestors of the focused concept
- The presence of direct instances is rendered by means of an “aura”
Instance overview

- Shows the instances of a given concept onto a sphere
- White instances take part in relationships with other instances (facts)
- May become overcrowded if the number of instances is high (in the CIA FactBook for example)
“Facts”

- Shows relations between instances (Facts)
- Is similar to the “Concept focus” scene
- XSD values are represented as cylinders
Dependency tree

- Organizes along a tree the instances involved in a selected relationship (e.g. requires)
Interactions

- Scenes interchange at mouse clicks
  - Left click on a concept
  - Right click on a concept – contextual menu
Future trends

• Logical views stored inside ontologies rather than in a separate file
• Direct editing (drag and drop, etc)
• Query facility (creates logical views as result of a RDQL/SPARQL query on the ontology)
• GUI enhancements / full management of relations (transitivity, inverseOf, subPropertyOf, …)
• High-performance standalone for dealing with huge ontologies (OpenCyc, e-Class, …) that take hours to be loaded in Protégé
Conclusions

- Ontosphere3D can be a viable solution for ontology visualization, even for not experts
- It’s a very active project so:
  – Feedback
  – Suggestions
  – Comments
Are welcomed !!!
Thanks

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