Using a Degree-of-Interest Model for Adaptive Visualizations in Protégé

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Abstract

Visualizations are commonly used as a cognitive aid for presenting large ontologies and instance data. One challenge with these visual techniques is that the generated views are often very dense and complex. It is difficult to know which concepts to include in the visualization to meet a user's information needs. In this talk, we present recent work that proposes using an attention-reactive interface to provide adaptive visualizations in Protégé. This furthers our recent work in providing visualization "on demand" for maintenance, editing, and understanding tasks by drawing users' attention to concepts of interest within the context of the current task.

1. Introduction

Understanding and maintaining the structure of large ontologies is a cognitively demanding task. Over the last several years the CHISEL group at the University of Victoria has been working on developing advanced visual interfaces to help users browse and understand large, complex ontologies.

Our main ontology visualization tool, Jambalaya, is an integration of the SHriMP[1] (Simple Hierarchical Multi-Perspective) visualization toolkit with Protégé [1]. In Jambalaya, the ontology is represented as a graph where classes and instances are depicted as nodes, and relationships between the classes are represented as directed arcs. Jambalaya provides multiple, inter-changeable views of the graph structure allowing users to explore multiple perspectives of information at different levels of abstraction.

As the size and complexity of the ontology grows, however, the usefulness of Jambalaya's advanced visualizations and Protégé's standard views decreases. Users report that they often work for extended periods of time on a small subset of the ontology. The concepts relevant to their task become difficult to locate because non-interesting concepts consume valuable screen real estate, obscuring the interesting concepts as illustrated in Figure 1.

Within Protégé's class browser, for example, the concepts of interest given a particular task may not be visible. Users are therefore forced to spend considerable effort navigating the ontology by scrolling, expanding and collapsing nodes in order to find concepts of interest.

2. Approach

To address this problem and to help users find concepts of interest within the ontology, we are developing a plug-in for Protégé which applies principles of attention-reactive user interfaces to provide adaptive visualizations within Protégé

Attention-reactive interfaces consist of two components: a mechanism to continuously calculate the user's degree of interest (DOI) and a dynamic display of the information that uses the DOI calculation to draw users' attention to interesting elements in order to reduce navigation overhead [2].

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1. http://www.thechiselgroup.org/shrimp

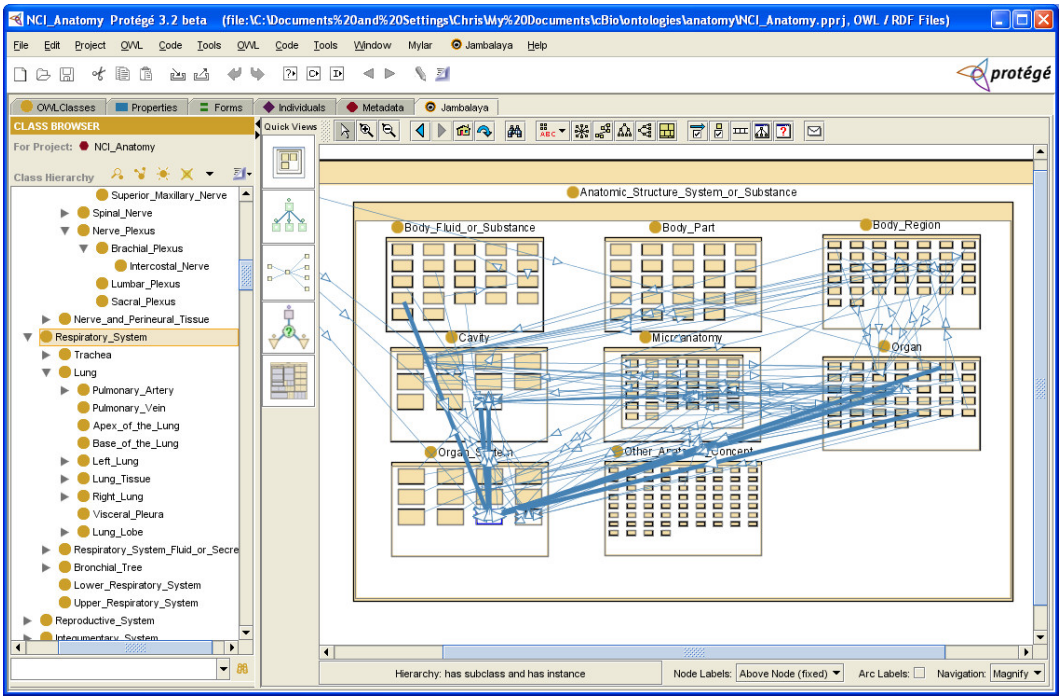


Figure 1: Protégé with the Jambalaya Tab selected displaying a portion of the NCI Thesaurus

The approach will be applied to both the standard tree browser views in Protégé as well as to the graphical based views in Jambalaya.

To calculate the user's DOI within the ontology, we have adapted Mylar[2], a plug-in for the Eclipse[3] integrated software development environment to work with Protégé [3]. Within Eclipse, Mylar monitors the programmer's activities, computes the users' DOI of the various code entities, and adapts the respective Eclipse views using the DOI calculation. To integrate Mylar with Protégé, we have written our own monitor to track user activity within the ontology and to pass that information to Mylar.

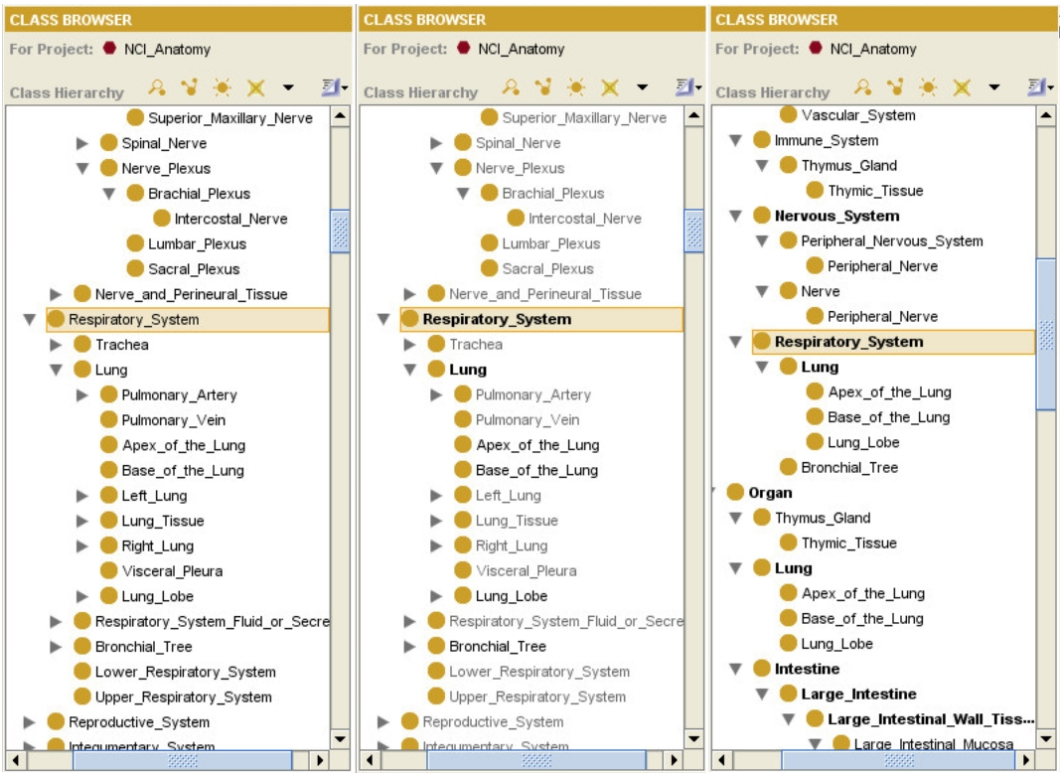
Mylar's DOI model associates an interest value with each concept in the ontology. When a concept is selected or edited, its DOI value increases. The DOI calculation also contains a *decay* function which decreases an element's interest value if it has not been selected.

We use the DOI calculation to adapt the appropriate views in Protégé to reduce navigational overhead and to draw user's attention to concepts of interest within the context of the current task. A primary consideration in the design of these adapted views has been to provide lightweight, easily reversible mechanisms to focus user's attention without deviating significantly from the existing, familiar Protégé views.

3. Adaptive Visualizations

Within Protégé's class, owl, and instance browsers, a user's DOI over the concepts is visualized using font weight and font color as shown in Figure 2b. Non-interesting concepts, ones that the user has not selected or whose DOI value has decayed to zero, are displayed in gray. *Landmark* concepts, those with a high DOI calculation or which the user has manually specified to be a landmark, are highlighted in black, bold text. Interesting concepts, those that have been selected but whose calculated DOI value falls below a threshold value are shown in black. To provide for finer granularity, we are also exploring the use of font size as a mechanism for highlighting a user's DOI.

2. http://www.eclipse.org/mylar/
3. http:// www.eclipse.org



(a) (b) (c)

Figure 2: a) Standard Protégé class browser b) Highlighting concepts in the class browser. c) Highlighting and filtering concepts in the class browser.

In addition to displaying the user's DOI by highlighting the concepts in the different views, we provide a mechanism for filtering non-interesting concepts from the view as shown in Figure 2c. Although it is still possible for the view to display a vertical scrollbar, the number of items through which the user must search can be drastically reduced thereby decreasing the time spent finding relevant concepts. Users can also specify that a concept is no longer of interest, the associated DOI value is updated correspondingly, and, if filtering is enabled, the concept is removed from the view.

4. Ongoing and Future Work

As a first step toward investigating this approach, we are designing studies of users' interaction patterns within Protégé and Jambalaya. Throughout our work in this domain, we have been concerned with which tasks could benefit from visualization support and when visualization support should be provided [4]. These studies will provide important insight into these issues as well as a basis for preliminary evaluation of the impact the adapted views have on users' navigation.

Our proposed user studies will consist of two phases. During the first phase, users' interactions within the ontology will be monitored using the standard views provided by Protégé and Jambalaya. The second phase will involve monitoring user activity with the adapted views. The goal of these studies will not only be to evaluate and refine the approaches we have presented here but also to discover additional situations in which an attention-reactive interface may provide cognitive support.

This work is in its earliest stages, and it is very important to us to get feedback from the Protégé user community. During our presentation, we will lead a discussion on how these adapted visualizations may, or may not, be helpful.

Our future work will explore ways to adapt the advanced visualizations in Jambalaya given a user's DOI model. Beyond highlighting concepts using color or size, we will explore using motion to make elements above a certain degree of interest "pop out" from the graph using motion techniques [5].

In addition, we are interested in investigating the possibilities of sharing DOIs among users, for example, sharing an expert's DOI with a novice to provide guidance.

5. Acknowledgements

This work was supported by the National Center for Biomedical Ontology, under roadmap-initiative grant U54 HG004028 from the National Institutes of Health.

We would like to acknowledge the work of Mik Kersten and the rest of the Mylar project team.

Chris Callendar and other members of the CHISEL group have been instrumental in this work.

References

1. M. Storey, M. Musen, J. Silva, C. Best, N. Ernst, R.Fergesen, and N. Noy. Jambalaya: Interactive visualization to enhance ontology authoring and knowledge acquisition in Protégé. *In Workshop on Interactive Tools for Knowledge Capture*, Victoria, B.C. Canada, October 2001.
2. S. Card and D. Nation. Degree-of-interest trees: A component of an attention-reactive user interface. In *International Conference on Advanced Visual Interfaces (AVI02)*, 2002.
3. M. Kersten and G. Murphy. Mylar: a degree-of-interest model for IDEs. In *Proceedings of the 4th international conference on Aspect oriented software development*, pages 159–168, New York, NY, USA, 2005. ACM Press.
4. N. Ernst, M. Storey, and P. Allen. Cognitive support for ontology modeling. *Int. J. Hum.-Comput. Stud.*, 62(5):553-577, May 2005.
5. C. and R. Bobrow. Motion to support rapid interactive queries on node-link diagrams. *ACM Transactions on Applied Perception*. 1: 1-15, 2004.