Extension models of Cone Tree Visualizations to Large scale Knowledge base with Semantic Relations

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ABSTRACT

Cone Tree is an appealing interactive 3D visualization model for hierarchical data structure. In any prior studies, data objects for visualization were constructed by only tree structure, which contained small number of data and nodes. Subject domains in real world for visualization studies have highly complicated relations, which cannot to be expressed in a few nodes and only hierarchical structure. In this paper, we proposed the visualization technique based on cone tree model to apply for a large-scale knowledge base, which has complicated data structure. The EDR Electronic Dictionary as a large-scale knowledge base was used in our study. The visualization system fro EDR was implemented with Java 3D. This paper describes the technique and the implemented system, and discusses some problems on the technique.

Keywords

Cone Trees, visualization, navigation, structural views, lexical knowledge base.

1. INTRODUCTION

Information Science is developed into knowledge science and its importance will increase more and more in recent years. As knowledge data get larger and more complex, they become more difficult to understand its whole structure. The maintainer, who tries to understand knowledge data, reads some semantic relation, and searches the relation and documentation for a confirmation of the conjectures. In developing this prototype tool our primary goal is to help maintainers to easily verify conjectures on the knowledge base with semantic relations.

Interactive visualizations of complex information spaces are designed to improve the ability of users to work with, and navigate through, rich data spaces [Mar97]. Examples include the 3D data displays provided by cone trees [Rob91], the Data Mountain [Rob98], the Perspective Wall[Mac91], and the rich 2D displays of the Information Mural[Jer98]. A fundamental limitation of the work on visualizations is the lack of using few data set and types [Mun98a]. We are unaware of any prior attempt to use large scale data or to use complex data type of cone trees.

In this paper we describe a cone tree visualization models that enables users to visualize large scale knowledge with semantic relations. This system gives the user the ability for the purposes of large scale knowledge analysis.

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2. VISUALIZATION MODEL

First of all, we describe about EDR electronic dictionary used by our cone tree system [Edr]. The

EDR is developed for the language processing and composed of some large-scale individual dictionaries like the word dictionary etc.

Our cone tree system uses the EDR concept dictionary to display the conceptual system. The broader/narrower relations of the EDR electronic dictionary are huge concept trees which contains more than 400,000 concepts. Each concepts have a unique concept identifier by which they are identified. Lots of concept might have two or more parents concepts because multiple broader concepts.

3. VISUALIZATION EXPERIMENTS

The visualization system based on above mentioned models has been implemented with Java/Java 3D APIs. Java 3D APIs supplies some basic navigation functions by default, i.e. moving angle, rotation of 3D objects, and so on.

First, the coordinates of the apex of the cone is computed and determined. The value of the apex at X axis is equals to it of the rightist node located at X axis, which is located in the same label of the target node.

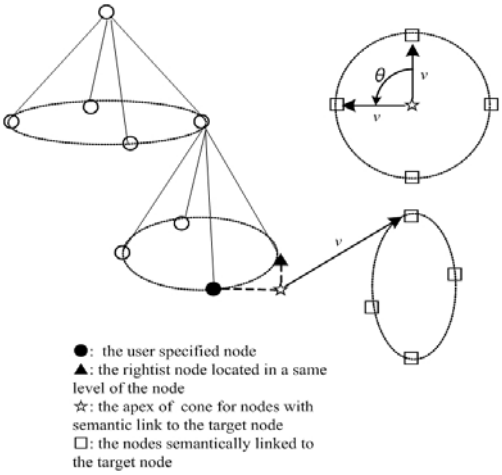

Figure 1. An Image for the relative locations

Figure 2 indicates the example of visualizing the hierarchy tree and the nodes which have semantic relation to the user specified node.

We propose the method of excluding nodes as objects to be visualized, which have no semantic relations. In this method, visibility for semantic relation will be improved, and in addition, hierarchical structure is still maintained. This function as a command has been implemented in our visualization system

4. CONCLUSTION

Cone trees visualizations of hierarchical data structures were first described by Robertson et al [Rob91]. Since then, there have been numerous refinements on the model, but there has been notable applications to only simple tree data structure. This paper provided the visualization technique to complex data structures which gives user to be able to browse and navigate large scale knowledgebase.

In our further work we will investigate the techniques for improvement of operability and visibility for large scale knowledgebase.

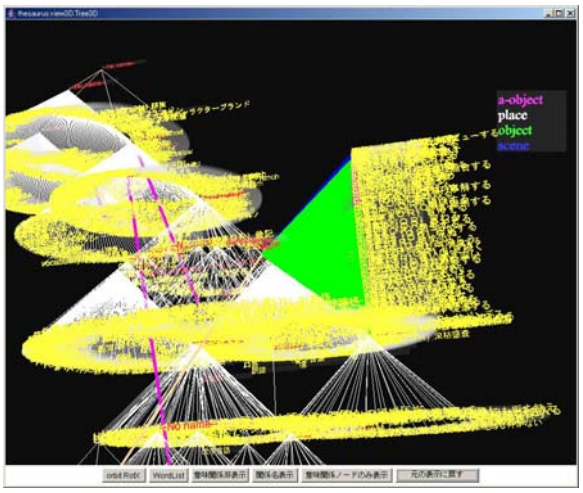

Figure 2. An example for visualization of semantic links between nodes over different trees

5. REFERENCE

[Edr] EDR: http://www2.nict.go.jp/kk/e416/EDR/J_index.html

[Mun98a] Munzner T, Exploring Large Graphs in 3D Hyperbolic Space, IEEE Computer Graphics and Applications, 18(4), pp.18-23, 1998.

[Rob91] G. G. Robertson, J. D. Mackinlay, and S. K. Card., Cone Trees: Animated 3D Visualizations of Hierarchical Information, In Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI'91), pp. 189-194. ACM Press, 1991.

[Mac91] J.D. Mackinlay, G.G. Robertson, and S. K. Card, Perspective wall: Detail and context smoothly integrated, In Proceedings of CHI'91 Conference on Human Factors in Computing Systems, pp. 173--179, 1991.

[Jer98] D.F. Jerding and J.T. Stasko, The Information mural: A technique for displaying and navigating large information spaces, IEEE Transactions on Visualization and Computer Graphics, 4(3): 257-271, 1998.

[Mar97] Marti A. Hearst, Chandu Karadi, Cat-a-Cone: an interactive interface for specifying searches and viewing retrieval results using a large category hierarchy, Proceeding of the 20th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval, pp. 246-255, 1997