Integrated Visualization for Semantic Web

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Abstract

In this paper, we present an integrated Semantic Web interactive visualization environment (ISWIVE) to visualize the information of Topic Maps and RDF. In ISWIVE, both the detailed resource descriptions and the overall topic relationship can be clearly displayed. Besides, the interactive local viewer and visual query interface facilitate browsing and searching over the Semantic Web resources.

1 Introduction

Information visualization techniques have been increasingly applied to the Semantic Web to facilitate large-scale information resource access and outline the frameworks. The current Semantic Web visualization approaches are based on two major standards RDF (Resource Description Framework) and Topic Maps. Owing to their different development motivations, the corresponding visualization approaches extremely vary. RDF visualization characterizes the elaborated drawing of n-triple statements [Pietriga, 2002]. Topic Maps visualization features the overview and the main topics of Semantic Web to describe the information resources in a high-level indexing view [Grand and Soto, 2002].

Past research efforts focus on developing the visualization interfaces of RDF and Topic Maps respectively [Pietriga, 2002; Grand and Soto, 2002; Geroimenko and Chen, 2003]. Since the visualization interfaces based on the alternative framework are developed in different views, they only present part of the Semantic Web. Consequently, the panorama of the Semantic Web cannot be displayed.

In this paper, we propose an integrated Semantic Web interactive visualization environment (ISWIVE) to visualize the concept of Topic Maps in the RDF framework where the RDF Topic Maps (RTM) namespace is used to translate the syntax of Topic Maps [Moore, 2001; Lacher and Decker, 2001]. In the ISWIVE environment, both RDF and Topic Maps frameworks are displayed in a cooperative way. From the visualization results, users can understand the framework structure intuitively through viewing the resources in both high-level indexing and detailed views. Besides, ISWIVE can further help users efficiently handle and utilize the Semantic Web resources by interacting with the visual semantic query and the interactive local viewer.

2 Integrated Visualization Design

ISWIVE is designed to facilitate browsing the Semantic Web resources and topic information in RDF documents. Especially, the visual interface design provides users with interactive functionalities of relational semantic query and a magnified graph. Therefore, users can browse the detailed relationships of a certain resource node and have a complete view of the Semantic Web resources in a friendly visual interface.

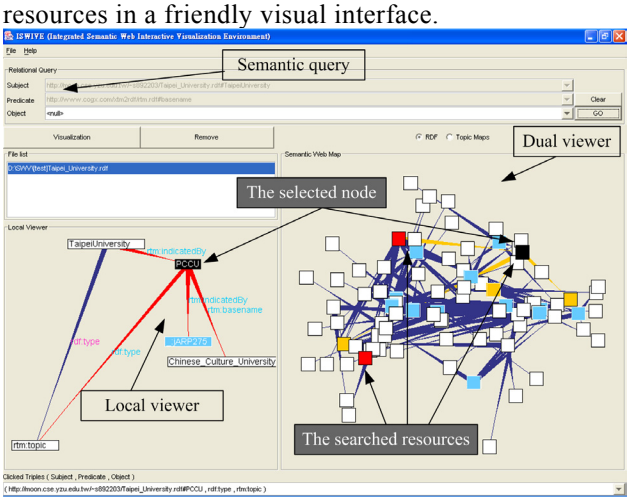

Figure 1. The ISWIVE interface layout.

2.1 Interface Layout

The interface layout of ISWIVE is pictured in Figure 1. The ISWIVE interface consists of three major areas, namely the semantic query, the dual viewer, and the local viewer. The semantic query allows users to search the Semantic Web resources by the subject, predicate, or object. The dual viewer panel displays the RDF graph and the topic tree graph by switching the radio buttons above the panel. The local viewer panel is to display the detailed relationships of the selected node and its surrounding resources appearing in the dual viewer panel. In the local viewer panel, a magnified graph is displayed with few crossing edges. The nodes are painted in different colors denoting diverse meanings in the display areas. In Figure 1, the Semantic Web map area of the dual viewer panel shows

that the red nodes denote the searched resources, the black node denotes the selected resource, and the yellow nodes denote the resources around the selected one.

2.2 The Visualization Algorithms

The ISWIVE interface utilizes two algorithms for visualizing the Semantic Web. A multi-scale force-directed algorithm is used to visualize the RDF graph [Harel and Koren, 2001]. And an extended hv-tree-drawing algorithm is for the topic tree visualization [Battista et al., 1999]. The main purposes are summarized as follows:

1. The multi-scale force-directed algorithm features that a balanced graph can be fast created, and the connected semantic relations can be intuitively close to human experiences.
2. The hv-drawing benefits that the area bound can be properly arranged to avoid overlapping. Besides the well-arranged area bound, the edges are also prevented from intersection to display a clear view.

By combining the benefits of the above algorithms, the complex structures and semantic text descriptions are displayed in a friendlier interface. Besides, the semantic relationships are outlined in clear view, and the high-level topic information is visualized in an orderly top-down tree graph.

3 Prototype Demo

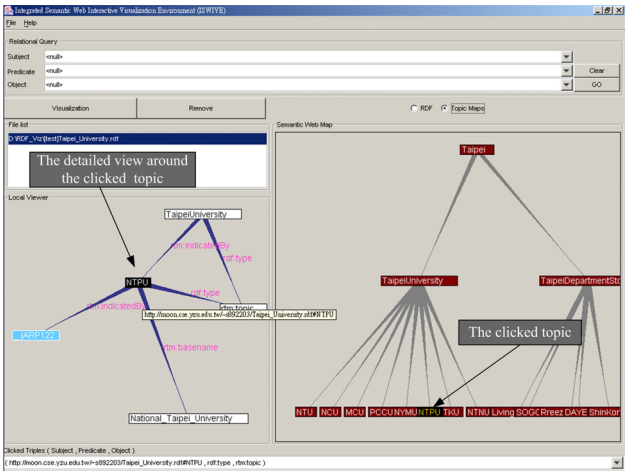

Figure 2. The visualization of the topic tree.

Figure 1 shows the interface layout where the Semantic Web map area of the dual viewer panel, the local viewer, and the visual query results are displayed. Figure 2 demonstrates the visualization of the topic tree. The topic tree shows that the Taipei topic has two subtopics: TaipeiUniversity and TaipeiDepartmentStore. In the topic tree graph, SOGO is one of the subtopics of TaipeiDepartmentStore. The related resources are listed below, and the detailed semantic descriptions are displayed at the local viewer panel.

In Figure 2, the topic tree panel explicitly displays the relationship between the main topic and the subtopics in proper order. With the dual mode of RDF and Topic Maps, users can browse the whole view of topic maps in a top-down tree and find the topic of interest quickly by clicking the corresponding node. Because the dual viewer panel can reveal the detailed relationships between the resources and the overall view of the topics, users can handle the Semantic Web resources more effectively and efficiently.

4 Concluding Remarks

The Semantic Web is an important gateway for computers to understand human semantics. A suitable visualization interface plays a significant role in improving the use of Semantic Web information. The past Semantic Web visualization work ignores the problem of communicating the visualization interfaces between Topic Maps and RDF, and thus cannot display the whole view of Semantic Web. In this paper, we have shown that ISWIVE presents the Semantic Web visualization by clustering the associated Semantic Web resources and displaying the topic tree orderly. Currently, the ISWIVE prototype is still primitive and a lot of work needs to be done such as designing a more simple and clear metaphor and an advanced inferential visual query.

References

[Battista et al., 1999] Giuseppe Di Battista, Peter Eades, Roberto Tamassia, and Isannis G. Tollis. *Graph Drawing: Algorithms for the Visualization of Graphs*. Prentice Hall Inc., 1999.

[Harel and Koren, 2001] David Harel and Yehuda Koren. A Multi-scale Algorithm for Drawing Graphs Nicely. *Discrete Applied Mathematics*, 113(1):3-21, 2001.

[Moore, 2001] Graham Moore. RDF and TopicMaps: An Exercise in Convergence. In *Proceedings of XML Europe 2001*, Berlin, German, 2001.

[Lacher and Decker, 2001] Martin S. Lacher and Stefan Decker. RDF, Topic Maps, and the Semantic Web. *Markup Languages: Theory and Practice*, 3(3):313-331, Summer, 2001.

[Pietriga, 2002] Emmanuel Pietriga. IsaViz: A Visual Environment for Browsing and Authoring RDF Models. In *Proceedings of WWW 2002, the 11th World Wide Web Conference (Developer's day)*, Honolulu, Hawaii, USA, May 7-11, 2002.

[Grand and Soto, 2002] Bénédicte Le Grand and Michel Soto. Visualisation of the Semantic Web: Topic Maps Visualisation. In *Proceedings of the Sixth International Conference on Information Visualisation (IV'02),* pages 344-349, July 2002.

[Geroimenko and Chen, 2003] Vladimir Geroimenko and Chaomei Chen (Eds.). *Visualizing the Semantic Web.* Springer Verlag, 2003.