Visual Analysis of Hierarchical Management Data

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Abstract

The sales force management data at Thomson Reuters often contains multiple hierarchies and dependencies. Conventional business graphics are not sufficient for analyzing, presenting and exploring such data sets. The Treemap is effective for depicting hierarchical data, although it lacks structural clarity. Thus, distinguishing different levels within the treemap is difficult. In this abstract, we develop an interactive system for business analysts which enables structure-aware visualization of hierarchical data using multiple coordinated views. The design of this system includes hierarchy extraction, structure tracings and the direct manipulation of the treemap. We demonstrate our result on various sales force management data sets from Thomson Reuters.

1. Introduction, Motivation and Background Data

As a global company whose business spreads over ninety countries, the sales force management data in Thomson Reuters consists of many hierarchies. For example, each product is sold by a sales person in the company. Each sales person reports to a sales manager. Each sales manager is located at one organization or country, such as the UK. Each organization or country belongs to a region, such as Europe. Each region belongs to an administrative channel. The business analysts often have to figure out queries like which are the best/worst selling products in each/all organization/region/channel and which sales persons/managers contribute most for selling these products. By reordering and tracing the hierarchies, our system can easily help them find out the answer. However, it will take more work and time using simple business graphics, such as bar charts, pie charts and etc.

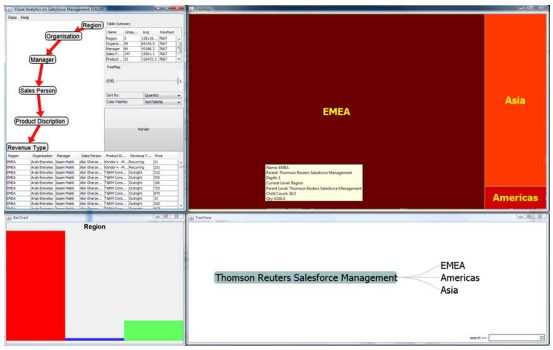

Figure 1: *This image shows the general overview of our system. The two windows on the left are the control panels which summarize and manipulate the ontological hierarchy information. The two windows on the right are the coordinated views of treemap and DOI tree. They both form a structure-aware visualization for hierarchical data.*

2. System Overview

Our system is composed of two parts, namely the control panel and structure-aware visualization. The control panel is shown on the left half of Figure 1. It extracts the ontological hierarchy information from the input data sets and sets up the configuration for the visualization. The right half of Figure 1, is a structure-aware hierarchical visualization containing the coordinated views of the squarified treemap and DOI tree [CN02]. Our system is developed using the Prefuse API [HCK*05]. In the next two sections, we present these two components in more detail.

2.1. Control Panel

Each data hierarchy can be derived and manipulated separately from the original input data. As shown on the bottom right of Figure 2, there are six tree levels represented by force-directed graphs. The user is able to directly manipulate and position the graph nodes to change the ordering of tree hierarchy. As shown on the top right of Figure 2, by moving the slider bar, the user is able to choose the number of tree hierarchies to be displayed. Selecting different attributes from the drop box determines the rectangle areas in

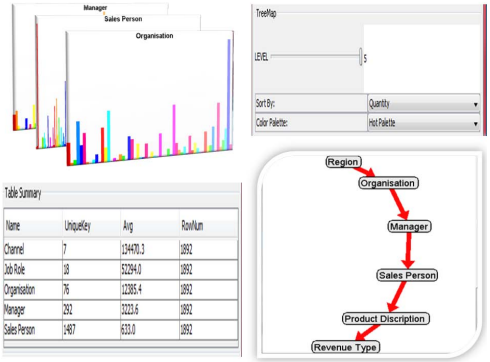

Figure 2: *This image shows four major parts of our control panel. From left to right, top to bottom, the control panel includes the bar charts for depicting the numerical comparison, slider bar for changing the number of hierarchies, the summary table of hierarchy meta data and ontological tree hierarchy.*

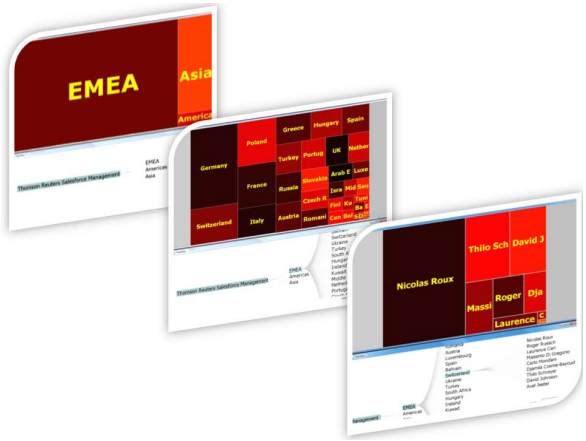

Figure 3: *This image shows how the DOI tree can be coordinated with our squarified treemap.*

the treemap. As shown in the left of Figure 2, we provide the bar charts for the comparison of tree levels with low density leaves (often below 4096 leaves), as they are more effective and accurate than treemaps for depicting the low resolution data [KHA10]. In addition, we also provide a summary table which contains the meta data of the hierarchical information, as shown on the left of Figure 2.

2.2. Structure-aware Treemap

The treemap is able to compare the node values in any tree level. But it lacks the ability to show the entire tree structure intuitively. In previous work, several authors have addressed the importance of presenting the change of hierarchy when traversing through intermediate nodes in a treemap. Shengdong Zhao et. al create elastic hierarchies which combine the treemap and node-and-link graph together [ZMC05]. Renaud Blanch and Eric Lecolinet also propose a hybridization between treemaps and zoomable user interfaces [BL07]. Such hybrid prototypes are very useful but might be hard to understand by the business community [VvWvdL06].

For tracing the treemap hierarchy, it's not necessary to list the whole tree structure, instead only the relevant substructure which shows the ancestor and descendants of the interested node. The Degree-of-Interest tree [CN02] provides a clear hierarchy at a low cost of screen space by changing the viewpoint and filtering out the uninteresting tree nodes. In addition, it offers the instant readability of the node labels to the business analysts. Therefore, we adopt the linked views with DOI tree and treemap to enable structure tracing. As shown in Figure 3, as we traverse back and forth between the intermediate levels of the treemap, the DOI tree view clearly keeps track of how each selected node is derived from its ancestors.

On the interaction side, moving the mouse over the treemap brings up a tooltip indicating the additional information of a selected node. Clicking the mouse drives the direct zooming between the tree levels. Also, the DOI tree could initiate the searching task, as shown in the supplementary video.

3. Conclusion

In this abstract, we have introduced an interactive, coordinated multiple views visualization system for large sales force management data at Thomson Reuters. The structure-aware treemap takes the advantages of DOI tree layout to trace the change of hierarchy. Also, we provide several interaction options, such as direct manipulation and hierarchy extraction for the treemap. In the future, we will focus on how to visualize the changes of treemap for time-varying data.

References

[BL07] BLANCH R., LECOLINET E.: Browsing Zoomable Treemaps: Structure-Aware Multi-Scale Navigation Techniques. *IEEE Transactions on Visualization and Computer Graphics 13*, 6 (2007), 1248–1253. 2

[CN02] CARD S. K., NATION D.: Degree-of-Interest Trees: A Component of an Attention-Reactive User Interface. In *WORKING CONFERENCE ON ADVANCED VISUAL INTERFACES (AVI)* (2002), pp. 231–245. 1, 2

[HCK*05] HEER J., CARD, K. S., LANDAY, A. J.: Prefuse: A Toolkit For Interactive Information Visualization. In *Proceedings of ACM CHI Conference on Human Factors in Computing Systems* (2005), vol. 1 of *Interactive information visualization*, pp. 421–430. 1

[KHA10] KONG N., HEER J., AGRAWALA M.: Perceptual Guidelines for Creating Rectangular Treemaps. *IEEE Transactions on Visualization and Computer Graphics 16*, 6 (2010), 990–998. 2

[VvWvdL06] VLIEGEN R., VAN WIJK J. J., VAN DER LINDEN E.-J.: Visualizing Business Data with Generalized Treemaps. *IEEE Transactions on Visualization and Computer Graphics 12*, 5 (2006), 789–796. 2

[ZMC05] ZHAO S., MCGUFFIN M. J., CHIGNELL M. H.: Elastic Hierarchies: Combining Treemaps and Node-Link Diagrams. In *Proceedings of IEEE Symposium on Information Visualization (InfoVis)* (2005), IEEE Computer Society, pp. 57–64. 2