Quantitative Comparison of Treemap Techniques for Time-Dependent Hierarchies

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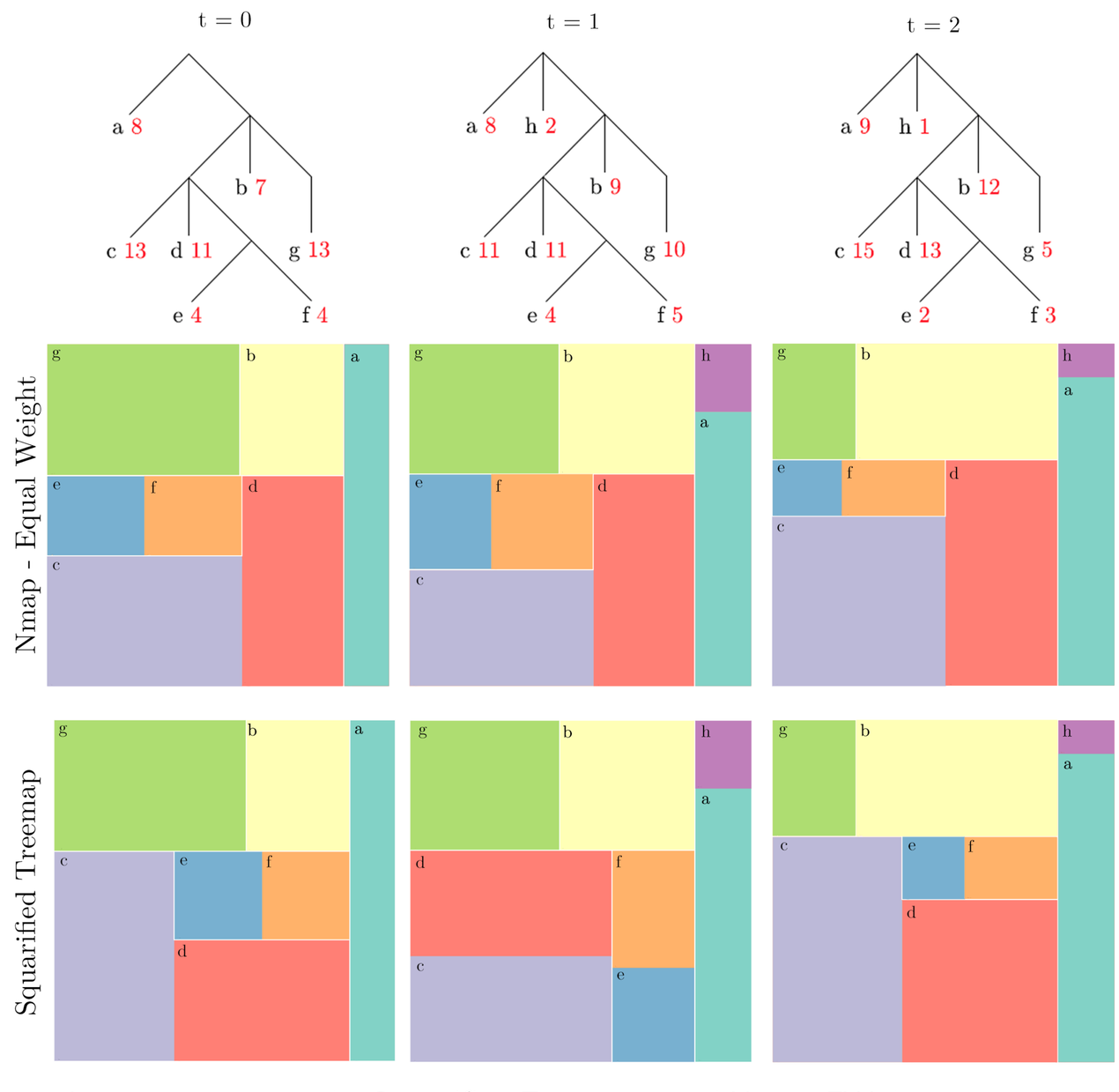
Introduction

- Treemaps are popular space-filling methods for display of hierarchical data.
- Different treemapping techniques are optimized for different objectives (e.g., aspect ratio, preserve dataset order, semantic grouping).
- These objectives tend to introduce layout instability when dealing with dynamic datasets, affecting user performance in analytical tasks.
- Therefore, we want to ensure not only good cell aspect ratios, but also an amount of change in the layout which reflects well the amount of change in the data.
- In this work, we compare four RT methods on several real-world dynamic hierarchies and measure cell aspect ratio and stability.



Layouts generated by Squarified Treemaps and Nmap EW demonstrating the visual confusion generated by unstable cell arrangements on a simple Time-Dependet Hierarchical Dataset..

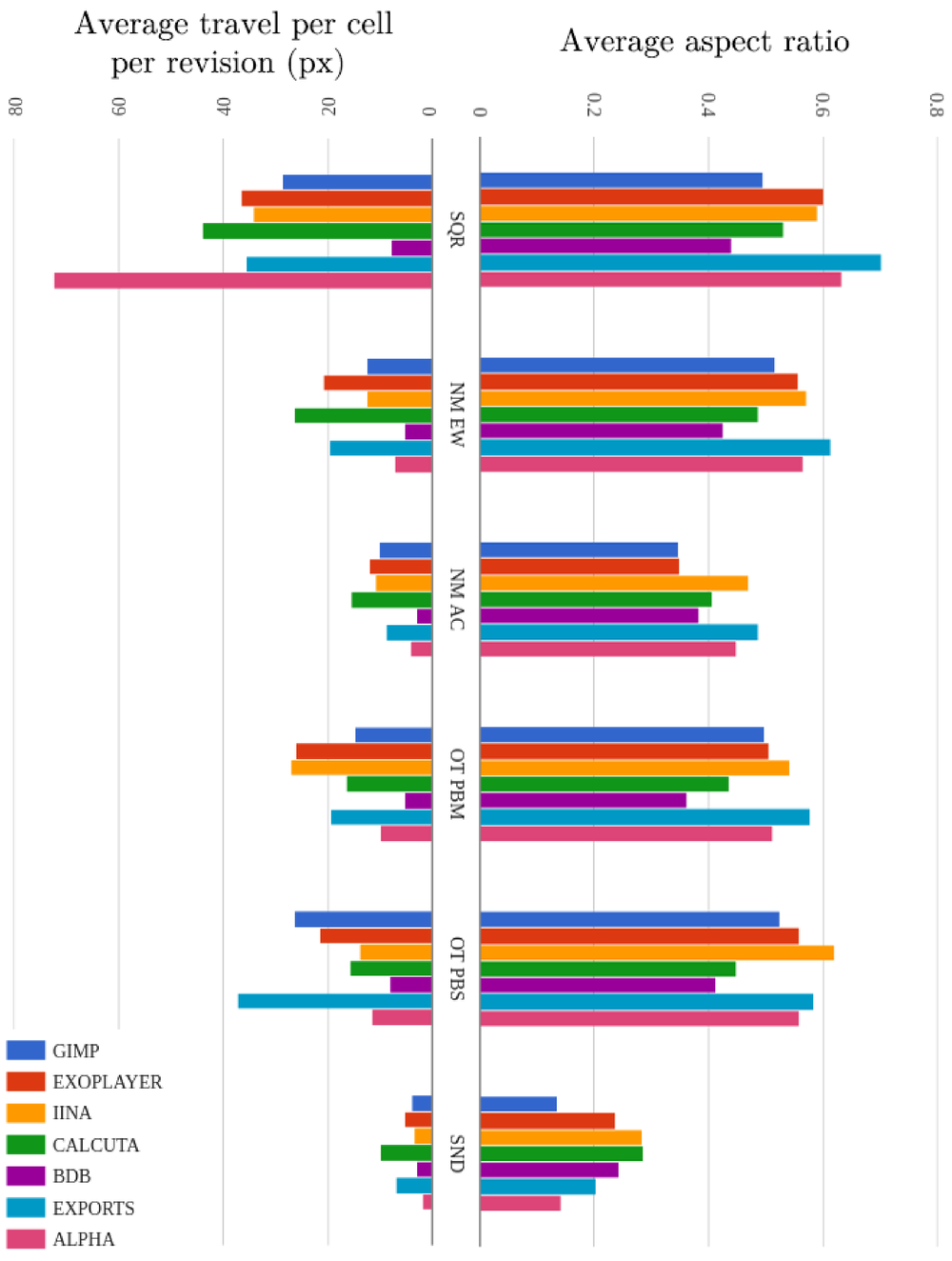
Techniques

- Slice-and-Dice
- Squarified Treemap
- Ordered Treemap
  - Pivot-by-Middle
  - Pivot-by-Size
- Nmap
  - Alternate Cut
  - Equal Weight

Metrics

- Euclidean distance travelled by cell center between consecutive time moments.
- Average aspect ratio of cells, including non-leaf nodes.

Results



Results generated by running the techniques on 7 real life datasets.

Findings

- In one end of the spectrum we have Squarified Treemaps, offering the best aspect ratios at the cost of large layout instability.
- On the other end is Slice-and-Dice, very stable but generates poor layouts.
- Ordered Treemaps and Nmap both offer a compromise between aspect ratios and temporal stability.
- **Our results show that Nmap — which was not designed, nor promoted, as a dynamic hierarchy visualization technique — is a more suitable method for display of dynamic hierarchical datasets than the current state-of-the-art technique in this context – Ordered Treemaps.**

Main References

BRULS M., HUIZING K., VAN WIJK J.: Squarified treemaps. In Proceedings of the Joint Eurographics and IEEE TCVG Symposium on Visualization (1999), Press, pp. 33–42. 1

DUARTE F. S. L. G., SIKANSI F., FATORE F. M., FADEL S. G., PAULOVICH F. V.: Nmap: A novel neighbourhood preservation space-filling algorithm. IEEE Transactions on Visualization and Computer Graphics 20, 12 (Dec 2014), 2063–2071. 1

SHNEIDERMAN B.: Tree visualization with tree-maps: 2-d space-filling approach. ACM Trans. Graph. 11 , 1 (Jan. 1992), 92–99

SHNEIDERMAN B., WATTENBERG M.: Ordered treemap layouts. In Proceedings of the IEEE Symposium on Information Visualization 2001 (INFOVIS'01) (Washington, DC, USA, 2001), INFOVIS '01, IEEE Computer Society, pp. 73–. 1