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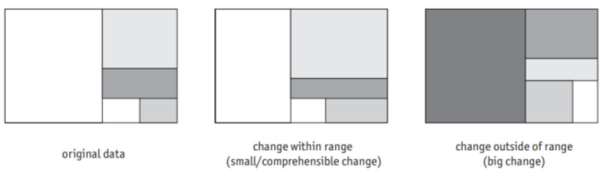
VISUALIZATION OF STREAMING DATA: OBSERVING CHANGE AND CONTEXT IN INFORMATION VISUALIZATION TECHNIQUES

INTRODUCTION

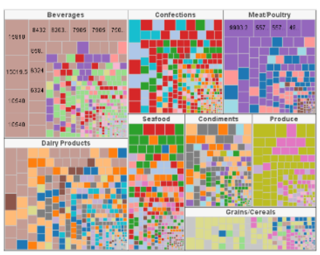
In the era of big data, data streams have become omnipresent, originating from various sources like personal logs, network infrastructures, financial transactions, and social media text feeds. Handling this continuous flow of data requires efficient visualization techniques to help analysts make sense of both current and historical information. Visualizing streaming data often revolves around mapping time to the horizontal axis, yet other data dimensions are equally important. This paper investigates well-known visualization methods and their adaptability to changing data in streaming scenarios, highlighting that most changes can compromise contextual information, contingent on the nature of the data stream modifications.

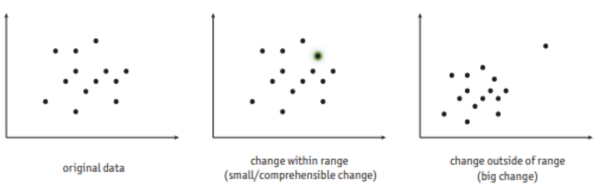
WHAT CAN CHANGE?

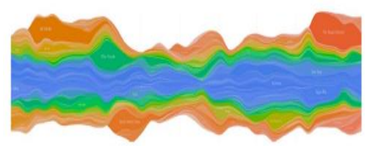
This section delves into the properties that can change in well-known visualization techniques when new data is introduced. These changes are categorized into two main types: changes within the existing range and changes outside the range.



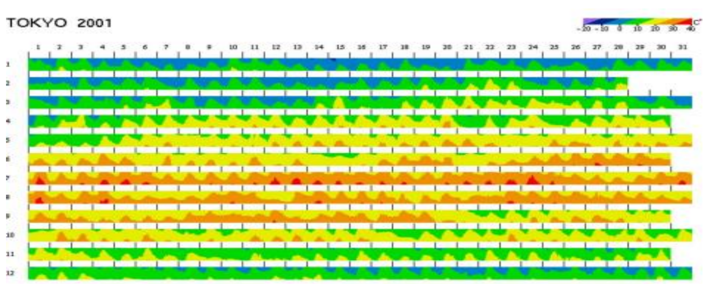
The following visualization techniques are:



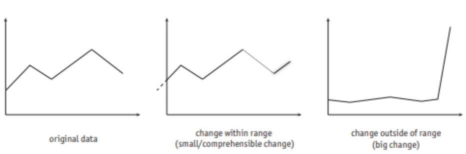


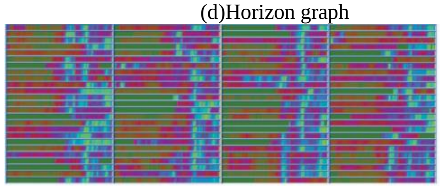


(a) Treemap (b) Scatterplot (c)Stream graph



(d)Horizon graph





(e) Line chart (f) Pixel-Oriented Visualizations (g) Word Cloud

(a) Treemap: Changes in treemaps can include adjustments in rectangle size, color, opacity, and positioning. While small changes may not significantly impact context, bigger changes can lead to a complete rearrangement of the layout.

(b) Scatterplot / Map: Changes in scatterplots and maps occur when new data points are introduced. If the new data points are within the existing range, the display requires minimal adjustments. However, if new data falls outside the existing range, the entire display may need to be reconfigured.

(c) Streamgraph: Streamgraphs involve layering variables symmetrically over time. Changes primarily pertain to rescaling axes or shifting layers when new data is introduced. Additionally, optimal layer ordering is critical for legibility, and reordering may be required.

(d) Horizon Graph: Horizon graphs are used for visualizing multiple time series. When new data points fall outside predefined ranges, the color map must be readjusted, resulting in a loss of context.

(e) Line Chart: Line charts may require adjustments in display when new data is added or when new lines are introduced. Overplotting and clutter issues may arise.

(f) Pixel-Oriented Visualizations: Pixel-based techniques involve pixel arrangements based on user-defined parameters. Changes can occur when data values fall outside the colormap's maximum range or when dimension order changes.

(g) Word Cloud: Word clouds use layout algorithms to pack words tightly. Changes can lead to loss of context when significant layout re-computation is required.

CONCLUSION:

In conclusion, the paper emphasizes the challenges posed by streaming data visualization and the complexity of issues related to data, image, and user space. It highlights the importance of addressing the loss of context in streaming data visualization and the need for metrics and criteria to measure these losses. As research in streaming data visualization is still emerging, this paper paves the way for future work in this field, offering a foundation for understanding and tackling the complex problems associated with visualizing data streams in the era of big data.

MY LEARNINGS:

After reading this paper, it's clear that visualizing data streams in the era of big data is a complex and evolving challenge. The authors did a great job dissecting the issues and potential solutions in this domain. It's fascinating to see how well-established visualization techniques can struggle when dealing with streaming data, especially when trying to maintain the context between new and past data. The discussion on metrics and criteria for measuring the loss of context is thought-provoking, as it highlights the importance of evaluating the effectiveness of visualization methods in this context. Overall, this paper underscores the need for innovative approaches and tools to help analysts make sense of the continuous influx of data in today's data-rich world.

RESEARCH PAPER:

"Visualization of Streaming Data: Observing Change and Context in Information Visualization Techniques" by Milos Krstajić and Daniel A. Keim , IEEE Conference Publication

[Visualization of streaming data: Observing change and context in information visualization techniques | IEEE Conference Publication | IEEE Xplore]