Interactive Visualization of Scientific Datasets on Ultra-walls

Participants: Emmanuel Pietriga (INRIA), Olivier Chapuis (UPSud-CNRS/LRI)

Ultra-high-resolution wall-sized displays, also called ultra-walls for short, feature a very high pixel density, typically 60-to-100 pixels per inch, over a large physical surface. Ultra-walls have properties that make them well-suited to the visualization of large, heterogeneous datasets. They can represent the data with a high level of detail while at the same time retaining context: users can transition from an overview of the data to a detailed view simply by physically moving in front of the display. Wall displays also offer good support for collaborative work, enabling multiple users to simultaneously visualize and interact with the displayed data.

INRIA and UPSUD-CNRS/LRI have one such wall each. Both are nodes of the Digiscope EquipEx: WILD has a total resolution of 20480 x 6400 = 131 megapixels for a surface area of 5.5m x 1.8m; WILDER features a lower resolution but trades display capacity for narrower inter-tile bezels a touch-sensitivity, enabling users to directly manipulate the data visualized on screen. Both platforms are used for Human-Computer Interaction research in general (e.g., [1,2]), and interactive data visualization in particular. Application areas include scientific data analysis [3], crisis management [4] and the monitoring of complex systems [5]. We develop software toolkits that ease the development of applications for wall displays [6,7].

Research on these platforms in our lab has been privileging applications in areas strongly related to data science. For instance, FITS-OW [3] is an application designed for, and with, astrophysicists. It enables them to visualize and interact with very large FITS images and collections thereof, that can be several hundred thousand pixels in both width and height. As part of their data analysis workflow, astrophysicists can overlay the results of data analyses, fetch and display additional images of a specific object or region in the sky, showing observations in different ranges of the electromagnetic spectrum or made at different times, query databases, and visualize the results of such queries in-place, next to the corresponding source in the image.

Collaborative projects within CDS would be an opportunity to further study the usefulness of ultra-walls for data science, both by considering other application areas beyond Astrophysics, and by investigating the possibility to perform some simple forms of on-the-fly data analyses. This would enable a more exploratory form of visual data analyses, by tightening the loop between data processing and interactive visualization. For instance, taking the example of the FITS-OW application again, the recent bridge we implemented between FITS-OW and Astropy + Numpy for sky coordinate computations could also be used to run algorithms directly on the data loaded on the wall using the wall display's cluster.

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