

Enhancing the ENVISION Interface for Digital Libraries

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ABSTRACT

To enhance the ENVISION interface and facilitate user interaction, various techniques were considered for better rendering of search results with improved scalability. In this paper we discuss the challenges we encountered and our solutions to those problems.

KEYWORDS

Information Visualization, Digital Library, ENVISION, Aggregation, Variable Width.

1. INTRODUCTION

The Envision interface helps visualize search results from the MARIAN digital library system [1]. The old Envision interface (Figure 1) featured a Query Screen (left), Result Visualization Screen (right), and Result List Screen (bottom). Envision presented each document in the result set graphically as an icon. The user could select several documents on the Visualization Screen and see corresponding details in the Result List Screen [2].

Envision used a rigid matrix to display search results. As with various other visualization tools, it provided no overview, thus no context information to users. Scrollbars were needed for data outside the viewable area. In working to enhance Envision, we considered other efforts. Some approaches (e.g., ThemeScapes [3]) are almost exactly opposite, displaying data in a completely flexible manner. The data is not bound to any axis but is arranged according to relationships between documents. We now explore a middle ground with an overview as well as loose matrix arrangement, with related documents mapped together, as shown in Figure

2. The major changes considered are described in Sections 2-4 below.

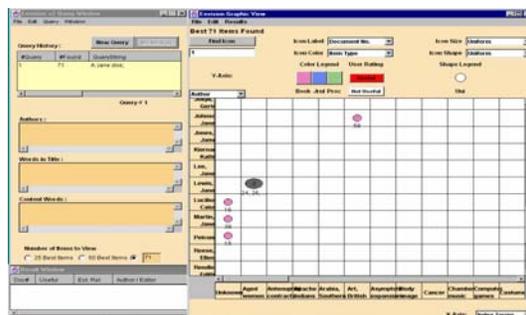


Figure 1. Old Envision interface

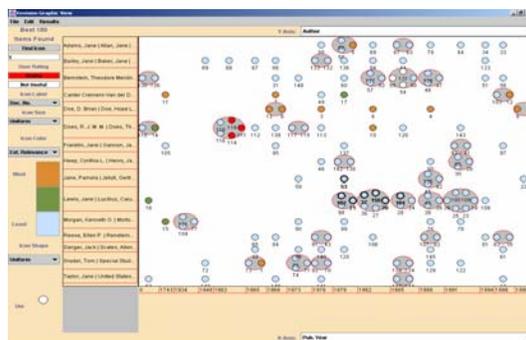


Figure 2. New Envision interface

2. AGGREGATION

With some visualization tools, users face the “keyhole” problem, wherein they can only see a part of the entire visualization at a time, with scrollbars used frequently. In the old Envision interface, with typical query results, much screen space was empty. At the same time, few details were visible for large clusters. In one case with 71 results, and a screen of 144 cells, 20 screen spaces were required to see all results. We use an aggregation algorithm to get rid of scrollbars and visualize everything in one screen space. Adjacent columns/rows are aggregated together. Consequently, either the X or Y-axes might have more than 1 attribute value per unit.

3. VARIABLE-WIDTH ALGORITHM

The original implementation of Envision showed icons inside a matrix of equal size cells. Hence all icons, even cluster icons representing more than one document, were of the same size. In the case of a cluster (shown as an ellipse), the icon label was the count of documents in the cluster. But the cluster did not show the icons inside, and did not allow selection of individual icons.

To obviate these problems we chose a variable-width algorithm: The width of each column or row is not fixed but depends on the largest collection inside. The area of a cluster is related to the number of documents contained. However, for readability we also had a minimum size for each row and column, employed when the count of assigned documents was below a threshold. This approach provides us space to further paint icons inside the cluster. We use a *show cluster algorithm* so icons can be selected individually.

4. SHOW ICONS INSIDE CLUSTER

The variable width approach provides a solid foundation to reveal documents inside clusters. But we sought a better placement of documents in the cluster ellipse than just putting it randomly. We viewed a cluster as a group of concentric ellipses with diameter differences of equal magnitude. Documents are placed from the outside in. The key remaining problem is determining distance between icons. An equal-arc algorithm would be optimal but is slow and hard to implement in Java. So, we used an equal angle algorithm and customized the angles near the vertices of the ellipse, as shown in Figure 4. Figure 5 shows how this algorithm improves the presentation, using the data shown in Figure 3.

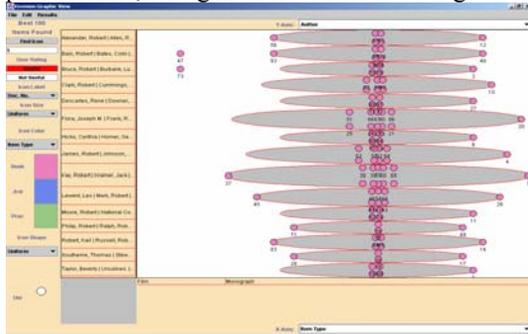


Figure 3. Clusters, unevenly distributed icons

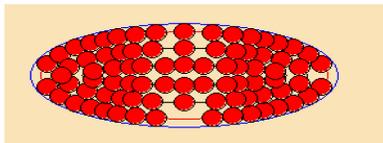


Figure 4. Pseudo-equal distance icon rendering

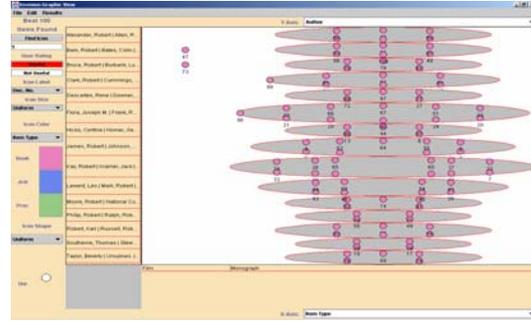


Figure 5. Clusters after angle adjustments

5. CONCLUSION AND FUTURE WORK

The new interface of Envision adopts a middle ground between a strongly coordinated matrix view and a loosely arranged map view approach. Aggregation of attribute values on the axes of the matrix removes the problem of scrolling, but creates many clusters. An icon-rendering algorithm reveals the documents inside clusters. A variable-width algorithm assigns screen area to clusters depending on document counts, while a modified equal angle algorithm improves placement of documents inside cluster ellipses.

Our interface runs with the C/C++ version of MARIAN. Through formative evaluation we will refine our methods as we deploy this interface as front-end to the Java version of MARIAN, which soon should afford access to diverse digital library collections. We also are working to define a lightweight protocol to connect visualization tools and digital libraries, and so hope Envision will have even wider utility.

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