

results among the massive number of documents returned, research needs to focus on the following aspects:

Visualization should be combined with clustering for providing overviews of topics related to the search query. Clustering should be interactive and it should provide multiple criteria for the user depending on their interest. This helps users who look for information related to different topics for a task. Visualized clusters should be easy to manipulate so that users turn to clustering techniques and abandon the list-of-hits-based presentations. Users should be able to easily and interactively search clusters of interest and not follow the hierarchy usually provided by clustering search engines such as Clusty (<http://search.yippy.com/>). Finally, the type of user and their interest and task should also be taken into consideration.

There are further enhancements that need to be implemented in our DMSRPI prototype before it can be tested. Zooming is provided only for each individual page. Only one clustering criteria (topical clustering) has been considered in DMSRPI. Future work will involve clustering based on the genres to which each web page belongs, the network domain, and possible other criteria. Moreover, testing DMSRPI would reveal further issues that would need to be handled in future versions.

In order to test DMSRPI, a user study is needed. In a user study, the prototype will be compared to current Web search engines such as the raw-based presentation used in Google and the clustering-based search engine Clusty. User will be given search tasks and will be asked to submit queries and evaluate the results provided by each interface involved in the comparison. The study will evaluate the effectiveness as well as the engagement of DMSRPI compared to the other search engines in the comparison. However, since this prototype is at the early stages of development, a pilot study will be conducted first.

VII. CONCLUSION

This article presents a prototype system in which visualization and clustering were implemented to improve the presentation of Web search results. The DMSRPI prototype employed web page snapshots for presenting each individual result while using a data mountain layout for presenting each cluster of documents that belong to a topic covered in the result set. Future steps include implementing a visualization-based mechanism for reformulating queries as suggested in Alhenshiri and Blustein (2010) as well as using more than one clustering criteria. Following a pilot study, a complete factorial user study will be conducted to evaluate the effectiveness of the DMSRPI system in assisting users gathering information on the Web.

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