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Recommending Views from Stacked Graph Logs

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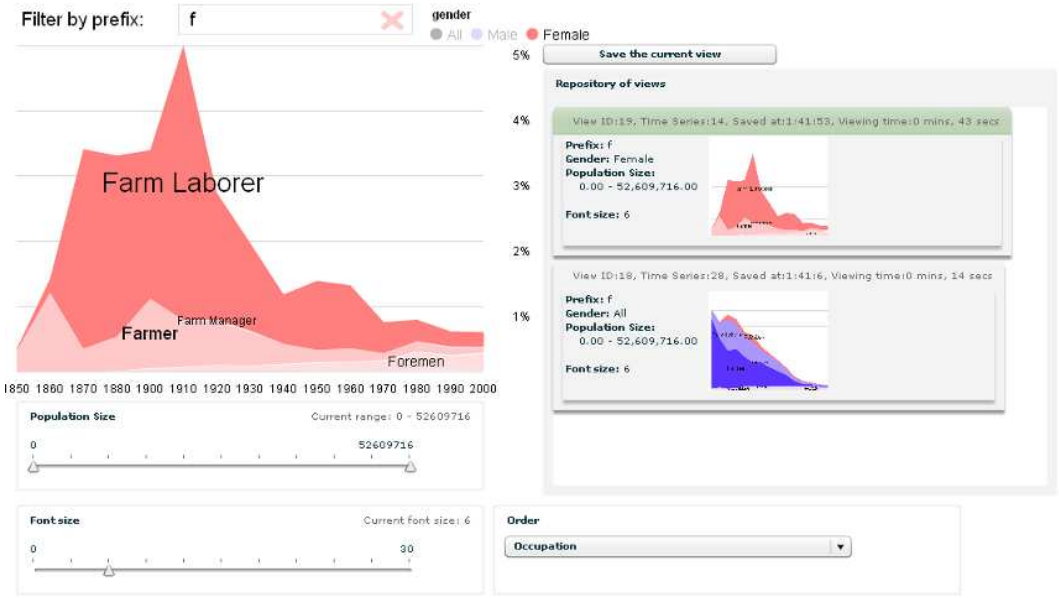

Figure 1: *Screenshot of our stacked graph visualization tool*

Abstract

We developed a view recommender module to encourage and support creativity. Our module was built for the stacked graph visualization and is based on a first study on implicit interest indicators. In our system, dwell time on a view is considered as good user interest indicator. Based on our first study, we examined several dwell times thresholds for identifying interesting views and found that the most effective threshold was 11.5 seconds. Views satisfying this property were considered to calculate the dwell time mean and views above the mean were considered as good candidates for recommendation. Our goal is provide a tool to facilitate creativity by knowledge gathering, knowledge integration and ultimately, idea generation.

CR Categories: K.6.1 [Management of Computing and Information Systems]: Project and People Management—Life Cycle; K.7.m [The Computing Profession]: Miscellaneous—Ethics

Keywords: stacked graph, creativity, dwell time

1 Introduction

Stacked graph visualizations have been widely promoted as an approach for time series visualization. The stacked graph is a method for visualizing changes in a set of items, where the sum of their values is as important as the individual items. One important issue associated with the stacked graph is that viewers, from simple tasks, can quickly gain insight into a data set with a glimpse into the visualization as a whole. A comprehensive analytical task plan, however, requires trying several analytical paths in the search for a solution, due to the multiple perspectives on the data from the stacked graph usage. In this paper we propose a recommender module to foster creativity in the search for solutions through the stacked graph usage. Inspired from recommender systems, we based our study on the notion of implicit interest indicators.

2 Related Work

Stacked graph Visualization tools have proved to be effective for facilitating users analytical tasks. Projects such as NameVoyager [Wattenberg and Kriss 2006] and sense.us [Heer et al. 2009] used animated stacked graphs to explore demographic data. The former proposes the use of two filtering interaction controls while the latter additionally includes the support of asynchronous collaboration. To facilitate a diversity of views, we focus on a single-user approach

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and include five interaction controls: three for filerting, one for sorting, and another to adjust the labels'font size.

Implicit interest indicators techniques have been used to retrieve, filter and recommend a variety of items: hyperlinks, Web documents, journal articles, email messages, news articles, movies, books and jobs [Kelly and Teevan 2003]. Claypool et al. [Claypool et al. 2001] provides a categorization of different interest indicator categories and addresses the question of which behaviors can be used as implicit measures of interest. After a usability evaluation, they found that the dwell time had a strong correlation with a given explicit ratings. In this spirit, Rafter et al. [Rafter and Smyth 2001] provide a method to prevent spurious dwell times in data collected from log records. In this work, we include a study [Toledo et al. 2010] of the effects of dwell times as implicit user interest in the context of information visualization systems.

Tools to support creativity has been addressed by Shneiderman [Shneiderman 2000] and Greene [Greene 2002]. Shneiderman provides a "genex framework" in which there are four phases for promoting creativity: *collect*, *relate*, *create*, and *donate*. In this work we adopt the *collect* approach as a means to support creativity by learning from previous views. Greene, on the other hand, suggests seven user-centered design techniques as characteristics of tools supporting creativity. The one we adopt is concerned with the support of search, retrieval and classification.

3 Methodology

We developed a stacked graph visualization that was designed to facilitate the production of views required for different visual analytics tasks. By means of five interaction controls, our interface encourage users to gain insight into a data set of 510 times series of 255 kinds of jobs. Additionally, a repository of views was implemented so that users, during visual inspection, could save and retrieve their views. With this framework at hand, systems logs were kept indicating the usage of the stacked graph.

Using a client-server model, two components were designed. The client-side was implemented using Flare [Flare] for Flash Player 9, and the server-side using J2SE 6.0. View screenshots were captured using the ascorelib library from Adobe, and data logs were recorded using plain text files. The two components were tested on windows desktop computers.

In a first study [Toledo et al. 2010], we conducted a usability evaluation of the stacked graph with participants from our laboratory. For the usability study, we asked participants to answer two different kinds of questions according to the visual tasks characterization (*identify*, *compare*, *correlate*) [Zhou and Feiner 1998]. After answering each question, participants were asked to rate the usefulness of the views he/she produced. The rating criteria was as follows: HIGH (very useful), MIDDLE, and LOW (not useful). Our general hypothesis was that participants would produce more dwell time on views they explicitly rate as useful.

Fourteen participants participated in the usability evaluation. The participants were graduate students, who had no prior knowledge of and experience with the stacked graph. Participants took part in individual sessions that lasted an average of 40 minutes. For each question, participants were given a time limit of 4 minutes to complete the question. Each participant was timed, observations were gathered, and the participant's answers was collected for each question.

From the usability evaluation, we examined several dwell times thresholds for identifying interesting views, i.e., rated in the HIGH group. We found that the most effective thereshold was 11.5 seconds, resulting in 70% of interesting views being identified at 66.6% precision. In our sytem, views with dwell time above this threshold were used to obtain the dwell time mean. Then, our system, through subsequent usages of the system, deems as useful for recommendation any view with dwell time above the mean, which are presented to the user in the corresponding interface.

4 Discussion and Future Work

Our recommender module has a twofold purpose in visual analytics taks. First, as a tool for learning from previous work implicitly stored; which is the case with dwell times, in the sense that the collection of recommended views reflects potential hypothesis the analyst might be interesting in. Secondly, as a constrained cognitive environment to delimit the space of search.

In this work we have considered only one implicit interest indicator, i.e., dwell time versus explicit rating. We are working on more implicit interest indicators, such as mouse activity or view revisits. Additionally, we are exploring many more indicators present in the literature [Claypool et al. 2001; Rafter and Smyth 2001]. Finally, an evaluation on the usefulness of the recommender module has to be conducted using experts in a target domain knowledge.

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