Mobile Topigraphy: Large-scale Tag Cloud Visualization for Mobiles

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ABSTRACT

We introduce a new mobile topigraphy system that uses the contour map metaphor to display large-scale tag clouds. We introduce the technical issues for topigraphy, and recent requirements for and developments in mobile interfaces. We also present some applications for our mobile topigraphy system and describe the assessment on two initial applications.

Categories and Subject Descriptors

H.4.3 [**INFORMATION SYSTEMS APPLICATIONS**]: Communications Applications—*Information browsers*

General Terms

Design, Experimentation

Keywords

tag cloud, Android OS, Wikipedia, graph drawing

1. INTRODUCTION

Topigraphy ("topic" + "topography") [1] is a method for displaying a large-scale tag cloud as a two-dimensional contour map. Topigraphy uses a topographic image as the background against which the tag clouds are displayed: tag "heights" represent the centrality of the concept, and the two-dimensional layout addresses tag similarity. Users may find unexpected but interesting and novel information by exploring or wandering over the topigraphic map (topigraph). Serendipity is the unique point of the topigraphy, since it is missing in query-search-based web schemes.

The original topigraphy technique was developed for PC-based web browsing. However, the rapid adoption of smartphones is gradually turning them into the primary web interface. In this paper, we propose a topigraphy-based mobile application "Mobile Topigraphy" for smartphones. To comfortably use topigraphy systems on resource-limited mobile phones, we augment the original topigraphy technique in several ways. Two proof-of-concept applications are introduced: a category ranking system and a quiz system based on Wikipedia articles about people.

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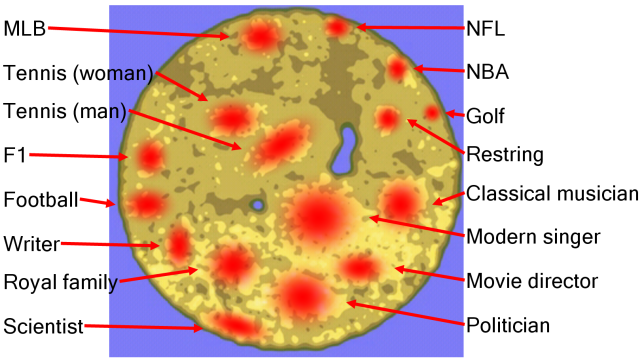


Figure 1: Topigraph of the people known to Wikipedia

2. TOPIGRAPHY

Let us describe the original topigraphy technique [1] on which our proposed mobile technique heavily depends. To construct a topigraph, we need undirected graph $G = (V, E)$. Each vertex $v \in V$ is a tag, $D(v)$ is a set of documents tagged as v. Each edge $e_{ij} \in E$ has its own weight, which corresponds to the similarity of tags v_i and v_j. Given G, we calculate (x, y) locations of tags based on a graph drawing technique [2]. Tag "heights" z can be defined by some measure of tag importance such as Document Frequency(DF).

In our experimental implementation, we generate a topigraph for the people-oriented articles in Wikipedia. About one million articles that include human names (tags) were collected. We computed the similarity edge weights based on Fisher's exact test of the DF and the co-occurrence frequency of name tags in the articles. We retain only the top 50K weighted edges, and remove smaller isolated sub-graphs if they contain fewer than 10 tags. The result is topological undirected graph data G with 5,908 tags (names) and 48,223 edges (human networks). In this implementation, we add the central force and the circularized boundary condition to the labeled graph drawing method [2]. The tag height, z, represents DF. An example of the resulting "moon-like" topigraph of the human network is shown in Figure 1 [1].

3. MOBILE TOPIGRAPHY

Our goal is to develop a topigraphy system for smartphones, called "Mobile Topigraphy". However, mobile-based

[1]A high resolution picture is available at:
http://www.kecl.ntt.co.jp/as/WWW2011/

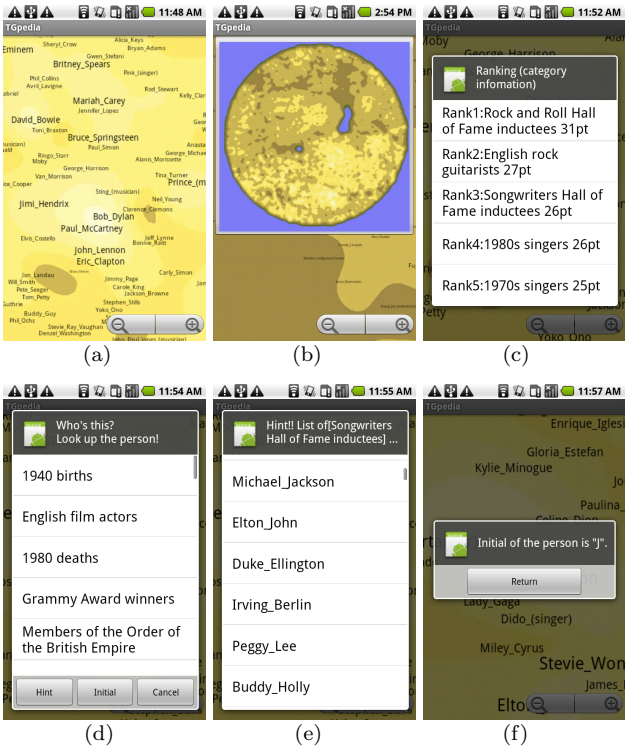


Figure 2: Screen-shots of Mobile Topigraphy.

topigraphy has different technical requirements from PC-based topigraphy. For comfortable use in smartphones, Mobile Topigraphy augments the original technique in the following ways.

1. Scalable maps for tiny screens Smartphones have much lower resolution displays than PCs. Therefore, it is difficult to draw a complete whole topigraph at once at a sufficiently usable size. Thus it is reasonable to implement scalable maps, which allow the user to freely zoom in on and out of the map. In addition, we provide a overview mini-map to make it easier to jump and fly over the topigraph as in Figure 2(a) and (b).

2. Scrollable maps for touch-screen navigations Most smartphones are equipped with touch-screens. To utilize intuitive operations by touch-screens, we have developed a scrollable map feature. This enables the user to intuitively explore or wander around in the topigraph by using the touch-screen to indicate the desired direction. One demerit of smartphones is the difficulty of inputting words. However, topigraphy navigation needs only a single finger, of course, voice retrieval is also available.

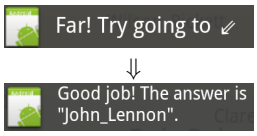
4. EXPERIMENTAL APPLICATIONS

We developed two experimental applications for the mobile topigraphy system.

4.1 Who's here?: ranking the category

"Who's here?" shows a human category list where each category entry is ranked among all human articles within the current screen. A screen-shot is shown in Figure 2(c). The system computes points for each human name (tag) for ranking based on the tf-idf method. The ranking of the i-th category is computed as $P_i = D_j \times \log(N/C_i)$, where N is the total number of human tags, C_j is the number of the human articles that include the i-th category, and D_j is the number of human articles appearing within the screen.

The "Who's here?" application allows us to know the relative status of one human against the neighboring people.



The user is led to the correct tag by the distance-based accuracy index and the navigator arrow.

Figure 3: The navigation flow.

4.2 Who's this?: guessing the tag

"Who's this?" is a quiz system that asks us to guess a human from the category profile. As a query, the system randomly chooses a human article that has more than five category entries. A user can set the difficulty of the quiz by selecting one of three grades: "easy", "normal", and "hard" based on the DF of the human articles. When the user starts this application, a question is presented as the category information of the answer name(tag) as in Figure 2(d). The user is provided with two hints. First, the user can consult possible candidates for each tag entry (Figure 2(e)). Second, the initials of the correct name are shown as in Figure 2(f).

If the user choses an incorrect human tag, the accuracy of the selected tag is scored using three grades of "Far", "Close", and "Very close". In addition to the distance-based index, we added direction navigation with eight directions, " $\leftarrow$ $\rightarrow$ $\uparrow$ $\downarrow$ $\nearrow$ $\searrow$ $\swarrow$ $\nwarrow$" as shown in Figure 3. These serve as "geographic" hints that indicate the direction of the correct tag in the topigraph.

"Who's this?" is a novel quiz system. The users search for the right answer by actually exploring a topigraph. The users may encounter unexpected but interesting information and articles during the quiz, which is difficult to achieve with query-based search systems.

5. CONCLUSION

In this paper, we proposed a topigraphy-based mobile application "Mobile Topigraphy" for smartphones. The system is based on the topigraphy technique [1]. We augment the topigraphy to make it suitable for smartphone platforms. In addition, we have implemented and described two novel applications.

We are now interested in identifying new features that can improve the user experience of mobile topigraphy systems. We are also eager to examine the quantitative and qualitative effects of topigraphy.

6. REFERENCES

[1] K. Fujimura, S. Fujimura, T. Matsubayashi, T. Yamada, and H. Okuda. Topigraphy: visualization for large-scale tag clouds. In *Proceeding of the 17th international conference on World Wide Web*, WWW '08, pages 1087–1088, New York, NY, USA, 2008. ACM.

[2] T. Matsubayashi, T. Yamada, S. Fujimura, and K. Fujimura. Individual ellipsoidal potential method for labeled graph drawing. to appear in *Visualization and Computer Graphics*, in preparation.