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Exploring Subjective Survey Classification of a Photographic Archive using Visual Analytics

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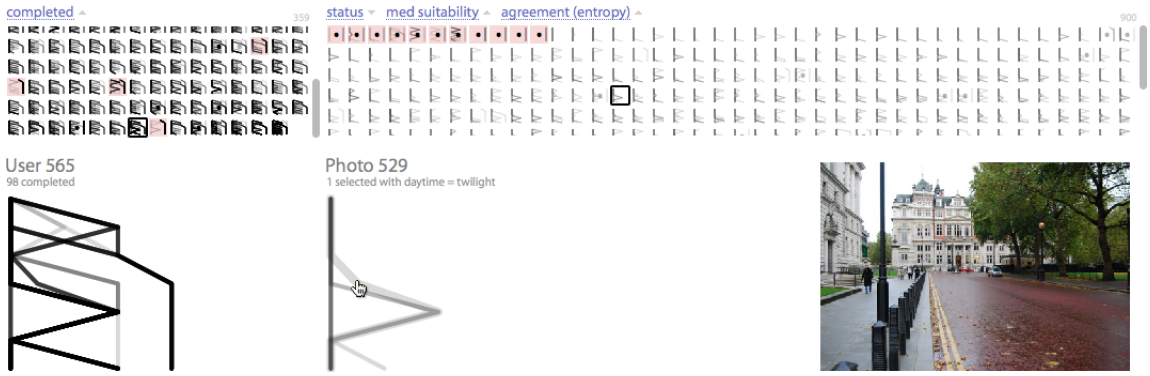

Figure 1: The interface of the survey results analysis tool allowing navigation through all 8,434 collected responses (49,285 answers) with use of glyphs, small multiples, linked views and real-time interaction. *Photograph © CC-BY-SA 2.0 Nigel Chadwick.*

Abstract

We use an interactive visual analytics approach to explore the results of a survey and utilise parallel coordinate plots and small multiples as key visualization techniques. The scope of the survey is a set of 900 photographs from 3 origins, which were to be subjectively classified by the participants in a number of ways. In this poster we describe the interface of the designed tool and also highlight the findings it allowed us to make. By visualizing the collected survey data and navigating through it we could estimate the proportions of different types of photographs, identify qualitative differences between their sources and correlate the responses with image metadata. We were also able to support the survey process itself: with various visual representations of the collected results we could detect inappropriate behaviour of a number of participants, handle issues related to unavailability of some photographs and also ensure responses sampled the image database appropriately.

Keywords: Survey results, data exploration, glyph-based techniques, visual knowledge discovery and representation, crowdsourced assessment, photographic data.

1 Introduction

As part of a project aiming to investigate how the spatial density of shared photographs contributes to a measure of attractiveness of urban streets, we conducted a survey[1] to collect people's opinions on the content of a random sample of photographs. We were looking for human input to better understand the nature of the datasets and to support automatic selection of photographs that best depict the attractiveness of urban walkways. The sample we worked with contained 900 photographs shared by users of Flickr[2], Geograph[3] and Panoramio[4] (300 items for each source). The participants were asked to classify the images shown to them in a random order by a set of 7 criteria, e.g. to state whether a photograph is taken indoors or whether it is attractive for a walk. Our aim was to collect multiple answers for each image, because we knew that the inputs could vary due to different opinions or vandalism. The subjective nature of the responses increases the complexity of the dataset although makes it more interesting to investigate.

Being uncertain about what to expect from the results of the survey we decided to use interactive visual means to explore the collected data. Our main objective for using the visual analytics tool was matching the aim of the entire survey: we wanted to get more understanding of the datasets we were working with. Thus, we were aiming to find out the qualitative differences between the selected photographic sources and also to see the correlation between the human opinion and the image metadata. The second objective was to control and understand the process of survey data collection itself; there were 2 issues we wanted to cover: (1) vandalism, the nature of which we could not predict in advance, (2) potential problems with used photo service APIs to which we had to react quickly.

2 Exposition

Design principles and the interface layout Adhering the following principles helped us to construct the interface of the visual analytics tool: *the data as interface*, *consistency of encoding*, *history* [4], *wide use of keyboard shortcuts*, *transitions between views*. The layout of the application is shown in Figure 1. We were interested in visualizing all responses grouped by both participants and subjects (photographs) in a single view and also be able to request the details of each grouping on demand. This suggested a semi-symmetric layout with the screen vertically split into 2 equivalent parts. We decided to use small multip les [5] to represent both subjects and users in the lists to support their comparisons and achieve a high density of shown information. The space below the lists is used to visualize responses of an arbitrary selected participant and a photograph on demand.

Representation of participants' responses Inspired by the success of use of glyphs and small multiples for the representation of dyadic social relationships [1] and temporal patterns in climate data models [6], we decided to use a similar approach for displaying collected categorical survey data. We were looking for a rep-

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[1] http://www.photoassessment.org/
[2] http://www.flickr.com/
[3] http://www.geograph.org.uk/
[4] http://www.panoramio.com/

resentation that would allow us: (1) to see each individual answer, (2) to observe individual responses (a set of answers), (3) to visually estimate the number of answers in a group, (4) to see the most frequent answer profile and (5) to estimate the amount of disagreement among answers. Adopting the concept of parallel coordinates plots [2] we chose to represent the positions of switches for each response by linking them with a polygonal path (Figure 2):

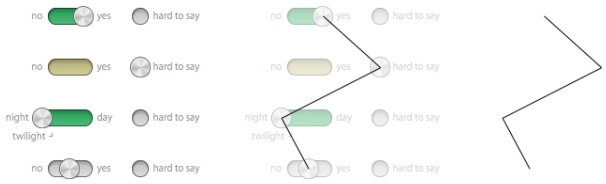

Figure 2: Design idea for a single user response representation.

With this approach we could show multiple response profiles in a single view by laying them on top of each other and adding transparency to the paths. To make the view more abstract we aligned the answers on a *virtual grid*, making sequences of both questions and categories clear and adjustable. *Purpose-orinented ordering* of categories is one of possible modes – it makes it easier to distinguish subjects (photographs) that according to human opinion are the fittest (are found the most reliable measures of urban streets), see Figure 3 row 1. The glyphs are interactive so that it is possible to quickly navigate through the answers about a certain photograph or by a given user.

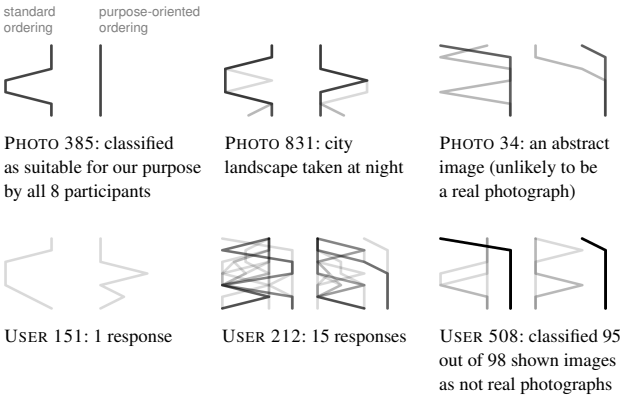

Figure 3: Glyphs representing responses grouped by photographs (samples) and users (participants). Opacity of a single line is 15%. Vivid patterns in groupings denote a high level of agreement among responses. In the context of photographs this means the easiness of their interpretation, but hints to a problem in user groupings.

Aggregated Lists of responses Having the glyphs scalable down to thumbnails, we were able to display all of them on one screen for the entire dataset: 359 contributed participants and 900 photographs. We made the glyphs optionally replaceable with a solid single-coloured fill representing some value featuring each group (e.g. a number of completed responses) and also combined the usage of the glyphs with the background colour to identify rejected (banned) users or removed (deleted from the origin) photographs . While the glyphs could hardly be made less than 20×20 pixels without a loss of depicted information, fill-colour mode could be made more compact to represent tens of thousands of response groups on a single screen if there was a need [3].

A number of optional symbols were also used, for instance grey border shading for highlighting users with new responses and bullet points ◦ or • to denote temporal or permanent photo unavailability. Cross-highlighting of linked entities in two lists on demand helped to better understand the relationships between certain patterns, and multi-level sorting (Figure 4) allowed looking at the survey results from a variety of different angles.

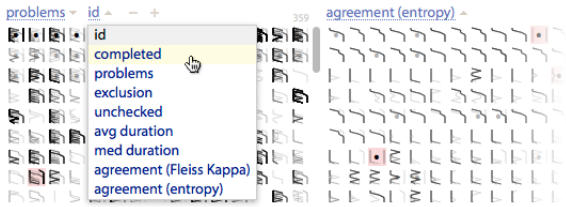

Figure 4: Multi-level sorting of the entity lists, in each level counting 9 options for users and 28 options for photographs.

3 Findings and Conclusions

There are two groups of findings we got by means of the designed interactive VA tool, according to its objectives. The first one is related to maintenance of the survey: we could detect and exclude 7 misbehaving users, respond to photo service API faults, and also improve the algorithm of photograph-to-user assignment to deliver a smoother coverage of subjects with responses. The second group of findings relates to the goal of our study: the interactive exploration gave insights on the selected photographs and helped with characterising the datasets they are from. Thus, we discovered that Flickr sample contained significantly larger numbers of indoor photographs, images taken overnight, containing human faces, etc. This source also contained fewer 'attractive' photographs according to the opinion of the users. Mixing additional data into the lists and combining different views with various orderings helped to conclude about the relations between the metadata of the photographs and the responses. For instance, we found that a timestamp is not a reliable measure for detecting night photography and that such task can be better done by looking at the combination of aperture, shutter speed and ISO found in EXIF.

Although the chosen method is limited to certain types of questions and numbers of answers, we believe that the visual analytics tool similar to ours could be successfully used in a number of other cases helping survey organisers to better understand the collected subjective data. The source code of our implementation as well as the dataset with the answers are open and free to use[5].

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