Improving Product Browsing whilst Engaging Users

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ABSTRACT
We describe a new browsing system that improves online navigation of large numbers of objects which are otherwise difficult to label or split into categories. We use a two-stage process to obtain human similarity information which forms the core of the system and is used to create a resizable self-organizing map. This comprises a matrix of image stacks that provides a fast, intuitive and highly visual navigation environment. It can be easily implemented in sites, blogs and newsletters. We report the methods used to obtain the similarity data and derive the navigation system, and illustrate this with an example taken from the domain of abstract art.

Categories and Subject Descriptors
H.5.m [**Miscellaneous**]: Information Interfaces and Presentation (e.g. HCI) Miscellaneous.

General Terms
Documentation, Design, Human Factors.

Keywords
Navigation, categorization, engagement, Interactive, presentation, engagement, web, tool, visualization, gamification.

1. INTRODUCTION
One of the core components of any website is the navigation (menus). In most websites, products can be easily categorized by type, functionality or colour. For example in a shoe shop the shoes will be categorized by gender, type, colour, size and brand. Known categories and common labels allow users to find products with relative ease and speed. However, objects that do not have obvious categories such as wallpapers, abstract art or patterns are notoriously difficult to navigate.

In most cases users quickly become frustrated if they can't easily locate the object they are looking for. This can have a negative influence on shopping behaviour, Menon et al [1]. Therefore, we have investigated the use of community-derived similarity judgements to develop a new browsing system.

The data are collected in a two stage process. First, free-grouping experiments are performed with a smaller (circa 100 object) subset to provide an embryonic navigation system which is then used to elicit information on the whole catalogue. The second stage can be 'gamified' as described by Deterding et al [2] to improve engagement and take-up.

2. CROWD BASED NAVIGATION
It is well known that crowds have a relatively similar performance when compared to an expert on a given task (wisdom of crowds) [3]. In our method, we compile the knowledge from an online community to create a navigation which is intuitive to all users. We decided to use a browsing model based on self-organizing maps (SOM) [4] as described by Halley [5].

In the first stage we 'bootstrap' the process by creating a similarity matrix with a subset of a reduced number of samples (100) in a controlled environment. Individuals are asked to organise the subset into groups of 'similar' objects. A similarity matrix is derived in which the similarity score between any two objects is simply the number of times that the objects have been placed in the same group. This provides the data for construction of the 'bootstrap' navigation system comprising a self-organizing map (SOM) of a specified width and height (size is tuned to display space). The 100 objects are divided into a number of 'image stacks' that contain similar objects. Each image stack being represented by a single exemplar image, clicking on the exemplar reveals the contents of the stack. The exemplars are arranged in a grid in which the screen distance correlates with the mean similarity between the two stacks of objects.

This model of navigation is simple for observers to grasp and has been proven to be an efficient browsing model [5]. We use the bootstrap system to derive similarity matrices for the complete catalogue using crowd-sourcing. Users are presented with a 'new' objects and asked to navigate to the closest matches in the bootstrap subset. These matches are used to calculate new entries in the similarity matrix. User Engagement in this second phase is particularly important.

3. GAMIFICATION OF THE TASK
The main problem of crowd-based processes is finding a willing and focused audience. This is when "gamification" is important. Gamification is the term commonly used when video game elements are introduced to non-gaming systems to improve user's experience. Many websites now use gamification to engage and reward users.

We incentivised the second stage of the similarity matrix derivation by creating a game environment where users see new object which they try to match with a similar object. Users are then rewarded for their contribution. The game-reward mechanic helps the enjoyment and engagement of the users. It is also important to note that users increase their sense of community, ownership and contribution [6] by using this mechanism.

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4. ABSTRACT ART STUDY

In order to evaluate the effectiveness of our approach we chose to derive a navigation system for abstract art as it can be separated into many movements and types. Art websites use many labels for navigation which confuse and alienate non-expert users. As a result, abstract art is a good test for our system

To start, we gathered 1000 random images (with public domain licenses) tagged with the word 'abstract' from the Flicker website (http://www.flickr.com) and Google Images (http://www.google.co.uk/imghp). We then removed repeated samples from the set and images with recognizable objects. We finally randomly reduced the set down to 500 images while attempting to avoid too many similar images. The final set of images is shown in Figure 2.

To create the similarity matrix to bootstrap the process, we asked 20 naive observers to group 100 random images (from the set of 500) as they saw fit. As we do not have access to an art website or community, we decided for the second stage to augmented the similarity matrix with new objects using Amazon's Mechanical Turk (https://www.mturk.com) a crowd-sourcing tool. In it, users where presented with a game like interface where they were shown an image and asked to match it with an image they thought was similar(Figure 1). MTurk users were rewarded with micropayments (with payment amounts exceeding the UK basic hourly salary). We collected 2000 observations from 100 MTurk users, which we used to augment the similarity matrix of the catalogue.

Figure 1. Example of the MTurk interface.

Using the augmented similarity matrix we created the self-organizing maps. These maps can be created with any number of rows or columns with the optimal being 8 rows by 14 columns. Figure 3 shows a simple 5 row by 5 column SOM to demonstrate the concept. Features to note are:

- The top left section is mostly composed of colourless, man-made abstract-like structures, whilst the bottom right section is composed mostly of colourful, messy abstracts.
- The bottom left section contains more natural, plant-like abstracts, whilst the top right corner consists of abstract lines.
- The centre is composed of simple structure-less samples with any stack in between being its own node related to the matrix.

The SOM's matrix size can be easily changed and accommodated in any website and it is very intuitive to browse objects without a background knowledge of the subject. As seen in Figure 3, the SOM encapsulates all the 500 abstracts, simplifying the navigation for users.

5. FUTURE WORK AND CONCLUSIONS

Even though the SOM works well for browsing, the optimal number of rows and columns is still unknown when displayed in various kinds of displays. It is unknown if users with lower screen resolutions such as those found in mobile devices can have problems navigating catalogues. Further research is needed to analyse the best width and height of the SOM in various devices.

The gamification of the second stage can also be investigated further to discover the most engaging mechanism for users and how the task can be varied to stop boredom in returning users.

As discussed, this navigation system can be further optimized for different devices and to avoid task boredom. However, our study shows that the method as it is, works well to simplify the navigation from difficult to categorize objects. At the same time, the gamification of the second stage augmenting the catalogue helps to engage users and create a sense of community and ownership.

6. ACKNOWLEDGMENTS

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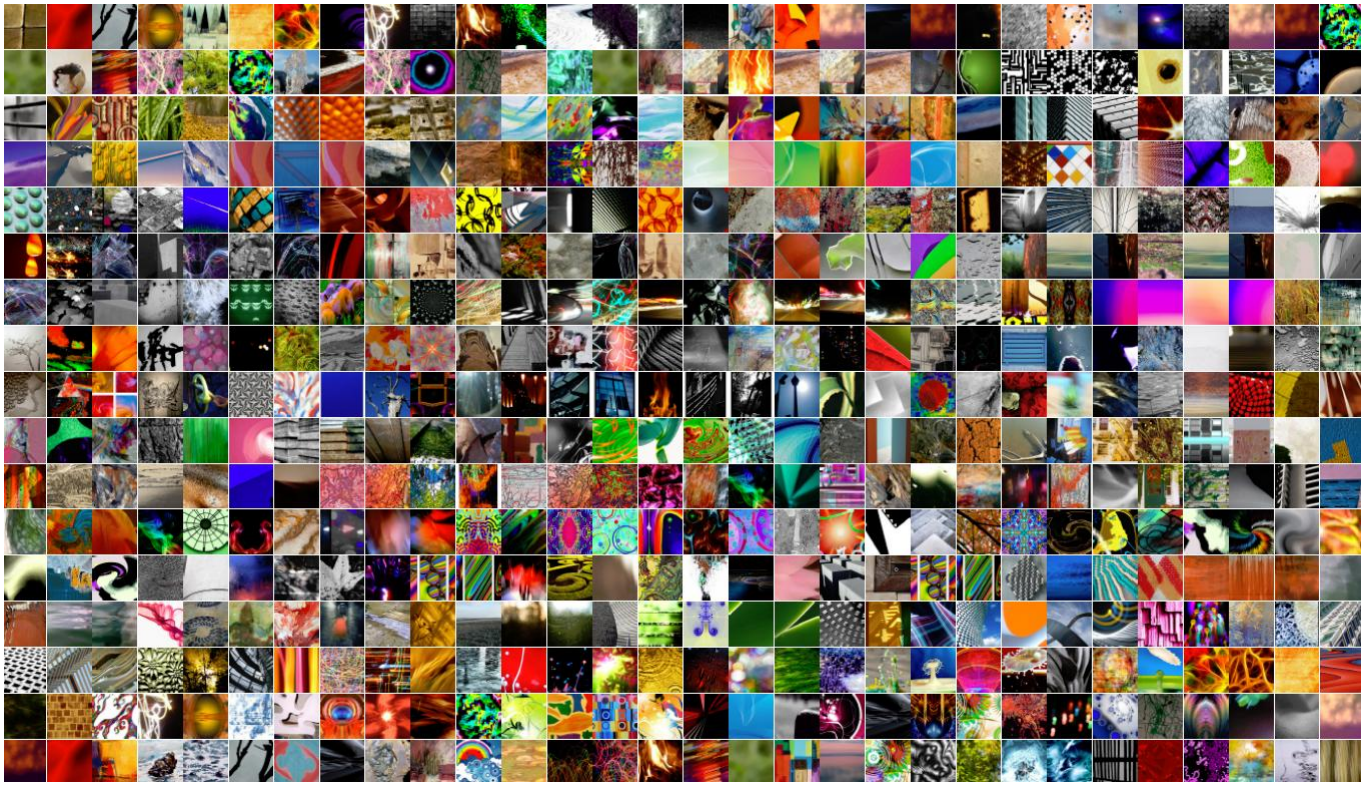

Figure 2. Image set of words tagged as 'abstract' from Flickr and Google Images.

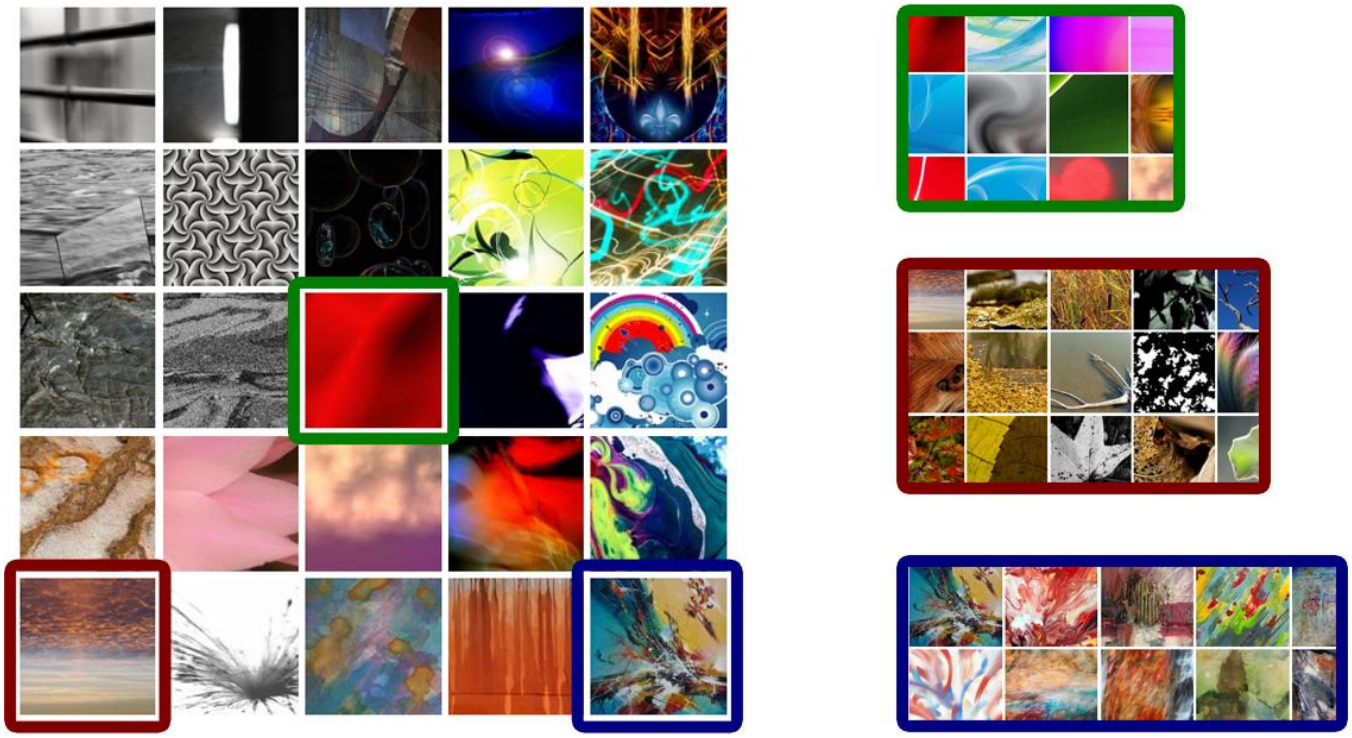

Figure 3. On the left, an example of a 5x5 SOM, each image on the grid represents a stack of images. On the right, the border colour represents the stack for the SOM and the images inside are a sample of each stack.