Browsing Abstract Art by Appearance

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ABSTRACT

In this paper we describe an innovative browsing system that improves on the navigation of a large set of objects which are either difficult to label or categorize. We use a two-stage process to obtain similarity information from humans, which then becomes the core of the system, this perceptual information is then used to create a resizable self-organizing map which comprises a matrix of image stacks that provides a fast, intuitive and highly visual navigation environment. We report the methods used to obtain the similarity data from observer to derive the navigation system and illustrate this with an example from the abstract art domain.

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, similarity, appearance, web, tool, visualization, organization, art, abstract, browsing.

1. INTRODUCTION

The ability of humans to quickly associate labels or categories to objects is astonishing, a tell tail sign of this ability is shown on the navigation design of most of the online retailers and websites were products are normally sort in commonly recognizable categories by type, functionality or colour. For example in an online 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.

It is very common for users to 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]. And in the worst case, the user will simply not find the desire object losing a sale to the retailer.

As a result, we have investigated the use of community-derived similarity judgements of visual appearance to develop a new browsing system intuitive to humans.

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 consists of aggregating similarity judgements of new samples using a fun interactive or 'gamified' environment as described by Deterding et al [2] to improve the engagement in the community whilst adding new samples to the browsing environment.

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 system, 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' object and asked to navigate to the closest matches in the bootstrap subset. These matches are used to calculate new entries in the similarity matrix.

3. ABSTRACT ART STUDY

In order to evaluate the effectiveness of our approach we chose to derive a navigation system in the domain of abstract art. Art can be separated into many movements and types, art websites normally use many different labels for navigation, many of which confuse and alienate non-expert users. Therefore, abstract art is a good test for our new visual navigation 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 artefacts inside them like faces, people, text or objects. We finally randomly reduced the set down to 500 images while attempting to avoid too many similar images by avoiding big sets of similar downloaded 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. For the second stage augmenting the similarity matrix with new objects, we used Amazon's Mechanical Turk (https://www.mturk.com) a crowd-sourcing tool as we do not have access to a large art website or community. In it, users where presented with a game like interface (Padilla et al [7]) 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 were payment amounts exceeded the UK basic hourly salary. We collected 2000 observations from 100 MTurk users, which we used to augment the similarity matrix of the whole catalogue of abstract art objects.
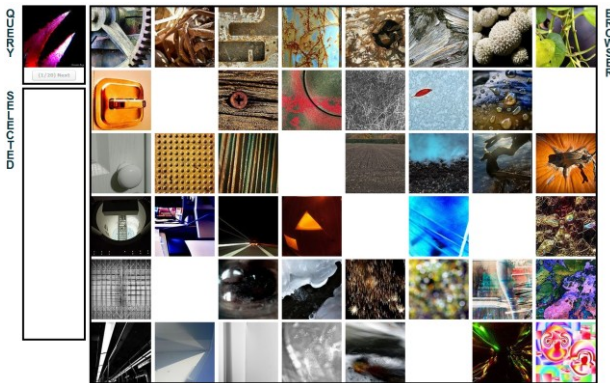

Figure 1. Example of the MTurk interface used to add new similarity judgements.

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 rows by 5 columns SOM to demonstrate the concept. Key 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 dimensions and it is very intuitive to browse objects without a background knowledge in the subject. As shown in Figure 3, the SOM encapsulates all the 500 abstracts using the similarity judgements of appearance from the abstract, greatly simplifying the navigation for users.

4. 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 will have problems navigating catalogues. Further research is needed to analyse the best width and height of the SOM in various devices.

As discussed, this navigation system can be further optimized for different devices and a better augmentation can be created to avoid task boredom. Nevertheless, our study shows that the method as it is, works well to simplify and improve the navigation from difficult to categorize objects. Finally we hope this study will help to further understand how human perceive the various objects in our world.

5. ACKNOWLEDGMENTS

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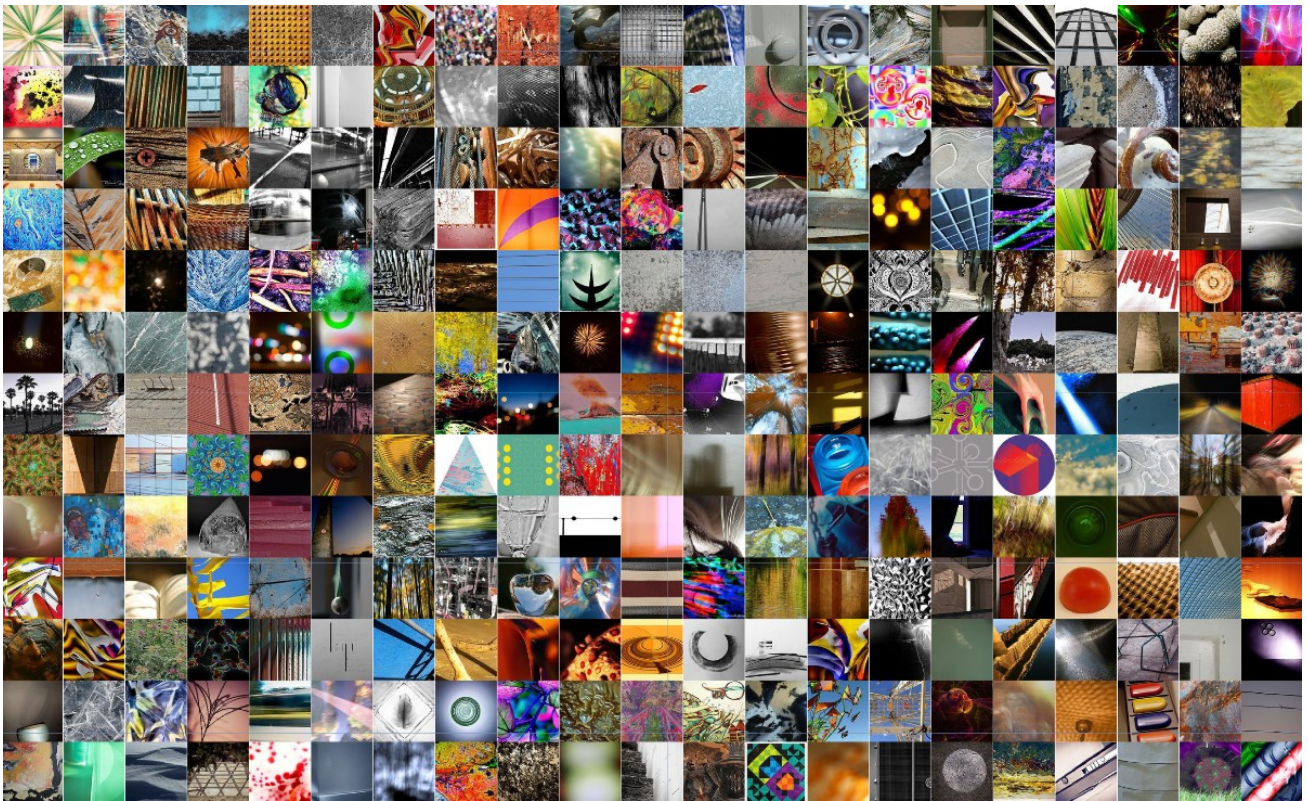
Figure 2. Set of images with words tagged as 'abstract' from Flickr and Google Images.
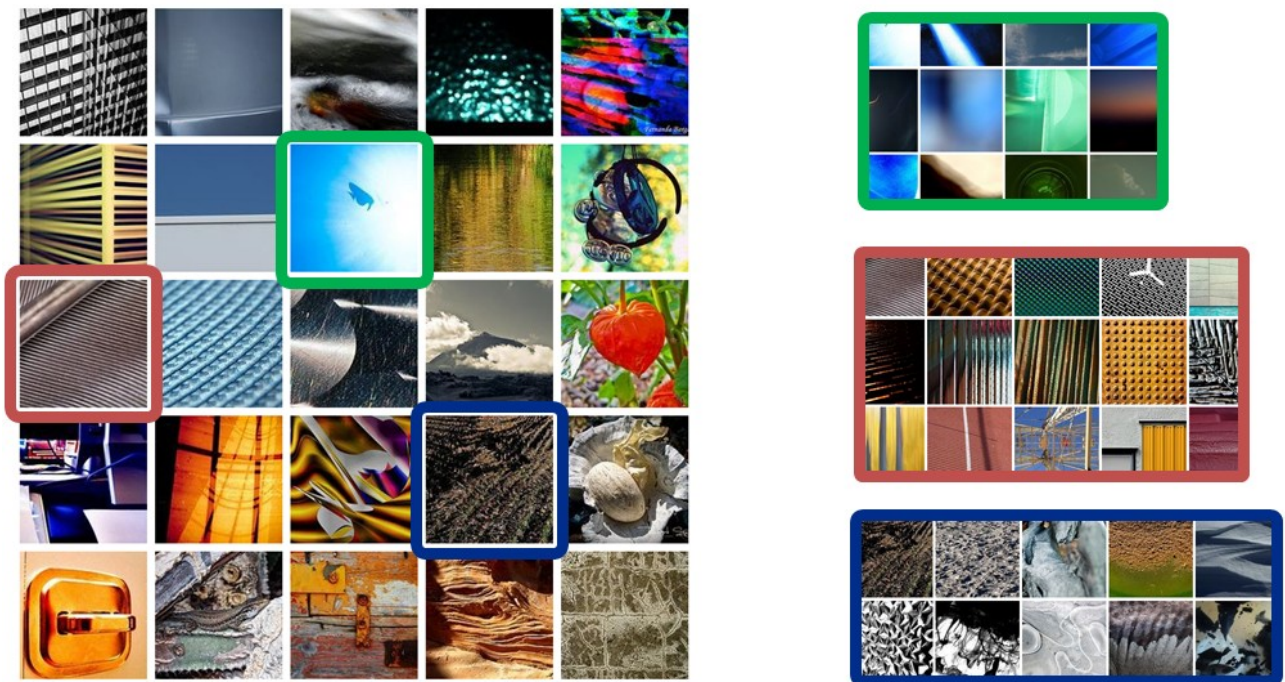

Figure 3. On the left, an example of a 5x5 SOM, each image on the grid represents a stack of images. On the right, the border colour represents the stack in the SOM and the images inside each border are a sample of each stack.