

MemViz: A Tool for Creating Memorable Visualizations

Darius Coelho, Sungsoo Ha, Shenghui Cheng, Salman Mahmood, Jisung Kim, and Klaus Mueller

Visual Analytics and Imaging Lab, Computer Science Department, Stony Brook University, NY, USA and SUNY Korea, Songdo, Korea

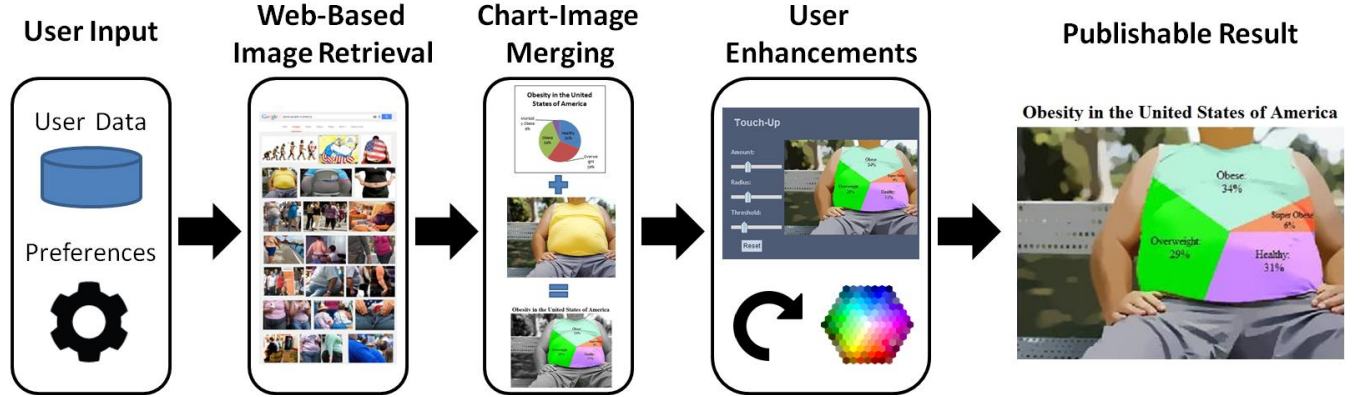


Figure 1: Block diagram of the workflow in our MemViz tool.

ABSTRACT

Our paper describes a framework that aids users in the creation of data visualizations augmented with *chart junk*. Chart junk refers to graphical decorations that are irrelevant to the data, but are meant to make the data graphics more interesting, giving rise to visualizations with low data-to-ink ratios. While outcast at first, recent studies have shown that users tend to find visualizations with chart junk more memorable, specifically for trends and the topic of the chart. It was found that images that contain human recognizable objects are especially useful. So far, chart junk creation has been a quite elaborate task, requiring the skills of an artist. With our MemViz tool now general users can also create attractive chart junk augmented visualizations. It is an interactive framework that links web-scale image search with a set of image processing tools to design chart junk data visualizations with ease.

Keywords: Chart junk, visualization, web-scale image search engines.

1 INTRODUCTION

Memorability is an important aspect of a visualization. We would like users to remember the information they see in a visualization but unfortunately not all visualizations are memorable. Recently, Borkin et al. [1] conducted a study to understand what makes a visualization memorable. One of their observations was that chart junk helped to make a visualization memorable due to low data to ink ratio, high visual density and the inclusion of human recognizable objects. Today such kind of chart junk is mainly created by designers and artists, but we would also like the average Joe to be able to create these types of visualizations with ease. While the creation of highly imaginative-chart junk augmented visualizations like those created by Nigel Holmes [7] is probably out of reach, we show that one can achieve fairly

sophisticated visualizations of this sort with the help of text-based image search engines and image processing tools. These abilities have been implemented in our tool *MemViz* which makes use of these readily accessible resources to enable the average user to create chart junk for presentations, posters and similar.

2 MOTIVATION

While the study conducted by Borkin et al. was the main inspiration for our tool, in our work we focus specifically on the creation of useful chart junk. Bateman et al. [2] conducted a study to test the usefulness of chart junk. Their study concluded that while chart junk and plain graphs were equally comprehended by users, chart junk was more memorable. Stephen Few wrote a critique on Bateman's study [3] where he points out that the study was flawed in some ways, but he ends his critique by stating that properly designed chart junk can be useful. In this spirit, our tool aims to create useful chart junk by embedding basic charts into images retrieved from the internet. To select the most appropriate images from these sets, we can apply the study of Isola et al. [4] that gives advice on what makes an image memorable

3 THE MEMVIZ TOOL

Figure 1 presents the workflow of our method. The user provides the data file and selects the type of chart (pie or line) they wish to plot. Next, we obtain relevant backdrops for the chart junk using a web-scale text-based image search engine such as Google Image. The most intuitive descriptor of the chart is the topic of the data (the header) and the attributes (the dimension labels). The user puts all these into the search string box. The top image returns are then presented, prompting the user to pick one of them to create the backdrops for the chart. To create the actual chart junk we provide a set of different processes described below to merge the chart with the image. Finally, after the chart has been embedded, the user can apply a diverse set of visual effects (grayscale, cartooning, glow, transparency etc.) to the backdrop to give it an illustrative look and feel and also reduce image detail that might interfere with the detail of the chart. This finalizes the result.

3.1 Chart Junking Pie and Fill Style Charts

Pie charts and their spatial generalizations use a division of unity paradigm to show numerical proportions. We developed a method

Emails: {dcoelho, sunha, shenghui, smahmood, jskim, mueller} @sunykorea.ac.kr

that replaces and fills areas in an image with these fill style charts. Given the selected image the user first interactively selects a region into which to plot the chart. We then use grabcut [5] to segment this region and layout the chart into it as described now.

The user is allowed various options to divide and layout the chart in the segmented region. For pie-style charts we allow the user to divide the region radially in two ways: (1) angle-based, i.e. dividing 360° radially proportional to the data, and (2) area-based, i.e. dividing the area of the region radially proportional to the data. In the latter case we use a pixel count to determine the area. For fill-style charts we allow the user to specify an axis across the segmented region and then fill the region along this axis. Again, we divide the region in two ways: (1) based on the length of the axis, and (2) based on the area of each division within the segment for which we use a pixel count as well. Once the region is divided we color the different divisions of the region in CIE LAB color space. This keeps the texture of the region but changes the color.

Figure 2a shows data on US obesity in the form of a pie chart embedded into an image of a man with a large belly. The man's shirt is segmented out and then filled radially by dividing based on angles. An example of filling along the length of an axis can be seen in Figure 3, bottom right where we show movie data filled into a theater screen along its horizontal axis. Finally, the images on the top left and middle left demonstrate the radial area-based fill for data of popular lip stick brands and eye colors, respectively.

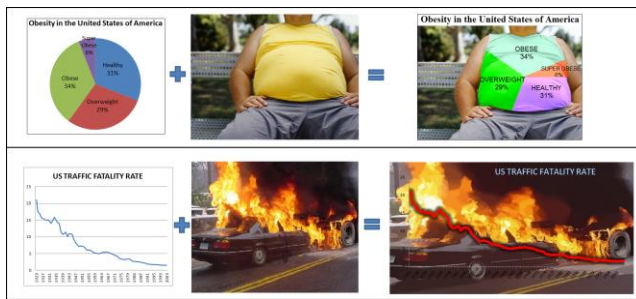


Figure 2: Merging basic charts with images using MemViz; (a) shows a pie chart embedded into an image and (b) shows a line chart embedded into an image.

3.2 Chart Junking Line Charts

To generate junk chart visualizations with embedded line charts, the first step is again to consult a text-based image search engine with title and axis labels of the plot and generate a set of images. But instead of looking for images with closed regions as in the fill chart task, we are now looking for images with features and edges that mimic the trend of the line chart as close as possible. We experimented with a number of methods to perform these matches automatically, but a solution remains elusive. Instead we have provided an interactive interface with some edge finding support that allows users to move, scale, and slightly rotate line charts to and in appropriate positions in the image.

Figure 2b shows an example where we merged US traffic accident rate data visualized as a line chart into an image of a burning car. Based on what is known about memorable images [4] this image will then trigger a car accident related data topic in the viewer's mind. Moreover, the shape of the flames on the car is similar to the overall trend of the line chart.

4 CONCLUSION AND FUTURE WORK

We have presented an initial version of MemViz, an interactive tool for designing chart junk that, according to recent studies, makes data more memorable to viewers. MemViz is unique in that

it allows average users that lack the creative and imaginative skills of an artist to create fairly decent chart junk-augmented data visualizations. A key feature of our system is its use of web-scale text-based image search engines to retrieve large sets of images that are relevant to the topic of the data. These images can then spark the user's creative to visually express the desired message of the data. Merging the chart into the image and adding illustrative enhancements is also easy to do with MemViz, requiring just a few simple mouse interactions.

As future efforts we intend to improve the MemViz tool by creating a custom image retrieval module, implementing better matching algorithms, and adding more chart types. Following our text-based image retrieval with a sketch-based image search of the type described in [6] is also an avenue we plan to pursue. Finally, we plan to conduct a user study to test the ease of use of MemViz as well as test the memorability and understandability of the visualizations created by MemViz.

5 ACKNOWLEDGMENT

This research was partially supported by NSF grant IIS 1117132 and the MSIP (Ministry of Science, ICT and Future Planning), Korea, under the "IT Consilience Creative Program (ITCCP)" (NIPA-2013-H0203-13-1001) supervised by NIPA (National IT Industry Promotion Agency).

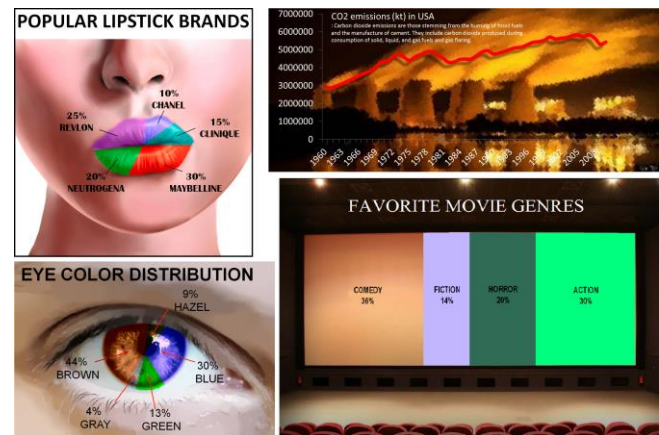


Figure 3: Selected chart junk visualizations created with MemViz.

REFERENCES

- [1] M. Borkin, A. Vo, Z. Bylinskii, P. Isola, S. Sunkavalli, A. Oliva, H. Pfister, "What makes a visualization memorable?," *IEEE Trans. on Visualization and Computer Graphics*, 19(12):2306-2315, 2013
- [2] S. Bateman, R. Mandryk, C. Gutwin, A. Genest, D. McDine, C. Brooks, "Useful junk? The effects of visual embellishment on comprehension and memorability of charts," *CHI*: 2573-2582, 2010.
- [3] S. Few, "The chartjunk debate. a close examination of recent findings," *Perceptual Edge Visual Business Intelligence Newsletter*, April, May, and June 2011
- [4] P. Isola, J. Xiao, A. Torralba, A. Oliva, "What makes an image memorable? IEEE CVPR: 145-152, 2011.
- [5] C. Rother, V. Kolmogorov, A. Blake, "Grabcut – interactive foreground extraction using iterated graph cuts," *ACM Trans. on Graphics*, 23(3): 309-314, 2004.
- [6] X. Sun, C. Wang, C. Xu, L. Zhang, "Indexing billions of images for sketch-based retrieval," *ACM Multimedia*, pp. 233-242, 2013.
- [7] <http://nigelholmes.com/>