Web Object Attention Model For Image and Text Object

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Outline

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Introduction

Motivation

- Webpage: Delivers information to the user.
- Most important content should attract user attention early.
- Web designer can use eye tracking instrument, but it is costly and the process is tedious.

Objective

- To develop a attention model for predicting the fixation sequence of human eye on a webpage.

Previous Work

Guided Search

- Parallel Processing followed by Limited Capacity Processing .
- Applicable only when user has particular task in mind.

Visual Saliency Model

- Three Factors: colour, intensity, orientation.
- Generates Saliency Map.
- Works only on images of resolution 640 x 480.

Web Attention Model

- Tries to measure attention factor in the form of a mathematical equation.
- Takes chromatic contrast, intensity contrast, and size of object into account.
- Poor real world results.

Model To Predict Attention Sequence of Web Objects

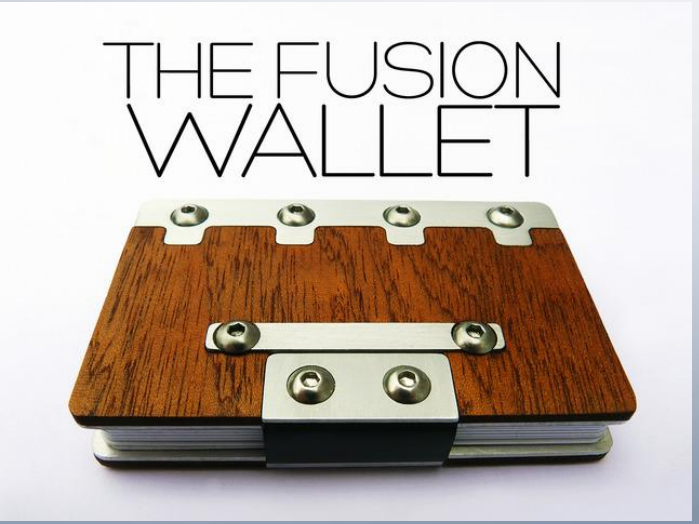
- Extends Web Attention Model.
- Removes Intensity Contrast and Includes x and y-position.
- Works well on webpages that only have images.

Model To Predict Attention Sequence of Both Image And Text Objects

- Tries to broaden previous model to include both image and text objects.
- Collects empirical data in the form of gaze plots of eye tracking instrument.
- Evaluates 150 real webpages to identify object types.

So what a web object is really?

- Coherent region of a webpage that conveys a single information.



Types of Web Object

- Pure Image.
- Image Overlapped with Text.
- Image with caption.
- Paragraph.
- List.
- Table.
- Heading.
- Menu.
- Interactive Objects.

Data Collection

We have extracted the following features in **.csv** format to determine the rank of web objects:

- **Area:** Area of web object in square pixels. Maximum area of the webpage is 1310720 $pixel^2$ i.e. 1280*1024.
- **Mean:** Average gray scale value of the object. This is the sum of the gray values of all the pixels in the object divided by the number of pixels.
- **StdDev:** Standard deviation of the gray values used to generate the mean gray value i.e. Root Mean Square Contrast of the object.
- **Mode:** Most frequently occurring grey value within the object.
- **Centroid:** The center of the object. This is the average of the x and y coordinates of all of the pixels in the image or selection. Uses the X and Y Headings. Leftmost-Topmost point of the screen in taken as origin.

- **Centre of Mass:** This is the brightness-weighted average of the x and y coordinates all pixels in the image or selection. Uses the XM and YM headings. These coordinates are the first order spatial moments. In almost all cases, it is very close to Centroid. So, we have excluded it in our data analysis, but they may be feed into classifiers to get better accuracy.
- **Min:** Minimum grey value within the object.
- **Max:** Maximum grey value inside an object.
- **Median:** The median value of pixels in an object.

	Area	Mean	StdDev	Mode	Min	Max	X	Y	XM	YM	Median
1	8418	204.385	67.557	255	13	255	204	52.5	204.599	52.133	252
2	364794	131.187	81.248	251	0	255	633	288.5	654.488	255.223	118
3	70432	175.102	91.223	255	0	255	256	699	256.017	720.619	227
4	70560	173.173	97.445	255	0	255	509	697	510.843	721.969	251
5	65793	164.177	91.401	255	0	255	760.5	694.5	765.081	717.146	161
6	64938	153.52	99.358	255	0	255	1005.5	697	1007.835	724.876	136
7	72861	234.472	55.915	255	0	255	360.5	933.5	364.857	933.891	255
8	65330	234.631	58.726	255	0	255	863	929.5	868.761	930.011	255

Features of the web objects of a webpage

Data Analysis

Key factors revealed from the analysis of combined rank of objects:

- Y-axis
  - 81 objects are ranked as per as their Y-distance from the top.
  - 25 objects showed inconsistency in their rank.
- Position
  - In 80% of the cases, entry position of the user's eye was the centre of screen.

- X-axis
  - Although in the data collected, we have taken leftmost-topmost corner of screen as (0,0), but for analysis, consider the centre of the screen is defined as X=0, as it is more intuitive.
  - In 19 occasions, a object on the left side of the screen is seen before right side objects.
  - In 13 instances, a object on the right side of the screen is seen before left side objects.
- Size
  - 9 of the 15 objects that ranked first were large images overlapped with text.
  - These 9 objects were attended 97 out of 135 times.

- Contrast
  - In 69.71% cases, high contrast objects generally grab user attention early.
- Mean
  - In 65.23% cases, we have seen that mean grey scale value increases for the object seen later, if all other factors are constant.
- Mode
  - It is observed that mode grey value has no influence on the object rank.

- Median
  - Median grey scale value has little or no effect on the rank of object.
- Min and Max Grey Value
  - Minimum grey scale value for most objects is 0 and maximum grey scale value for most objects is 255. Thus, min and max grey value of object has no considerable effect on object rank.

Empirical Validation

For Validation, we tested our hypothesis on two sets of experimental data. The results obtained are:

- Y-axis
  - 77% of the objects from the validation data are ranked correctly, according to their Y-distance from the top.
- Position
  - In 67.11% of the slides, user's eye was first fixated at the centre of the screen.

- X-axis
  - In 53% cases, left side object is seen before right side object.
- Size
  - In 91.67% occasions, larger objects ranked first.

- Contrast
  - In validation data set I and set II, we have found that in 72.31% cases high contrast objects are seen earlier than low contrast objects.
- Mean Grey Scale Value
  - In 63.57% cases in validation data, we have seen that mean grey scale value is lesser for the object seen earlier.

Conclusion And Future Work

Conclusion

- Larger objects are more likely to attract user's attention.
- Objects near the centre of the screen are noticed sooner.
- High contrast objects catch user attention early.
- Mean grey value increases for objects seen later.
- Objects on the top of screen are generally seen earlier.

Future Work

- Derivation of mathematical equation by combining identified factors.

Thank You