Eye-Tracking: Determining Visual Recognition and Mapping Gaze Fixations

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Abstract

Eye tracking is a technology that monitors, and records eye movement as gaze fixations and saccades. The team has put together an eye-tracking study, which involves presenting test subjects with blurred images, and tracking eye movement as they answer questions about each image. The data of where subjects look will determine the limits of recognition. This data can be used to assess perceived image qualities. For the noisier images the team hopes to see fewer but longer gaze fixations and shorter saccade distances.

Purpose

The main goal of eye tracking is to predict where a person will look. Knowing where people will look is very important. It makes for a design that will be more effective. There are various applications. People look at all sorts of images on a daily basis including web sites, video games and advertisements. These are all things that can benefit from the technology. Imagine bringing in test subjects, presenting them with images and recording where they look. One can take this data and determine the best design for the images. That is what we wanted to create by using a series of photographs as our images.

Materials and Methods

CITI Training and Research

In order to be certified to study test subjects, we were required to complete the CITI Program Online Training. Once complete, we read multiple studies on eye tracking to form an idea on how we will conduct our own study.

Blurred Images

We looked for various images depicting a variety of scenes for our study. Once we determined the set of images we wanted to use, we blurred them on Photoshop. Each of the images were blurred at different levels, ranging from no blur to completely pixelated. We picked 11 images with varying levels of blur, to test our subjects with.

Study

To conduct our study, we designed an album of the 11 blurred photos that would increase from 0 to 60 blur. During each test, the subject would sit up-right in front of the eye tracker and allow it to calibrate their eyes. Then the recording process was started while the subject analyzed each photo.

During the subject's analysis, we asked them a question about what they believe the image is of, and how confident they were about their answer. Their answers were recorded on paper, while left and right eye coordinates were written to a text file.

Analyzing the Data

Once all of our testing was complete, we analyzed each subjects answers and confidence levels to create a graph showing how they correlate with levels of blur.

The text files containing eye coordinates were read over and pinpointed to specific fixations on each photo. The fixations were then plotted on each photo as shown below in figure 1.

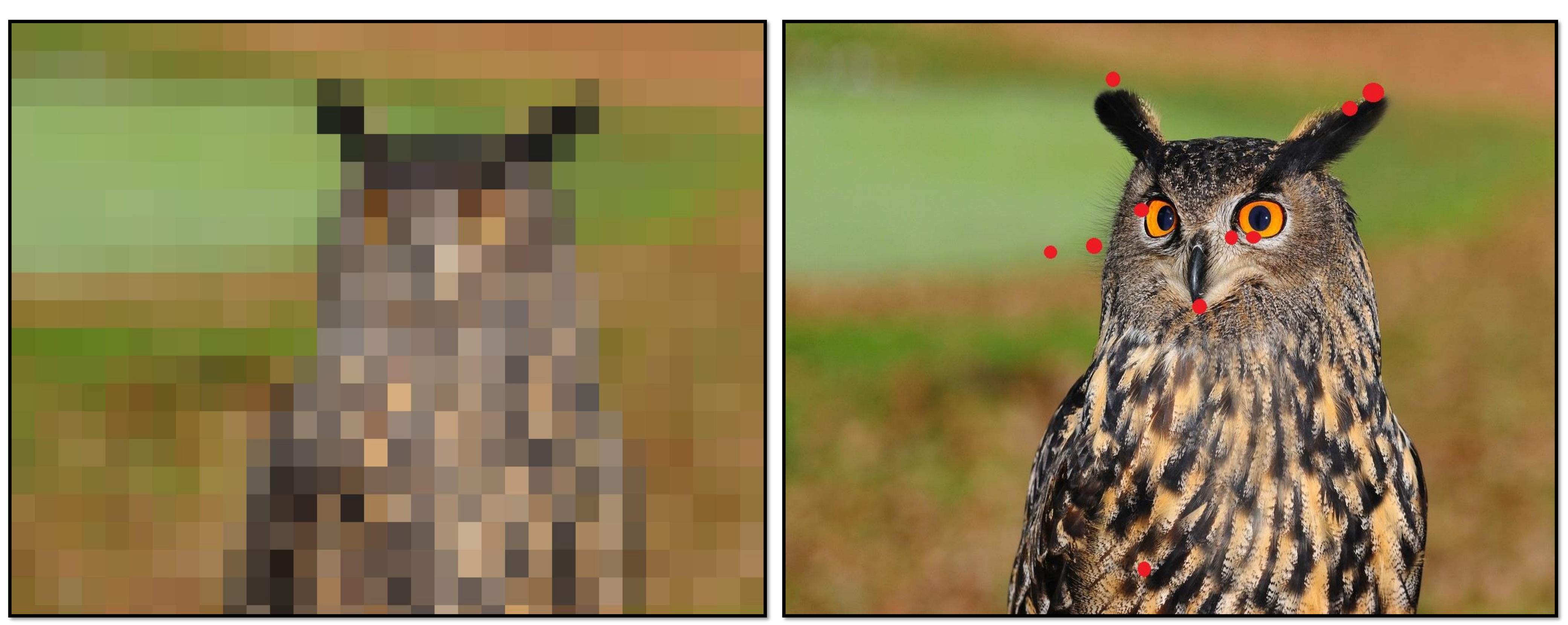

Figure 1.

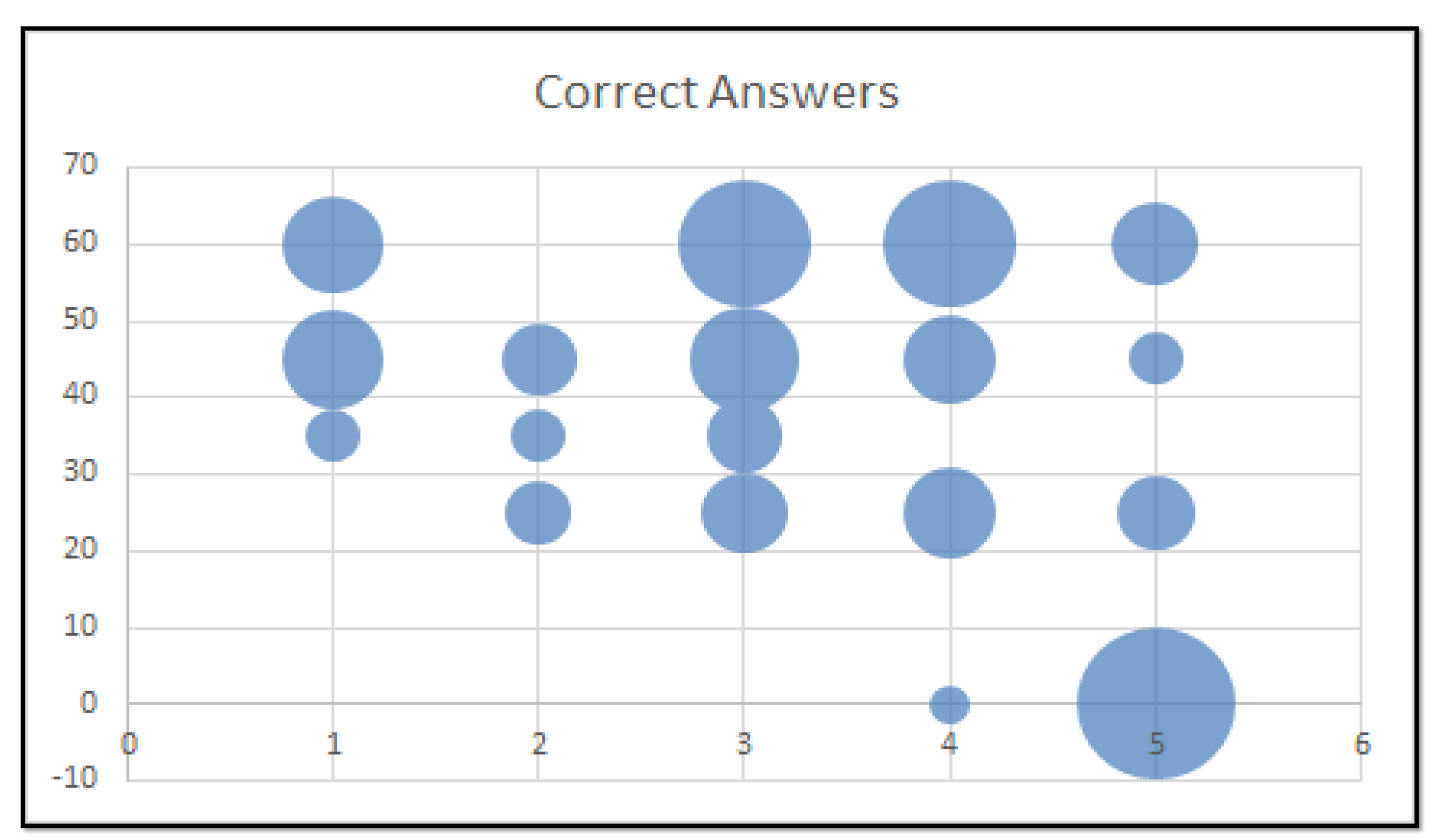

Figure 2.

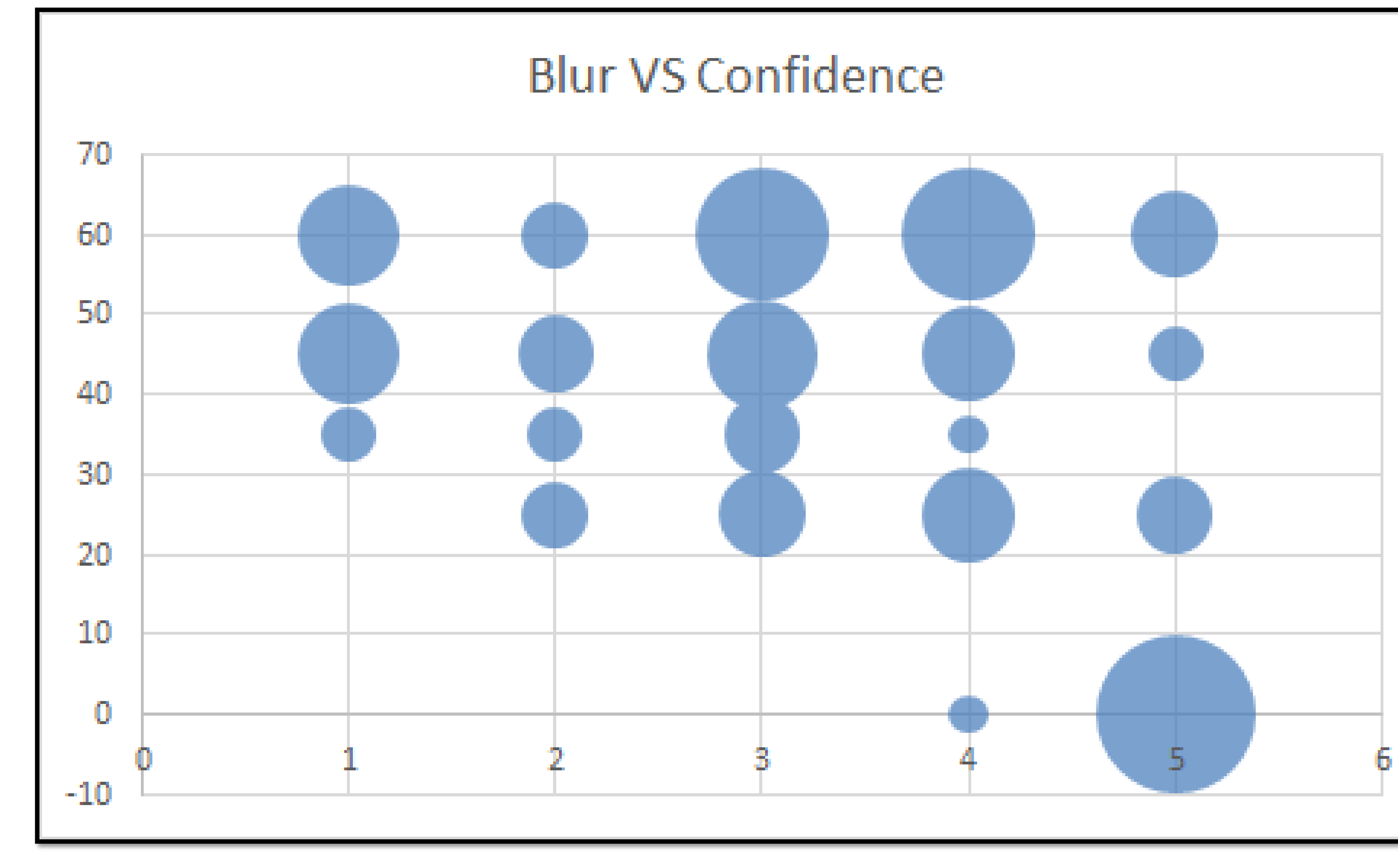

Figure 3.

Results

Once our recorded fixations were mapped, we were able to see that a majority of the subjects had a bias towards the center of each photo while analyzing.

Our oral test results informed us that higher confidence levels were associated with lower levels of blur. As the study progressed, and blur levels increased, confidence levels show a steady drop.

The amount of correct answers showed a similar trend; placing higher counts near lower levels of blur.

Conclusion

In conclusion, from this study our team was able to determine that the limits of visual recognition fall between the 45 and 60 blur levels. Our data shows that once blur levels reach 45, subjects lose confidence in what they are viewing, and have trouble deciphering the image.

As the blur levels rose during the test, confidence continued to drop while incorrect answers increased. Once peak levels of blur were reached at 60, subjects were selecting the lowest level of confidence, and were incorrectly describing the photo. Although a limit range was acquired from the tests, we were not able to specify a single, constant point that acted as a limit. In future tests, we hope to increase the amount of photos, blur levels, and test subjects, to acquire more accurate data that can be applied to deep learning technology.

References

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