Protecting Internet Users with Epilepsy or Chronic Migraine from Graphic-Based Attacks

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Introduction & Motivation

Often, people do not think about the dangers of graphic interchangeable formats (GIFs) that they see online. However, GIFs with sudden flashes or bright lights can endanger those with epilepsy or chronic migraines. GIFs are unique as after the last frame ends, it loops to the first frame and starts over. Thus, there are multiple factors that can jeopardize those with epilepsy. Hence, to prevent future attacks to occur, our goal was to flag dangerous GIFs to prevent users from suffering.

Methodology

To evaluate, GIFs better, we parsed GIFs into frames and compared consecutive frames in pairs, including the last frame with the first frame, using Java.

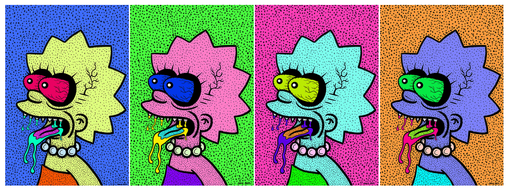

Figure 1: Lisa Simpson GIF broken down into four frames

Moreover, we decided to evaluate three different conditions: the ratio of average intensity, percentage of dangerous pixels, and hertz value of the frames. Furthermore, three threat levels, risky, dangerous, and extreme, were assigned if one, two, or three conditions were satisfied respectively.

Results & Discussions

When obtaining the ratio of average intensity, the formula: ***0.299 * red + 0.587 * green + 0.114 * blue*** (Sedgewick & Wayne, 2017) is utilized for each pixel in the frame. After all of the pixels are calculated, the averages of the two frames are compared. After evaluating numerous frames, we decided that if the ratio of the two frames is less than *0.55*, the intensity is dangerous.

Additionally, to determine the percentage of dangerous pixels, each pixel of the same location from the two frames is compared. If the pixels are different, the intensities of the two pixels are calculated using the same formula as above. Then, the absolute value of the differences is found.

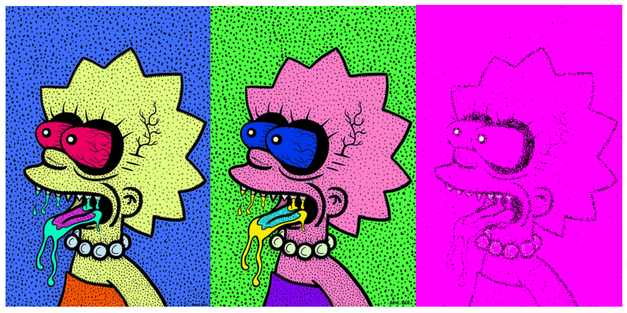

Figure 2: From left to right: frame one, frame two, and the different pixels are color-coded to magenta

A value less than *128.0* (Sedgewick & Wayne, 2017) is incompatible. For every incompatible pixel, a counter is incremented. To obtain the percentage of dangerous pixels, the formula: ***number of incompatible pixels / total pixels * 100*** is applied. Finally, if this percentage is greater than *30%*, it is deemed dangerous.

The last condition is finding the hertz value. The speed of the GIF is also important to evaluate as a quicker GIF can potentially be more dangerous as the flash rates will be more frequent than a slower GIF. To obtain the hertz value, the formula: ***inverse of the duration of each frame / 1000*** is used. If the GIF has a hertz value is in the range of *3 to 30*, the GIF can be dangerous.

Conclusions

After analyzing numerous GIFs with the three factors, it is evident that even GIFs that do not appear dangerous can have qualities that can be harmful to those with epilepsy or chronic migraine, thus needing to be flagged. We hope that the dangers of GIFs to those with epilepsy or chronic migraine bring light to the public so that proper actions can be made to prevent future attacks from occurring.

Future Work

My goal is to build on the current implementation and get more accurate values for the three conditions. Moreover, if applicable, add additional conditions to improve the precision of analyzing whether a GIF is dangerous to those with epilepsy or chronic migraines.

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References

Sedgewick, R., & Wayne, K. (2017). Object-Oriented Programming. *Computer science an interdisciplinary approach*. Addison-Wesley Professional. (pp. 330-381). Boston: Addision-Wesley.