Evolutionary Synthesis of Photographic Artwork Using Human Fitness Function Derived From Web-Based Social Networks

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We explore the possibility of approximating the performance of a human fitness function applied to the evolutionary selection of generative artwork. Traditional generators of evolutionary artwork rely on human interactivity for selection of aesthetically pleasing art from populations of computer-generated individuals. Users of the Web-based photograph sharing site Flickr.com, through interactions with the Flickr.com web site, have produced a large set of high-quality photographs considered interesting or popular by its users. Our experimentation exploited this established data set to estimate the interestingness of artwork evolved without human interaction.

Experiments used a Flickr data set of 177 images having high popularity. The data set can be seen here: http://oranchak.com/photosome/flickr/. Artwork was generated using two methods. The first method, the "Operations technique", uses image manipulation software to apply perturbations to an input image using basic image manipulations. The second method generates artwork using Huxtable's *Genetic Art*, a genetic algorithm which creates artwork based on human interaction [1] in a manner similar to K. Sims' approach [2]. In both cases, human interaction is replaced with a fitness function that compares the color content of the generated images to the color content of Flickr images, using a self-organized map to exploit its usefulness at performing content-based image retrieval [3]. This mimics the color distributions within Flickr images known to be interesting, as a first step towards coercing generated images to possess desired subjective traits.

Genotypes for the "Operations technique" are represented as sequences of pairs of integer-based genes corresponding to one of thirty-one possible image operations and their control parameters. The "Huxtable technique" genotype consists of a tree of nodes representing the applications of mathematical functions to (x,y) coordinates or constant values. The resulting function values are mapped to color values to produce images.

The experiments resulted in very strong color-based coordination of images with reference Flickr images. The technique herein ignores other important image attributes, such as composition, symmetry, texture, subject, and mood. There is likely to be much value in exploration of these other measurements as techniques to improve the evolutionary artwork.
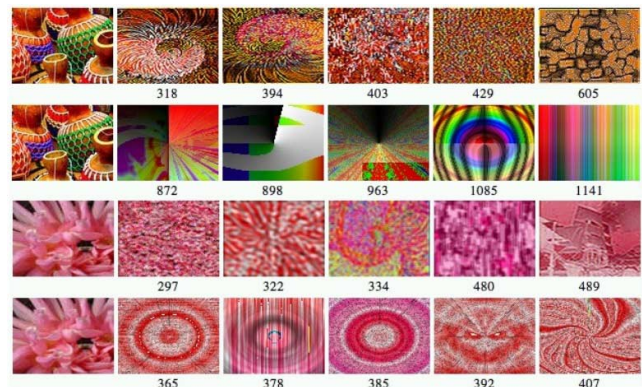
Figure 1: Resulting high-fitness generative art, using the color distribution histogram fitness function. Leftmost images are reference Flickr images. There are two rows per Flickr image. The first row shows images created by the Operations technique. The second row shows images created by the Huxtable technique. Fitness values are under each image.
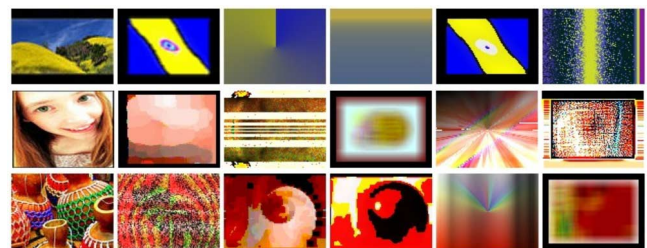
Figure 2: Resulting generative art created using a color count vector fitness function in both the Operations technique and the Huxtable technique. Left-most column contains Flickr reference images. Many more results can be seen here: http://oranchak.com/photosome/results/

References

[1] J. Huxtable. Genetic Art, 2005. Retrieved October 1, 2006, from JH Labs: http://www.jhlabs.com/java/art.html.

[2] K. Sims. Artificial Evolution for Computer Graphics. in *Computer Graphics*, *ACM SIGGRAPH Conf. Proc.,* Vol 25, pp.319-328, July 1991

[3] J. T. Laaksonen, et al. PicSOM - Content-based image retrieval with self-organizing maps. *Pattern Recognition Letters*, 21(13-14):1199–1207, December 2000.