Can we mimic the human ability for color-naming?

Carles Escrig Royo <al06655@uji.es> Universitat Jaume I de Castelló

An application that computes the approximate description of the perceived color of an image has been developed. Some experiments have been conducted to prove the validity of the descriptions obtained

Introduction

The abstraction on the real world's stimulus performed by humans allows the consciousness operation.

Otherwise It would be impossible to handle the amount of information. One of the characteristics usually abstracted is color. The ability to classify and name the color of things as perceived by humans would represent a step forward in the machine-human communication.

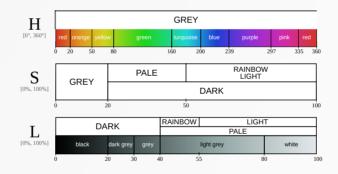
Some approaches have been proposed to perform colour categorization and naming, using different color models (CIE Lab, HSV, HSL, HCL, etc.), amount of semantic colour names (12 to 627), naming strategies (natural scene images, fundamental name + connotation), and similarity measures (euclidean, circular). We selected [Falomir et al.]'s approach, a computational model for cognitive and adaptive color-naming.

Our objective is to build an application that takes an image and summarizes the color perception using the Falomir's method, the most cognitive based method. This way will be able to test effectiveness and adequacy of the color descriptions obtained.

[Falomir et al.] Zoe Falomir, Lledo Museros, and Luis Gonzalez-Abril. A model for cognitive color description and comparison using conceptual neighbourhood diagrams. *IEEE Transactions on Image Processings*, unpublished.

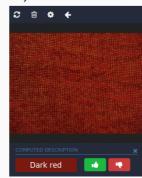
How the application works

We apply the k-means clustering algorithm on the input image, using the R, G, B channels as 3 dimensions, and the euclidean distance. The number of clusters is user defined (defaults to 4). The image is resized to speed up the algorithm (browser dependent). The resulting RGB centroids are converted to HSL color model to obtain their qualitative description (by range match, see Figure below). If two centroids have the same description, we perform a union on them. Results are sorted, and the winner perception is presented to the user to review.



Color perception computed is presented to the user over a colored background, filled with the color of the most common centroid (if more than one) of the most

common color description (side Figure). If review of the perception is negative, we ask (1) to input a free suggested description, and (2) to pick one of the colors allowed by the [Falomir et al.] model. We calculate the acceptance of a perception (for an image) as the mean of users that reviewed positively its result.



Experiments

We tested the application/model with 37 fabric images coming from a search engine, each one apparently fitting with one of the 37 descriptions allowed by the [Falomir et. al] model. This selection was partially subjective. The application's verdict about each image was reviewed by the two independent subjects. Reviewers were kept isolated, and review conditions were the same (light, screen, etc.).

Results

The application was able to successfully extract a qualitative description (only one) from all the tested images. First, this proves the application works as expected, and second, the range's of the [Falomirs et. al] descriptions are consistent.

User's acceptance	Num. of images
100%	16 (43%)
50%	8 (21%)
0%	13 (35%)

Most of the time perception was accepted by humans, but it was rejected 35% of the time.

"Light yellow" hsl(71, 57%, 63%)

"Light grey" hsl(300, 12%, 48%)



Some failures exposed:

- 1. Example of subjective frontier: is it yellow or green?
- 2. Low **S** is not perceived equally over all **H** scale.
- 3. Extraction of most common colour is not enough.

 Lesser common colours may influence the perception.

Conclusions

Even though experimentation has been insufficient, the application looks like a promising tool to detect flaws, trends, missing color names, etc. in the studied colornaming method or any other. It's presented as a standalone webapp, but it can be quickly adapted as a web site to allow research over a wider audience. Firsts experiments already show some areas that could be improved on both image analysis and color description.