Chapter 1
Profiling User Color Perception for Image Retrieving

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ABSTRACT

The aim of this work is to build a user profile according to his own perception of colors for image retrieving. Images are being processed relying on a standard or initial set of parameters using the fuzzy set theory and the HLS color space (Hue, Lightness, and Saturation). We developed a dynamic construction of the user profile, which will increase his satisfaction by being more personalized and accommodated to his particular needs. We suggest two methods to define the perception and transform it into a profile; the first method is achieved by querying the user and getting answers, which will guide through the process of implementation of the profile; the second method is achieved by comparing different subjects and ending up by an appropriate aggregation. We also present a method that will recalculate the amount of colors in the image based on another set of parameters, so the colorimetric profile of the image is being modified accordingly. Avoiding the repetition of the process at the pixel level is the main target of this phase, because reprocessing each image is time consuming and turned to be not feasible.

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INTRODUCTION

Image retrieving is an important problem that can be useful in many fields (Foulloy, 1990), Hammami (2002), Hong (2000) and Le Saux (2003)). For example, in medical applications, it is important to retrieve images in order to help medical expert forecasts. Another example lies in web content detection: classification of images to determine whether they contain a lot of skin texture or not in order to detect adult and sexual contents (Hammami, 2002).

There are several works on image classification based on the determination of a similarity degree between images. This kind of classification can be done through several techniques, for example: statistical approach like Support Vector Machines (Hong, 2000; Barla, 2003; Vapnik, 1998), color and illumination features using histograms intersection (Barla, 2003; Bourghorbel, 2002) and fuzzy logic (Chen, 2002; Omhover, 2004; Vertan, 2000).

Among these Image Retrieval Systems, we distinguish at least two kinds: those that consider the histograms and those that don't. Barla et al address the problem of classifying images by exploiting color and illumination features, using histogram intersections. The histogram intersection is used as a kernel function for SVMs and allows one to classify images by similarity of histograms (Barla, 2003).

Han and Ma propose a fuzzy color histogram that permits to consider the color similarity across different bins and the color dissimilarity in the same bin (Han, 2002). Thus, as in Vertan (2000), a pixel of a given color will contribute not only to its specific bin, but its membership value will be spread to other histogram bins.

Another kind of approach is presented by Wang and Du: they propose an algorithm for indexing and retrieving images based on region segmentation, and they also compute similarities between images in order to classify them (Wang, 2000). As for Frigui, he describes a system that offers the refinement of the user query (Frigui, 2001). The user's relevance feedbacks are modeled by fuzzy sets, i.e. the user expresses his satisfaction or discontentment by assigning a label to the retrieved images. A dissimilarity based on fuzzy integrals is then used. It is a kind of supervised learning for image retrieval systems.

All the aforementioned authors work with a query image. That is not the case of Binaghi et al who use a user query expressed by crisp values of colors (Binaghi, 1994). More precisely, they provide methodological and technical solutions to compute similarities between the query and the image index. The user also has to choose the color dimension (hue, chroma or lightness), the image area covered by the referent color and the type of color distribution in the image. Thus, the user has to know exactly what he is looking for in terms of colors and color distribution in order to obtain satisfactory results. That is why we have focused on the problem of the query expression which is very simple in our case: the user can ask only for a certain tone if he wants.

The aim of this work is not to make a classical classification but to retrieve images according to their dominant(s) color(s) expressed through linguistic expressions. In this work, Images are processed using a fuzzy representation of colors based on the HLS space. The image processing consists of modeling the three dimensions of color (hue, saturation and lightness) by using fuzzy membership functions.

The standard colorimetric profile of each image is build using standard values of the membership functions. These profiles may not be accepted by all users since the perception is a subjective issue. To resolve this problem, the user is asked to build his profile, thus when retrieving images, they will be brought regarding his perception.

To avoid the reprocessing of images, we use a new approach by applying a transformation procedure on the standard colorimetric profile of the images according to user's perception. In this procedure, we use the notions of comparability and compatibility of fuzzy subsets