2.2 Search in Color-WISE

The function of search operation in Color-WISE is to extract a set of target images from the database that are likely to be highly similar to the query image. Since Color-WISE uses Microsoft Access to store image descriptions, the search scheme used in Color-WISE is built around the Microsoft Access search engine. Instead of considering the color information present in the entire query image, Color-WISE searches for similar images on a block-by-block basis of the color information. This is done by following a block-based voting scheme. In this scheme, each database image has a voting counter associated with it, which is initialized to zero at the beginning of a query process. To perform voting and identify the set of target images likely to be similar to the query image, each block of the query image is considered separately. For each block of the query image, all images in the database update their counter according to the following rule: $counter(I) \Leftarrow counter(I)+1$, *if* $h_q - \delta h \le h \le h_q + \delta h$ *and* $s_q - \delta s \le s \le s_q + \delta s$, where I refers to a database image. The pair (h_q, s_q) denotes the dominant hue and saturation values of the query image block, and (h,s) pair represents the same for the corresponding block of the database image. The quantities δh and δs are pre-defined constants that determine the size of the target images that would be retrieved for similarity computation. The counter remains unchanged if the above rule is not satisfied. Once, all blocks with masking bit set to one have been considered, databases images receiving votes higher than a preset threshold are taken as the target images. For each target image, its similarity with respect to the query image is computed. These similarity values are used by Color-WISE to rank the display of the target images to the user.

2.3 Color-WISE Similarity Metric

A similarity metric or measure determines how similar are two images. Different similarity measures have been suggested in the literature to compare images. Given the color composition information of an image in the form of a K-dimensional vector, the *intersection measure* due to Swain and Ballard[9] computes the similarity between two images according to the following:

$$\frac{\sum_{k=1}^{K} \min(I_k, J_k)}{\sum_{k=1}^{K} I_k}$$

As this measure shows, the similarity between a target image J and a query image I is determined by the normalized number of pixels which show similar color. Although this similarity measure is very easy to compute, it does not take into account the perceptual similarity between the different histogram bins. A better similarity measure incorporating the perceptual similarity between the different bins of a color histogram is suggested in[4]. According to this measure, the similarity between a target image and a query image is computed by the following expression:

$$\sum_{i=1}^{K}\sum_{j=1}^{K} a_{ij}(I_i - J_i)(I_j - J_j)$$

In the above expression, the coefficient a_{ij} incorporates perceptual similarity between colors represented by bins i and j.

The similarity measure used in Color-WISE recognizes the fact that human perception is more sensitive to changes in hue values. It also recognizes that human perception is not proportionally sensitive to changes in hue value. Furthermore, the similarity measure used by Color-WISE also takes into account that each image in Color-WISE is represented by $m*n$ pairs of numbers, one pair per block representing the area-peaks in block-level hue and saturation histograms. Let q_i and t_i represent the block number i in a query (Q)