Simple Color Image Retrieval System
Due 05/12/2019 11:59pm

1. Compute Color Histogram **[30 points]**
   An image histogram refers to the probability mass function of the image intensities. This is extended for color images to capture the joint probabilities of the intensities of the three color channels. More formally, the color histogram is defined by:

   $$h_{A,B,C}(a,b,c) = N \times \mathrm{Prob}(A = a, B = b, C = c)$$

   where A , B and C represent the three color channels (R, G, B or H, S, V) and N is the number of pixels in the image. Computationally, the color histogram is formed by discretizing the colors within an image and counting the number of pixels of each color. Implement a Cal256binHSV function to compute the 256-bin HSV color histogram (i.e., 16-bin H, 4-bin S, and 4-bin V) for the input image. The function prototype should be: Hist = Cal256binHSV(Im).

2. Assuming that you have a small image database with 4 images, namely Elephant1.jpg, Elephant2.jpg, Horse1.jpg, and Horse2.jpg. Compute the 256-bin HSV color histogram for each image in this small database by calling your function implemented in a). Plot these four histograms on figure 1 with the appropriate title for each subplot. Respectively use each image as a query to search this small database and display the retrieval results on figures 2 through 5. Make sure that each figure displays all retrieved images for each query with the corresponding ranking (top match, second top match, third top match, and fourth top match) and the associated similarity score, which is computed by the histogram intersection defined below.

   The intersection of histograms *h* and *g* is given by:

   $$d(h,g) = \frac{\sum_A \sum_B \sum_C \min(h(a,b,c), g(a,b,c))}{\min(|h|, |g|)}$$

   where |h| and |g| give the magnitude of each histogram, which is equal to the number of samples. **[20 points]**