

TNM025 – Assignment 1 - 2015

The images for this homework are in the directory
S:\TN\M\TNM025\2015\ImageDatabase\imdbMEDIUM
(use imdbSMALL only if you have real problems with computation times)

You may use the functions described in
S:\TN\M\TNM025\2015\ImageDatabase\Interface-description.pdf
or use your own.

Some of the tasks require a lot of computations. If it takes too long time to calculate features do the computations for a subset and **store the results somewhere where you can use them afterwards**. Nevertheless, features for all 5000 images in the database must be included in your retrieval experiments.

1. Assume (R,G,B) is the RGB vector at one pixel then the intensity value can be defined as $I=R+G+B$. For all images in the database compute the intensity image and compute its mean intensity value. Collect all these values in a vector MeanIVector. For a given query image (either from the database or from a file or a website) compute the mean intensity value and find the 20 images in the database that have the most similar mean intensity values to this query image. Extra: Use `im2gray` and see if there is a difference (regarding results and computation times).
2. Read the description of the Matlab function `rgb2hsv`. If you want to use the histogram functions (`hist`, `histc`) in Matlab read also those descriptions to make sure you compute the same information for all the images. Convert all images from the RGB format into HSV form. For the V (intensity) component compute for each image a 32-bin histogram. Do the same for the H (hue) component (What does it mean that hue is an ANGLE?). For a given query image (either from the database or from a file or a website) compute its HSV form and compute the histograms of the V and H components. Find the 20 images in the database that are most similar to this query image. To find these 20 images use the usual L_2 -norm and (a) the V histogram and (b) the H histogram (What does it mean that hue is an ANGLE?). The norm of a vector v is $\text{norm}(v)$ and the distance between vectors x and y is $\text{norm}(x-y)$. Use the efficient method that pre-computes database information. (Remember that $(x-y)^2 = x^2 + y^2 - 2xy$!)

- 3.** Recall the definition of the correlation matrix and the eigenvector and eigenvalue of a matrix. Read the description of the eig and eigs functions in Matlab.
- a) Consider the histograms computed from the V component in last section
 - b) Compute the correlation matrix from these histograms
 - c) Compute the eigenvectors and eigenvalues of the correlation matrix
 - d) Approximate the histograms with linear combinations of (a few)
eigenvectors (belonging to the largest eigenvalues)
 - e) Use these approximations for image retrieval