

Content-based Image Retrieval

The objective of this homework is to design and implement several of the components of a content-based image retrieval (CBIR) system. You will be supplied with a small collection of a color images in PPM format. You may choose any features of the images that you feel will perform well on your image set for a particular user query. The features you choose may correspond to color, texture, shape or any combination of them. The application scenario for this assignment is that, the user will supply you with a query image, for which your system should return in order of closest match the images from the collection that are the most similar to the query.

You should write three programs as described below:

1. **fv**: which reads a PPM image and produces its feature vector. This feature vector should describe some visual features of the image. Suggestions for features are:
 - Mean color
 - Dominant color
 - Color regions
 - Color histogram
 - Localized color histogram
 - Spatial frequency energy
 - Co-occurrence matrix metrics
 - Tamura's texture features
 - Gabor's spatial frequency features
2. **fv_sim**: which reads two feature vectors v_1 and v_2 and computes the similarity of distance between them. Suggestions for similarity (distance) metrics are:
 - Square-block distance (l_1 distance, or Manhattan distance)
 - Euclidean distance (l_2 distance)
 - Weighted Euclidean distance
 - Cosine distance
 - Quadratic distance
3. **im_query**: which given the file of feature vectors already computed for the database and the reference to a query image, returns a list of images from the database in order of the closest match to the query image. Note that the query image is in the database already, you will be provided with its id number to make a query to your system and test your system's performance. This type of querying a CBIR system is called "Query-By-Example" or QBE.)

The following are block diagrams of the system you are building:

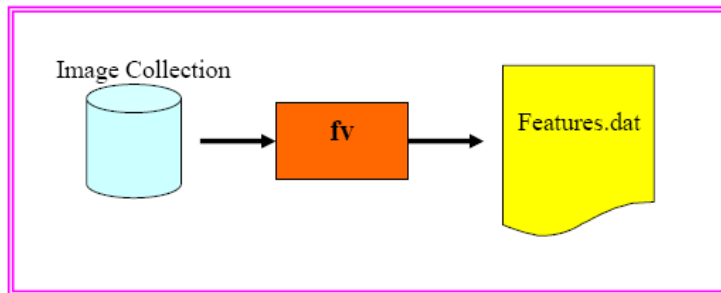


Figure 1: Feature extraction stage for the entire image collection

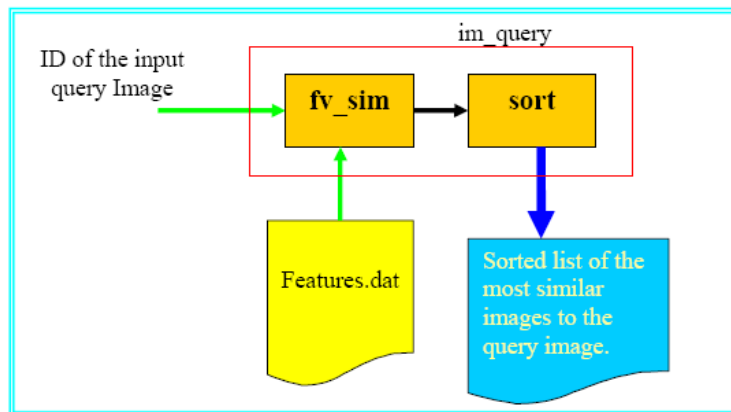


Figure 2: Query stage where you give the query image as input and get a sorted list of returned image ids

Each line of the file “feature.dat” would for example contain an image id and a feature vector. Please download the image collection from: <http://www.vis.uky.edu/~cheung/courses/ee639/data/cbir.zip>

Youll be provided with 3 query images a few days before the due date of the assignment. Make a query to your CBIR system with each of the 3 images. Then submit the following:

1. A list of 10 closest images (sorted in descending order) for each query image.
2. Recall and precision. (you should get the ground truth for each query image, i.e. you need to manually go through the image collection provided to you and determine visually which images are similar to each of the 3 query images)
3. Comment on your choice for the features.
4. Your code.

Please do not include any images in your submitted files.