Multimedia Analysis and Indexing – Fall 2015

HW#2 (DUE: noon, Tuesday, 17 Nov, 2015)

Note:
1) If you have any questions regarding the homework, send e-mail to the TA at kuonini@gmail.com.
2) Submit a soft copy of your write-up (in PDF) and programs to TA **before the due**.
3) The mail subject should start with "[mmai_hw2]."
4) The dataset are available in the course webpage.
5) You are highly encouraged to write the homework in English.
6) Please DO write appropriate comments along with your codes.

The goal of the homework is to design and implement important components of a content-based image retrieval (CBIR) system. Please evaluate your CBIR system by **mean average precision (MAP)** on the 20 queries (topics). For each query, you have to calculate the MAP for each modality (or method). Note that the database contains 20 topics (400 images). Those images in the same directory (i.e., the same category) are actually ground truth for each query. Hence, for each query, you can get the MAP over the 20 APs in a leave-one-out manner. Please also report the system MAPs for each modality (or method) by averaging the 20 queries' MAPs. Summarize the results in the table(s). The 3 methods (modalities) are described below.

Also remember to visualize your query results and see if it matches the AP calculation. ranking image relation

You will choose **one texture/shape feature and one color feature**, decide a similarity or distance metric (e.g., L_1 distance, L_2 distance, cosine similarity), and utilize metric learning tools on one of color or textual (shape) features. Please brief the features and the similarity (distance) metric you adopt.

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1) Color similarity. You can refer to the color features introduced in the lectures, chapter 11 of [Castelli'01] (available in the course webpage), or other relevant papers. Suggestions for color features are (but not limited to): *global color histogram, regional color histogram, grid color moments, means in each color channel, color (auto-) correlogram*. **You need to implement the color feature by yourself.**

   HSV for uniform compact colr space

2) Texture/shape similarity. You can choose any texture or shape features. Suggestions for such features are (but not limited to): *Fourier features, Laws' texture measures, co-occurrence matrix metrics, Tamura's textures, Gabor texture, PHOG, gradient histogram, etc*. You can find other open source tools for texture or shape features; however, you have to acknowledge the source of the tools.

3) Metric learning on color or texture (shape) features. You can choose any metric learning tools or methods. Suggestions are (but not limited to): *MML (Mahalanobis metric learning) [1], LMNN (large margin nearest neighbor) [2], NCA, MCML, ITML, RCA, OASIS, etc*. You can find other open source tools for metric learning; however, you have to acknowledge the source of the tools.

[References]

[1] "Distance metric learning with application to clustering with side-information," Eric P. Xing et al., NIPS, 2002. http://www.cs.cmu.edu/~epxing/papers/Old_papers/code_Metric_online.tar.gz
[2] LMNN (large margin nearest neighbor): http://www.cs.cornell.edu/~kilian/code/lmnn/lmnn.html
[3] ITML (information theoretic metric learning): http://www.cs.utexas.edu/~pjain/itml/
[4] OASIS (online algorithm for scalable image similarity learning): http://ai.stanford.edu/~gal/Research/OASIS/index.html

[5] Matlab toolbox for dimensionality reduction (e.g., NCA, MCML, LMNN):
http://lvdmaaten.github.io/drtoolbox/
[6] A Matlab toolkit for distance metric learning (e.g., RCA, NCA):
https://www.cs.cmu.edu/~liuy/distlearn.htm