CSE 515 Multimedia and Web Databases

Phase #3

(Due December 3rd 2019, midnight)

Description: In this project, you will experiment with

- clustering,
- indexing,
- classification / relevance feedback

All the following tasks will be implemented on a given data set.

- **Task 1:** Implement a program which, given a folder with dorsal/palmar labeled images,
  - computes k latent semantics (in the feature space) associated with dorsal-hand images,
  - computes k latent semantics (in the feature space) associated with palmar-hand images,

  and, given a folder with unlabeled images, the system labels them as
  - dorsal-hand vs palmar-hand

  using only these latent semantics.
- **Task 2:** Implement a program which, given a folder with dorsal/palmar labeled images and for a user supplied c,
  - computes c clusters associated with dorsal-hand images (visualize the resulting image clusters),
  - computes c clusters associated with palmar-hand images (visualize the resulting image clusters),

  (you can use the graph partitioning/clustering algorithm of your choice for this task) and, given a folder with unlabeled images, the system labels them as
  - dorsal-hand vs palmar-hand

  using only descriptors of these clusters.
- **Task 3:** Implement a program which, given a value k, creates an image-image similarity graph, such that from each image, there are k outgoing edges to k most similar/related images to it. Given 3 user specified imageids on the graph, the program identifies and visualizes K most dominant images using Personalized Page Rank (PPR) for a user supplied K. See
  - "J.-Y. Pan, H.-J. Yang, C. Faloutsos, and P. Duygulu. Automatic multimedia cross-modal correlation discovery. In KDD, pages 653658, 2004"

  for a personalized PageRank formulation based on RandomWalks with re-start.
- **Task 4:** Implement a program which, given a folder with dorsal/palmar labeled images,

- creates an SVM classifer,
- creates a decision-tree classifier,
- creates a PPR based clasifier,

and, given a folder with unlabeled images, the system labels them as

- dorsal-hand vs palmar-hand

using the classifier selected by the user.

- **Task 5:**
  - **5a:** Implement a Locality Sensitive Hashing (LSH) tool (for Euclidean distance) which takes as input (a) the number of layers, L, (b) the number of hashes per layer, k, and (c) a set of vectors as input and creates an in-memory index structure containing the given set of vectors. See

    "Near-Optimal Hashing Algorithms for Approximate Nearest Neighbor in High Dimensions" (by Alexandr Andoni and Piotr Indyk). Communications of the ACM, vol. 51, no. 1, 2008, pp. 117-122.
  - **5b:** Implement a similar image search algorithm using this index structure and a visual model function of your choice (the combined visual model must have at least 256 dimensions): for a given query image and integer t, visulizes the t most similar images (also outputs the numbers of unique and overall number of images considered).
- **Task 6** Let us consider the label set "Relevant (R)" and "Irrelevant (I)". Implement
  - an SVM based relevance feedback system,
  - a decision-tree based relevance feedback system,
  - a PPR-based relevance feedback system,
  - a probabilistic relevance feedback system – see

    Gerard Salton and Chris Buckley. Improving retrieval performance by relevance feedback. Journal of the American Society for Information Science. 41, pp. 288-297, 1990.

  which enable the user to label some of the results returned by 5b as relevant or irrelevant and then return a new set of ranked results, relying on the feedback system selected by the user, either by revising the query or by re-ordering the existing results.

Deliverables:

- Your code (properly commented) and a README file.
- Your outputs for the provided sample inputs.
- A report describing your work and the results.

Please place your code in a directory titled "Code", the outputs to a directory called "Outputs", and your report in a directory called "Report"; zip or tar all off them together and submit it through the digital dropbox.