CSE 515 Multimedia and Web Databases

Phase #1

(Due Sept 15th 2021, midnight)

Description: In this project, you will experiment with

- image features,
- vector models, and
- similarity/distance measures

This project phase will be performed by each group member; but, you will get group grades.

PROJECT TASKS:

- **Task 0:** In this phase of the project, we will use the Olivetti faces dataset:

  https://scikit-learn.org/0.19/datasets/olivetti_faces.html

  Note that we will not necessarily solve the specific problems addressed at this source or use the associated code base. However, feel free to familiarize yourself with both.

  Download and familiarize yourselves with the following data sets provided in the web site:

  - Face images
  - Associated metadata

  In this phase, you are free to store the data however you wish: you can use a relational database (such as MySql), a no-SQL database (such as MongoDB), or to create your own file/data structures.

- **Task 1:** Implement a program which, given an image ID and one of the following models, extracts and prints (in a human readable form) the corresponding feature descriptors:

  - *Color moments, CM8x8*: Split the image into 8x8 windows, compute color moments for each window, and concatenate these color moments to obtain a unified feature descriptor. See

    `https://en.wikipedia.org/wiki/Color_moments`

    for the three color moments (mean, standard deviation, and skewness).
  - *Extended Local binary patterns, ELBP*: Compute ELBP features for the given image. See

    `http://researchspace.csir.co.za/dspace/handle/10204/6491`

    The following web site has pointers to several libraries that you can use for extracting ELBP features:

    `https://en.wikipedia.org/wiki/Local_binary_patterns`

- *Histograms of oriented gradients, HOG*: See

  `https://lear.inrialpes.fr/people/triggs/pubs/Dalal-cvpr05.pdf`

  The following web site has pointers to several libraries that you can use for extracting HOG features:

  `https://en.wikipedia.org/wiki/Histogram_of_oriented_gradients`

  If needed use the following parameter settings:

  * number of orientation bins = 9,
  * cell size = 8,
  * block size = 2,
  * oriented gradients (yes/no) = no, and 0 otherwise.
  * L2-norm clipping threshold = 0.2

- **Task 2:** Implement a program which, given a folder with images, extracts and stores feature descriptors for all the images in the folder.
- **Task 3:** Implement a program which, given a folder with images and an image ID, a model, and a value "k", returns and visualizes the most similar k images based on the corresponding visual descriptors. For each match, also list the overall matching score.
- **Task 4:** Implement a program which, given a folder with images and an image ID and a value "k", returns and visualizes the most similar k images based on **all** corresponding visual descriptors. For each match, also list the overall matching score and the contributions of the individual visual models.

Deliverables:

- Your code (properly commented) and a README file.
- Your outputs for the provided sample inputs.
- A short 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.