http://crcv.ucf.edu/people/faculty/Bagci/

[Programming Assignment] (5)

Computer Vision

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Coding Standard and General Requirements

Code for all programming assignments should be **well documented**. A working program with no comments will receive **only partial credit**. Documentation entails writing a description of each function/method, class/structure, as well as comments throughout the code to explain the program flow. Programming language for the assignment is **Python**. You can use standard python built-in IDLE, or CANOPY for the working environment. Other commonly used IDLEs are the following: PyCharm Community Edition, PyScripter, CodeSculptor, Eric Python, Eclipse plus PyDev.

Following libraries will be used extensively throughout the course:

- PIL (The Python Imaging Library), Matplotlib, NumPy, SciPy, LibSVM, OpenCV, VLFeat, python-graph.

If you use CANOPY, make sure that you use version 2.7, which already includes many libraries. If you are asked to implement "Gaussian Filtering", you are not allowed to use a Gaussian function from a known library, you need to implement it from scratch.

Submit by **11th of November 2015**, 11.59pm.

Face Recognition [5 pts]

Download Face Recognition dataset from `http://vision.ucsd.edu/content/yale-face-database`
The Yale Face Database contains 165 grayscale images in GIF format of 15 individuals. There are 11 images per subject, one per different facial expression or configuration: center-light, w/glasses, happy, left-light, w/no glasses, normal, right-light, sad, sleepy, surprised, and wink. Your tasks are the following:

- Divide image into small blocks and extract local binary patterns (LBP) from each block. Concatenate all LBP histograms to make feature vector of an image.
- Use gray levels of integral image as another feature vector.
- Use gray levels of image as the last feature vector.
- Concatenate all feature vectors.
- Take four images of each person for testing and the rest as training examples.
- Use PCA to classify image using one-verses all classification scheme.
- Show your results for few images and report your accuracy for all testing images using individual feature sets (gray level, integral, and LBP separately) and also for concatenated feature sets.

Graph-cut Image Segmentation [5 pts]

Implement Boykov/Kolmogorov's Max-Flow/Min-Cut algorithm for computer vision problems. You should two gray-scale images from earlier PAs to test your system for image segmentation (foreground/background segmentation) problem. Your tasks are the following:

- You must define the graph structure and unary and pairwise terms. For graph structure, you can use available packages/libraries such as PyMaxflow.
- Explain your likelihood function for background and foreground. (comment lines)
- Write a general energy function consisting of unary and pairwise energy functionals.
- Display your likelihood maps (intensity map ranging from 0 to 1) for foreground and background.
- Use Boykov/Kolmogorov maxflow / mincut approach to for solving the energy minimization problem.
- Display your final segmentation. Create an image for which the background pixels are red, and the foreground pixels have the color of the input image.

Relevant paper is here: `http://www.csd.uwo.ca/~yuri/Papers/pami04.pdf`
Some example codes are here: `http://vision.csd.uwo.ca/code`