Assignment #1
CS510 Spring 2013
"Variations on Cross-correlation"
Due Monday, Feb. 11th

Introduction

The purpose of this assignment is to familiarize you with baseline template matching techniques, and to start to give you intuitions about both the strengths and weaknesses of those approaches. It will also introduce you to the OpenCV library (unless you want to write everything from scratch, which I don't recommend).

Task

The basic task is to cross-correlate a template with an image, outputting the maximum absolute correlation score and the (x,y) position where the maximum score occurred. However, for every combination of image and template, you need to do four variations on this task. I want you to build intuitions about histogram equalization, Pearson's correlation, and Linear Correlation. Therefore, for every template and image pair, you need to report the results of four cross-correlations: (1) raw image with Pearson's correlation; (2) raw image with linear correlation; (3) histogram equalized image with Pearson's correlation; and (4) histogram equalized image with linear correlation.

In particular, the tar file distributed with this assignment contains a set of black and white source images of cat faces. The images have been roughly geometrically normalized (via a similarity transformation based on eye coordinates). The images are called CatXX.png, where XX is a number. The file also contains 4 image templates: right eye, left eye, left ear and nose. Your job is to correlate the templates against the source (cat face) images using all four variants on template matching in the paragraph above.

For each template matching technique, produce output in the form of a table. Every row of the table corresponds to a source image, and the columns report max correlation scores and (x,y) positions for the 4 templates. To be exact, each table should be a text file with N rows (one for each source image) and whitespace separated values. A row should start with an image filename, and then have twelve values: the maximum absolute correlation score and the (x,y) location of that score for each of the four templates, in the order: left eye, right eye, left ear, nose.

Submission

Since there are only six students in the class, you will submit your assignment by emailing it to me (draper@cs.colostate.edu). Send me an email with Assignment #1 in the heading and attach a single tar file to it. The tar file should contain the four text files with the results of the four techniques. These files should be named RawPearson.txt, RawLinear.txt, HistEqPearson.txt and HistEqLinear.txt, respectively. The tar file should also contain all the source files necessary to compile and run your code and recreate the text files, as well as a README.txt file with the instructions for compiling and executing your code.

The due date in Monday, Feb. 11th. Files not emailed by the 11th with not be accepted (and receive a score of 0). There is always an exception for unforeseen emergencies (e.g. death of the family member, severe illness, etc.), in which case see the instuctor. Note that machine/disk crashes do NOT count as a unforeseen emergency.

Restrictions

You may not work with anyone else on this project. You may not submit any work that is not your own (so no copying code from the internet, etc.). See the department's honor code for more details.

You may write your code in C, C++ or Python (but no other languages). You may use the OpenCV library. Students who write in C++ may use the Boost filesystem library to manipulate files and directories. No other non-standard libraries may be used. (If you are unsure whether a library is standard, ask me.)

Hints

OpenCV includes functions for reading images, for histogram equalizing images, and for linear cross-correlation. It does not include any function for Pearson's correlation.