CS 631 Assignment #3

Due Date: **May 17th 1999**

Description

The objective of this assignment is to decode an MPEG stream and output an estimate of the number of people in the sequence. You are required to write a program that takes an MPEG sequence as an argument.

There are two parts to this assignment. In Part 1, we specify what you need to compute (much as in assignments #1 and #2). In Part 2, we ask you to do a short individual research project, hopefully making use of what you did in Part 1.

Part 1.

A) For every frame in the sequence do the following:

- output an image of skin blobs

  Procedure:
  - Implement the Fleck, Forsyth and Bregler skin finder algorithm (http://www.cs.hmc.edu/~fleck/naked-skin.html)
  - Run connected components, marking each skin patch with a unique grayscale number.
  - Output a pgm format image representing all the skin patches in the frame. For example, every pixel in skin patch 1 must be set to 1 on the grayscale, while every pixel in skin patch 2 must be set to 2 on the grayscale.

B) For every pair of successive frames do the following:

- output moving blobs

  Procedure:
  - Run image differencing between the frame pair.
  - Threshold the difference, then dilate and erode to eliminate noise.
  - Run connected components to mark moving patches.
  - Output a pgm format image representing all moving patches in the frame pair (as in part 1). Again, the pixels in the first moving patch must be labeled 1, the second 2, etc.
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(Note: All the parameters for part 1 are unspecified and you are free to select them)

Part 2.

For the research portion of this assignment, you must estimate the number of distinct people present in the entire sequence. The way in which you compute this is up to you; we expect you to be creative. We suggest that you make use of the results from Part 1, but how you do this is up to you. Note that you may assume that the video you will process came from Philips 101 on the same day as the test images we are giving you. You may also assume that the camera is stationary, and that no people enter or exit during a sequence.

For part 2, you must hand in a coherent 1-page description of how you count the number of people. This description should be technical enough for us to understand what you are computing.

Here a few suggestions you might wish to pursue:

- Look for roughly circular moving skin blobs that may be faces, using the output of part 1, and possibly modifying it as appropriate.
- Check to see if the area on the top of the "face" is darker (like most people's hair)
- Build a detector for the color of the Philips 101 chairs. Then use the computed chair area to figure out where faces should be, and see if there is something face-like there.
- Implement a temporal median filter to estimate the background when the people move.
- Implement an eye-finder, perhaps using template matching.

Implementation

For this assignment, you are required to use DALI which is a high performance library of routines for manipulating video, audio, and image data. You will need to download the source code for DALI from the following web-site and compile it under WIN/NT.

http://www.cs.cornell.edu/dali/

The installation/compilation procedures are provided on the web-site. You may also have to install TCL/TK in order to properly compile DALI. The TCL/TK can be downloaded from http://www.scriptics.com

Note, however, you are not allowed to use TCL/TK for interfacing with DALI. The entire program must be standalone (with the exception of DALI) and must be written in C/C++.

Few Helpful Hints For Compiling DALI

- In makefile.vc following changes may be required:
  - *TCLSH = $(TCLDIR)\bin\tclsh80*
  - Change *TCL80VC.LIB* → *TCL80.LIB*
  - Change *TK80VC.LIB* → *TK80.LIB*

- *Mkdir obj*

- Run *nmake /f makefile.vc*

- Run *nmake /f makefile.vc install*

Few Helpful Hints for Compiling Examples

- In makefile.vc (located in for e.g. \dali\examples\lib\canny) following changes may be required:
  - Search and replace ALL "/" to "\"
  - ROOT = ..\.. (assuming examples directory is located at \dali\examples)
  - Add msvcrt.lib to LIBS → LIBS = $(GUILIBS) $(DALILIBS) msvcrt.lib

- You need to make similar changes as above to makefile.vc in \dali\examples\lib

- Run *nmake/f makefile.vc* in for e.g. \dali\examples\lib\canny after making the above modifications.

Required Inputs/Outputs

The command-line must look like the following:

estimator <mpeg-sequence>

The output should consist of the following:

- The skin patches should be created in *<mpeg-sequence>_fr#.pgm*. The # corresponds to the frame # in the MPEG sequence.

- The moving blobs should be created in *<mpeg-sequence>_frp#.pg*m for each frame pair. Consequently, the # corresponds to the frame pair number.

- The estimated number of people should be output to both *stdout* and *<mpeg-sequence>_est.txt*.

For example, if the input mpeg file named *students.mpg* consists of 5 frames, you should output *students_fr1.pgm* thru *students_fr5.pgm*, *students_frp1.pgm* thru *students_frp4.pgm* and finally *students_est.txt* containing a single number. Also, feel free to show some progress indication while your program executes.

Instructions

- This assignment must be done in groups of 2 students.
- You should use C or C++ and please make sure that your code compiles on the Windows platform.
- We will provide you with a few sample MPEG sequences to test your programs. The minimum requirement is for your implementation to work on these samples.
- You are required to send "hw3.zip" file as an attachment containing the following:
  1. Source code and executables (estimator.exe)
  2. Readme.txt containing instructions on how to compile and run your program.
  3. Also in the Readme.txt or a Word Document, include a brief section on how you went about estimating the number of people in the mpeg sequence.
  4. Makefile (that can be run using nmake) or MS VisualStudio project files. Do not include object files if not necessary for compilation.
- How to submit?
  - Send *hw3.zip* as an attachment to warkhedi@cs.cornell.edu
  - The subject header of your e-mail must contain the string "CS631: HW3" (ignoring the whitespaces & case).
  - The assignment must be submitted on or before 11:59pm May 17th 1999.
- Grading
  - Part 1 of this will be graded on a scale of 10.
  - The grade for part 1will primarily be based on the accuracy of your results.
  - The part 2 (the people counter) will be given a letter grade, based on the quality of your research. We are more concerned with the quality of your ideas than with how well they perform at the people-counting task, since the task is so difficult.