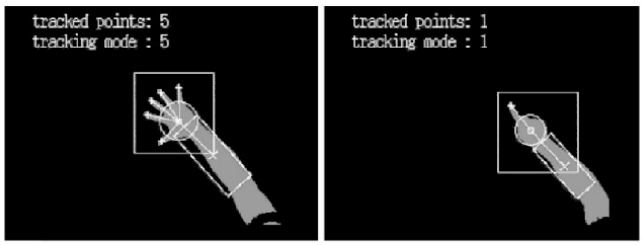
Gebze Institute of Technology
Department of Computer Engineering
BIL 665 / BIL 463
(Introduction to) Computer Vision
Fall 2014
HW2
Nov 9th 2014

In this homework, we are trying to build a simple LeapMotion device as we talked at the beginning of the semester. You will find your fingertips and mark their place on a live video. You are expected to find all fingertips and the palm center of one of your hands.

The input to the system will come from live stream of a web cam. You will use standard thresholding and other methods to isolate your hand from the the background to get a hand picture. For example, for the input image on the left produce a thresholded image on the right. (taken from Raheja et al.)

Then using the original and thresholded image, you run computer vision algortihms to locate the fingertips to produce the final results such as following (taken from Sato et al.)



Search the literature (google scholar) for topics such as “fingertip detection from images” or “image based fingertip localization” to get ideas from other people but never use code from other similar projerts. I found the following papers useful but you may find other sources more useful.

- Sato, Yoichi, Yoshinori Kobayashi, and Hideki Koike. "Fast tracking of hands and fingertips in infrared images for augmented desk interface." Automatic Face and Gesture Recognition, 2000. Proceedings. Fourth IEEE International Conference on. IEEE, 2000.
- Raheja, Jagdish Lal, Karen Das, and Ankit Chaudhary. "An efficient real time method of fingertip detection." arXiv preprint arXiv:1108.0502 (2011).
- Oka, Kenji, Yoichi Sato, and Hideki Koike. "Real-time fingertip tracking and gesture recognition." Computer Graphics and Applications, IEEE 22.6 (2002): 64-71.

Prepare a 5 page report that gives step by step detailed algorithm for your system. You should also give sample results and failure cases in your report. Your report should also include list of papers and other sources that you used in your work. Our plan for this report is to convert it to a conference paper later at the end of the semeter when our leap motion device is ready:)

Here are some rules and hints for the final system

1. Your system should work very fast (at least 10 frames per second on an i5 processor). If you do not get these speeds, use smaller images to make your system faster.
2. You may use any OpenCV tools available but do not use any code from other sources.
3. You will demo your final system in the lab. You may use a dark background to make your thresholding work but you are not allowed to adjust thresholds or any other parameters during the demo.
4. You should also print the frames per second numbers of your screen.
5. Your system can have modes from 1 finger detection, 2 finger detection, etc.
6. You should have separate optional windows for original, thresolded, and any other temporary images.

BONUS. 50 points.
Do the same homework with IR leds and IR filters as the LeapMotion device. Place an IR led array next to the camera ans put the IR filter on the camera lens. This setup should make your thresolding routine much faster and robust against background changes.