



Gesture Recognition Programming Assignment 1

CS 440 P 1

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Problem Definition

The motivation behind our project is to distinguish simple hand gestures by implementing our algorithm using the techniques such as convex hull and convexity defects. Specifically in this project, our goal was to distinguish between three kinds of different hand gestures: "Paper", "Rock", "Scissor". The algorithm was useful for counting the number of finger tips and recognizing different types of hand gestures. An application of this algorithm could be an implementation of the rock, scissor, paper game. However, there are also limitations to this algorithm. For example, we could only make assumptions that the hand is the biggest object in the video streams in order to track it and the arms should be covered by cloth. One of the difficulties we encountered was finding and understanding the different properties of the object such as convex hull and convexity defects in order to analyze the gestures.

Method and Implementation

First of all, we use the mySkinDetect function from the lab to filter the original image to binary image and find the area covered by skin color. Then we used the builtinfunction findContour from OpenCV to store all the contours into a vector based on binary image. Then we compare the size of every contour of the object we find from myskinDetect and filter the one with the largest size, which we suppose it to be the hand. Then we use the built in function convexhull and convexdefect to find the convex hull and defects of the object which we later analyze it to count as finger tips and store them. We also find the centroid of the object to compare with the start point of the defects. We noticed that there appears to be a lot of end point of defects found at the end of the hand, in order to filter out the finger tips. The method we use is that if the depth > 11 and the y value of the start point is lower than the y value of the centroid, which means the start points are higher than the centroid. At last, we counted the number of the finger tips. In order to be precise, we have # of finger tips less than or equal to 1 to be Rock, between 2 and 3 to be Scissor and larger than 4 to be Paper.

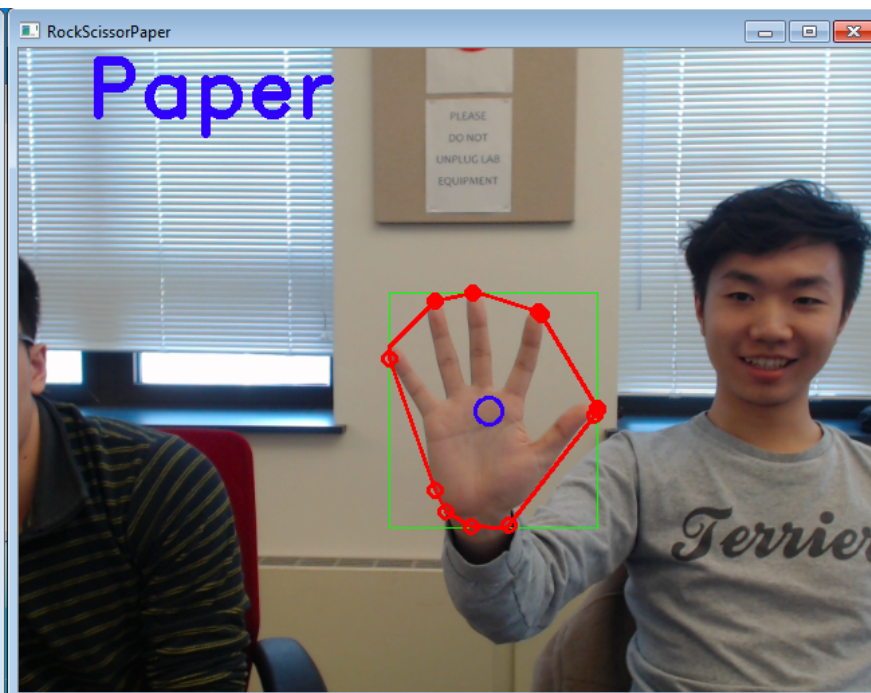
Experiments

We tested the "Paper", "Rock" and "Scissor" gestures each for 15 times. And we use the confusion table to compute the result. We found that, the accuracy of our program, was very high, but with a skin-like background color might decrease the precision.

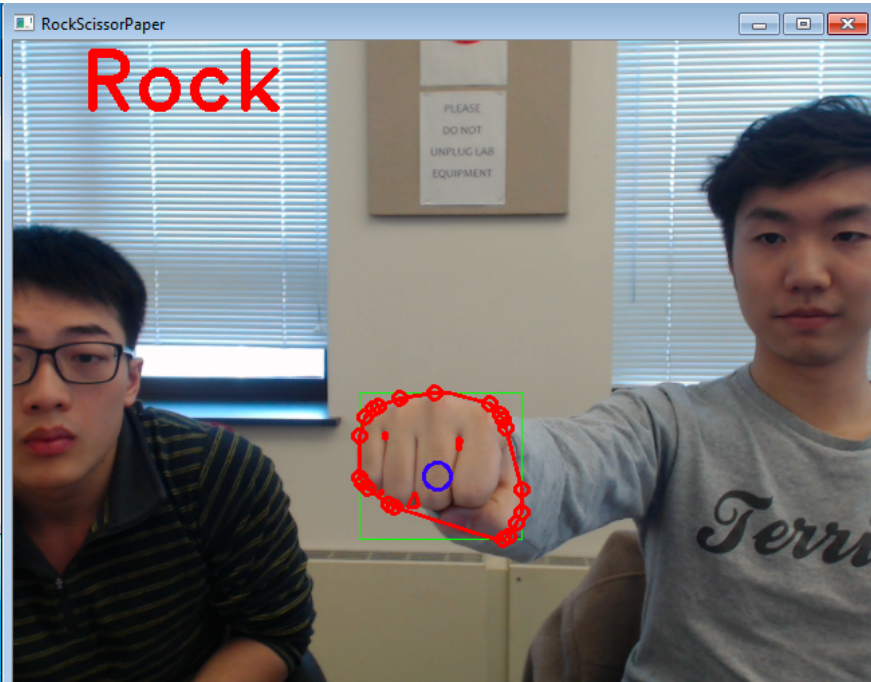
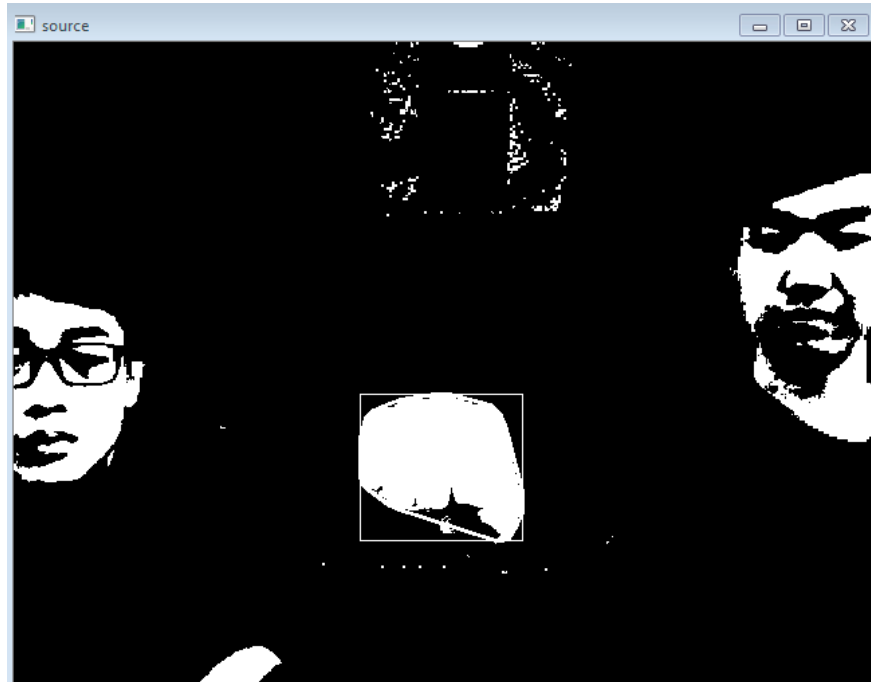
Data Evaluation:

	Rock	Paper	Scissor	
Rock	100%	0	0	
Paper	0	86%	0	
Scissor	0	14%	100%	

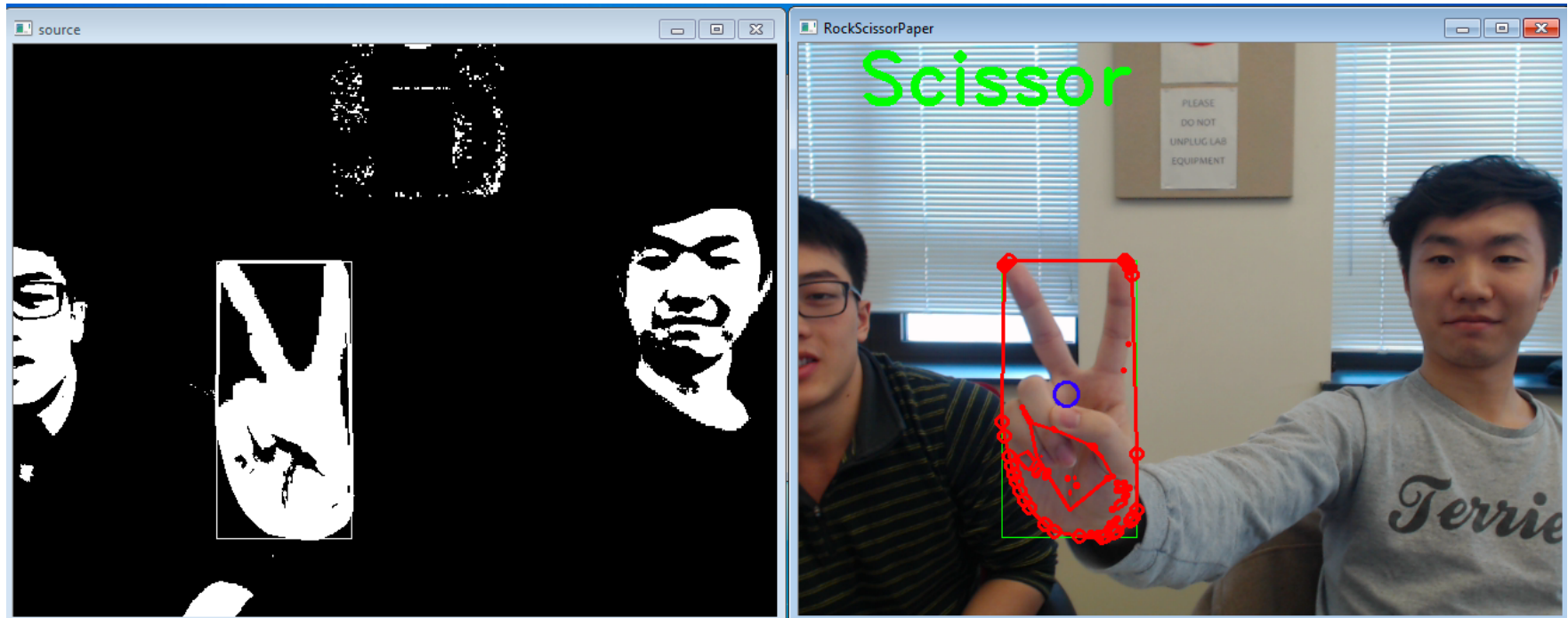
Average Success Rate (True Positive): 95.3%
Average Misinterpret Rate (False Positive): 4.7%



trial
2



trial
3



Discussion

Discuss your method and results:

- The strengths of our method is that the result is very accurate with an accuracy rate of 95.3%. However, the limitations and weakness of our method is that the hand contour is easily combines with any background color which is similar to the skin color and in order for the system to recognize the hand, the hand must be the biggest object in the video. Second, the system had a hard time recognizing gesture when our hand are leaning towards left or right side.
- The result is very accurate and in order to improve the method, we need to improve the accuracy of the calculation of the gesture recognition. For example, when you are presenting a fist, the starting point of the convexity defects starting point at the top might still be recognized as fingers, which may lead to potential failure.

Conclusions

The hand gesture recognition is very interesting and complicated aspect of Artificial Intelligence. During the process of building the algorithm, we have used many OpenCv functions and they are extremely useful helping us determine the different properties of the object. There are also many math works involved in the algorithm which by doing this project, we certainly improve our abilities and get familiar to the hand gesture recognition method and developed our more complicated thoughts on algorithm.

Credits and Bibliography

1. Amiraj Dhawan, Vipul Honrao, 2013, Implementation of Hand Detection based Techniques for Human Computer Interaction, International Journal of Computer Applications (0975 & 8887)
2. <https://www.youtube.com/watch?v=DEHk-5xbJhU> data of access: 2/6/2015

For the joint work and discussion with my teammates, I worked with my teammates to implement the findcontour function to the binary image produced by the myskindetect function. I also analyzed different properties of the image and discussed with my teammates to find the best hand gesture recognition algorithm. Then I worked with my teammates to apply Convexhull and ConvexityDefect to the image and come up with the algorithm of recognizing Rock, Scissor and Paper.

