

## Chapter 6

### Conclusion and Recommendations

From the literature, we know that hand detectors incorporating boosting and Haar-like features perform quite well in applications like sign-language recognition, in which images are relatively high resolution with less cluttered background and constrained hand gesture. These approaches suffer from high false positive rates and low detection rates when applied to detect less constrained hands in low resolution and cluttered images.

However, I find that these limitations can be overcome with the help of a simple but efficient post processing system. In my experiments, the prototype hand detection system achieved excellent performance on its test set. One important limitation of this work is that both the training and testing image sequences were captured in the same environment. This means that the performance of our current system is likely background dependent; if so, the reported performance is optimistic. Another possible limitation is that the system may not work well on the image, taken while human is in motion beside normal walking. I had doubt about this limitation because the classifier cascade was trained only on the hands of working humans. So far, current results indicate that my hand detector can be efficiently used to locate hands for applications such as gesture recognition and human action recognition systems.

As recommendations for those who would like to make use of or improve my system, I would like to recommend finding new features, which help discriminate true hand from false hand more, from skin detected binary image. Then, more false positives can be eliminated. Although I used boosted classifier cascade based on the rapid object detector [14, 3] because of its rapid detection, it is not much robust to the rotation of hand according to the analysis on the rotational robustness of hand detection with Viola-Jones detector [34]. The performance of the system will be improved, especially in detection rate, if boosted classifier cascade can be replaced with a high speed classifier that is more robust to rotation. The tuning of system parameters such as threshold of Mahalanobis classifier and number of neighbor may help improving detection rate while reducing false positive rate.