Abstract

Robust real-time hand detection and tracking in video sequences would enable many applications in areas as diverse as human-computer interaction, robotics, security and surveillance, and sign language-based systems. The first contribution in this thesis is the introduction of a new approach for detecting human hands that works on single, cluttered, low-resolution images. My prototype system, which is primarily intended for security applications in which the images are noisy and low-resolution, is able to detect hands as small as 24×24 pixels in cluttered scenes. The system uses grayscale appearance information to classify image sub-windows as either containing or not containing a human hand very rapidly at the cost of a high false positive rate. To improve on the false positive rate of the main classifier without affecting its detection rate, I introduce a post-processor system that utilizes the geometric properties of skin color blobs. The four features, which help discriminating false positives from real hand, are second contribution of this thesis. When my detector is tested on a test image set containing 106 hands, 92 of those hands are detected (86.8% detection rate), with an average false positive rate of 1.19 false positive detections per image. The rapid detection speed, the high detection rate of 86.8%, and the low false positive rate together ensure that my proposed system is usable as the main detector in a diverse variety of applications requiring robust hand detection and tracking in low-resolution, cluttered scenes.