Public Abstract
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The research on object detection/tracking and large scale visual search/recognition has recently gained substantial progress and has started to contribute to improving the quality of life worldwide: real-time face detectors have been integrated into point-and-shoot cameras, smart phones, and tablets; content-based image search is available at Google and Snaptell of Amazon;vision-based gesture recognition has been an indispensable component of the popular Kinect game console.

In this dissertation, we investigate computer vision problems related to object detection, adaptation, tracking and content based image retrieval, all of which are indispensable components of a video surveillance system or a robot system. Our contribution involves feature development, exploration of detection correlations, object modeling, local context information of descriptors. More specifically, we designed a feature set for object detection with occlusion handling. To improve the detection performance on a video, we proposed a non-parametric detector adaptation algorithm to improve the performance of state of the art detectors for each specific video. To effectively track the detected object, we introduce a metric learning framework to unify the appearance modeling and visual matching. Taking advantage of image descriptor appearance context as well as local spatial context, we achieved state of the art retrieval performance based on the vocabulary tree based image retrieval framework. All the proposed algorithms are validated by throughout experiments.