Behavior Subtraction

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Abstract
Network video cameras have become ubiquitous in wide-area surveillance applications. Automatic algorithms are necessary for efficient processing of the vast amount of visual data. In particular, many applications require the detection of suspicious behavior, or the objects whose activity is different from what is commonly observed. Many methods to date have high computational complexity due to reliance on object and path analysis. Our method, behavior subtraction, relies on temporally aggregating motion labels. Due to its simplicity, the algorithm requires little processing power and memory and thus can be run in real time. It is also general enough to monitor humans, cars, and any other object in uncluttered and highly-cluttered scenes. In addition, it is robust to harsh environments (such as camera jitter, rain, snow, and fog).

Challenge
Develop and implement real-time anomaly detection algorithm
Analyze behavior at the pixel level

Method
Input video → Motion field → Background motion model over each pixel
Input video → Motion field → Foreground motion model over each pixel → Behavior field

Application
Abandoned object detection
Video without foreground objects
Jitter compensation
Group detection
Robust motion detection

State of the Art
Many alternative methods used today are path-based, which require tracking and thus are subject to various tracking errors. There is also much research in methods that do not use tracking. Xiang et al. analyzes behavior at the blob level using features such as position, size, temporal gradient, and pixel history change (PHC). Bobick and Davis use 2D temporal templates to summarize human gestures. Also, Oh et al. divide the training video into temporal segments characterized by their motion characteristics. Then their algorithm uses these characteristics to cluster the segments. Behavior subtraction, on the other hand, does not segment the video and instead considers the entire sequence. It is also general enough to be used to observe anomalies in various objects such as pedestrians and vehicles.


This work was supported in part by Gordon-CenSSS, The Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems, under the Engineering Research Centers Program of the National Science Foundation (Award Number EEC-9986821).