Recognizing Activity Structures in Massive Numbers of Simple Events Over Large Areas

Ray Rimey, PhD

Lockheed Martin Corporation
(303) 932-4892, raymond.d.rimey@lmco.com

Abstract

This first half of this presentation addresses the exploitation of massive numbers of webcam-derived change detections. We use the term “change analysis” to emphasize the intelligence value obtained from large numbers of change detection over long time intervals. Our methods emphasize local temporal descriptions of activities and include minimal spatial information about activities. Our three methods adapt and extend: (1) classic unsupervised pattern recognition operating on bag-of-words features; (2) Latent Semantic Analysis (LSA); and (3) probabilistic LSA (PLSA). These methods allow us to: (a) Detect and describe anomalous activities; (b) Discover categories of activity, describe a category of activity, and assign an activity to a category; (c) Retrieve similar activities from a historical database. We present experimental results using webcam images of a town market square collected every few minutes over 74 days.

The second half of this presentation explores the general problem of how massive numbers of the simplest sensor-derived events can be exploited. Automated methods to extract the simplest events from image sequences are often fairly robust (e.g., change events derived from a distributed ground sensor network, or from video-derived tracks, or from EO or SAR image sequences). Massive numbers of such events can contain information with high intelligence value. We summarize the basic functionality an intelligence analyst needs for studying this type of event data, in short: to understand the spatial structure, temporal structure and event-pair structure within an area of regard. Then we present examples of algorithms for automated exploitation of such data and visualization tools to help analysts study such data, using simulated motion detection events from a ground sensor network covering an entire neighborhood near Al Mahmudiyah, Iraq.