Dealing with False Alarms in Camera Surveillance

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With the advancement of automated detection, CCTV operators run the risk of being swamped by false alarms. In order to avoid distraction, repeated false alarms may cause operators to start to ignore all alarms, knowing that each time it will most likely be false. In anticipation we have developed a camera surveillance interface with the purpose to handle substantial false alarm rates. The interface is designed to reduce task switches and minimize operator workload when false-alarms occur regularly. This challenge requires a set of audio-visual design measures. The 'false-alarm robust' interface may be viewed as supplementary to the other measures of human behavior described in the adjoining presentations. The prototype interface contains three approaches to help deal with false-alarms.

Sources of false-alarms

Besides originating in faulty hardware, false-alarms may have a variety of origins such as:

- Software false-alarms: acoustic event (sound) detection.
- Camera based false-alarms: license plate recognition, a person crossing a virtual 'trip wire', face recognition.
- Human false-alarms: store and bank alarms (e.g. robbery).

In this article we are interested in most false-alarms that do not originate in faulty hardware. The number and importance of each False-alarm varies with the information source. Few but important false alarms are expected to be generated by persons, such as a bank employee accidentally pressing a button which is linked directly to the police or to a surveillance centre. Automated alarms are more likely to cause errors. Acoustic event detection and face recognition are examples of technologies which are particularly prone to false alarms [1].

Priority alarms

The most important alarms we categorize as 'priority 1'. These alarms should not be missed and require a high attention value (i.e. a high conspicuity) leading to a quick response. Priority 1 alarms require a 2nd, 'back-up' operator if the primary operator does not respond within a specified amount of time. This approach should

Figure 1. Conventional Video wall with numerous cluttered video images, ideal to hamper situation awareness and vigilance (http://www.videonext.com).

Figure 2. The interface (Left) centered on a map display showing color-coded camera viewing cones. The map display (Right) increases spatial awareness of the camera locations, orientations, and zoom. The color coding helps to match the image above to the viewing cone. Located at the CIV (Centrum voor Innovatie & Veiligheid) of the city of Utrecht.

guarantee a timely response to the most important alarms, irrespective why the alarm is missed. Priority 1 alarms will at least include bank (robbery) alarms. The other alarms will be given lower classifications, depending on the required response time.

Spatial awareness

Camera surveillance of public spaces typically makes use of a 'video wall' with numerous video screens (see Figure 1). The spatial awareness of the operator is limited by the ability to integrate the individual images into a consistent whole. Our prototype interface contains a street map with color-coded field-of-view cones as an attempt to combine the top-down map view with the camera perspective [2,3,4]. The viewing cones are particularly useful in combination with pan-tilt-zoom cameras. Each camera cone is uniquely color-coded corresponding to the edge of the camera image to help switch eye fixation between the 'video wall' and the map display (see Figure 2). The colors are chosen to be easily identifiable from the corner of the eye.

Sound Surveillance

The interface further contains 'Sound surveillance', designed to draw attention to (sound) events that - most likely - occur outside the camera field-of-view. Each event that surpasses a threshold value on an automatic 'suspiciousness' scale will briefly be played to the operator [1,5]. The location of the microphone recording the suspicious sound is simultaneously shown on the map display by smoothly expanding circles (not shown). The operator himself decides whether to pay closer attention to the event, saving precious time in case of obvious false-alarms. In an experimental study we examined 'sound events' interspersed with false alarms, simulating 3 real events for every 17 false-alarms, i.e. a false-alarm rate of 85%.

Conclusion

Interfaces may be expanded to handle alarms, real as well as false. To maintain vigilance, priority is to minimize the effort needed to check on alarms, thereby minimally distracting from the main (surveillance) task. Sound and vision are by and large - but not entirely - complementary senses. Sound does not, for example, require eye fixations. The same holds true for alarms that are easily visible from the periphery [6,7]. Smooth motion and color are particularly useful to attract attention but not distract [8]. Lastly, coordination among co-workers is a must to not miss the most important alarms such as a robbery alarm.

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