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Pattern Recognized Surveillance System

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PATTERN RECOGNIZED SURVEILLANCE SYSTEM

THE NEED

With the increase of necessity of security system in homes and business, the hardware of video surveillance has been developed sharply. We can notice these developments in not only various and advanced instruments but also surveillance systems such as Digital Video Surveillance (DVS) of a turn toward digital video servers using Internet access, and Multi-modal User Interface (MUI). (refer to http://www.new-technologies.org/ECT/Other/videosurveillance.htm) However, these developments in hardware cannot satisfy the desire to watch closely like that a security guard monitors various human behaviors recognizing suspicious behaviors. Thus, the research for truly cognizant surveillance system that is adaptive and capable of learning normal behaviors based upon past experiences integrated with human expert knowledge and current scenarios to determine the state of the surveillance area.

THE TECHNOLOGY

The ultimate objective of research is to create a complete-decision maker which allows us to detect the new state and initiate appropriate actions taking and analyzing all historical and current information based upon adaptive reasoning. Computers have the ability to extract information from multiple sources and identify and track patterns of activity that are inconsistent with "normal" operations.

FIGURE 1 PATTERN RECOGNITION IN INTELLIGENT COMPUTER VISION

Warning systems can then be activated to alert human operators and recommend actions. This technology can be categorized into three concepts; 1) Pattern Recognition

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and Indepth Data Mining based on Adapted Reasoning, 2) Real-Time Anomaly Detection, and 3) Intelligent Sensors. The first step in Pattern Recognition is to define acceptable behaviors patterns through learning and updating normal patterns of behavior. Modern technologies such as neural-networks, feature extraction, computer vision, statistical and syntactical pattern recognition, anomaly detection, and knowledge discovery are adapted in analysis of identifying whether the behaviors detected are normal or abnormal. All anomalies which are detected as not just those that have been previously identified can be communicated to appropriate security personnel for immediate response in Real-Time Anomaly Detection. The issue of Intelligent Sensors stands on the point of view for hardware. In order to achieve the perfect system, the algorithm created in the phase of Pattern Recognition needs to be embed on sensors directly in the phase of Intelligent Sensors for data communication.

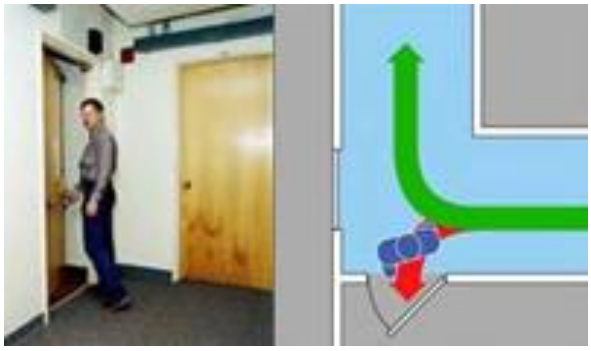

FIGURE 2 PATTERN RECOGNITION IN REAL-TIME ANOMALY DETECTION (COURTESY OF AMTL OF LOS ALAMOS)

THE BENEFITS

- Producing the most reliable and secure anomaly detection capabilities.
- Allowing us to determine and report the current status of monitored area of responsibility and also supports historical continuity of knowledge for materials and activities within a facility and network.
- Being applied to various applications of interest, such as facility monitoring or military reconnaissance.

STATUS

A test bed in DOE NN-20 sponsored the research necessary to develop such capabilities was created to test and demonstrate the various components required for a completely integrated facility monitoring system. This test bed was called the Adaptive Multi-sensor Integrated Security System (AMISS) and was located at the Critical Experiments Facility Highbay at TA-18. Attendees were provided a real-time demonstration of integrated technologies as a proof-of-concept toward intelligent facilities. Included was video image surveillance (personnel tracking), path tracking anomaly detection, adaptive reasoning, and nuclear material detection and pinpoint tracking with sensors such as video, active infrared, passive infrared, radiation detectors, portal monitors, face recognition, and hand readers.

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The system was able to detect and track personnel and objects as they entered and operated in the facility. Alerts and/or alarms were generated for various unauthorized activities such as shielding the nuclear material and attempting to leave the room or violating the two-person rule by visually detecting the two people too far from each other.

BARRIERS

- Massive quantities of diverse data have to be acquired and stored for knowledge discovery for creating pattern recognition algorithm.
- Lots of continuous and repeated experiments can be required to set up a reliable reasoning.
- Higher cost might invest on the design and development of a digital camera with intelligent sensors.

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REVIEWERS

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