
Smart Surveillance

Video Surveillance of the Not So Distant Future

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History of Video Surveillance

There is no doubt in the world that video surveillance has come a very long way in the past few years. If you bring up video surveillance, most people think of video cameras mounted in the corners of train stations and banks or private detectives video taping a cheating spouse for a chaotic divorce case. The truth is that the history of video surveillance is much more multifaceted and goes back beyond what most people actually realize.

As far back as 1969 there has been documented use of video surveillance that was used when police cameras were installed in the New York City Municipal Building near City Hall. The idea soon spread to other cities, with closed circuit television (CCTV) systems watched by officers twenty-four hours a day, seven days a week.

Video surveillance really made it big when video cassette recorders hit the market. Analog technology using taped video cassette recordings meant surveillance could be preserved on tape as evidence. The 1970's saw an explosion around the world in the use of video surveillance in everything from law enforcement to traffic control and even divorce trials.

Businesses such as banks, mini-marts, and gas stations, that were prone to theft or vandalism, began mounting video surveillance systems to deter would-be criminals and also in hope of catching the thieves. These cameras were used primarily and particularly in high crime areas.

There were many problems with these early surveillance systems though. Problems such as owners and employees that would become lazy and not change the

tapes daily or the tapes would wear out after months of being used over and over. There was also the problem of recording at night or in little or no light.

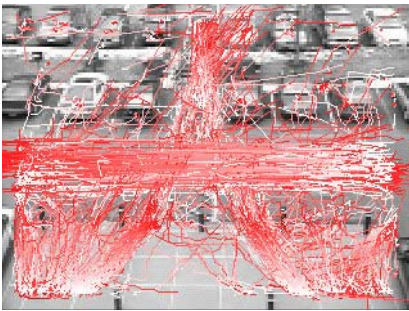
Eventually technology evolved as usual and Charged Coupled Device (CCD) cameras were developed which used microchip computer technology. These cameras permitted sensible applications of video surveillance by allowing low light and night recordings. Ultimately in the 1990's, Digital Multiplexing made it debut. When digital multiplexer units became reasonably priced it completely reformed the surveillance industry by allowing recording on several cameras at once, up to twelve at a time! Digital multiplex also added features like time-lapse and motion-only recording, which saved a great deal of wasted videotape.

IBM's Smart Surveillance

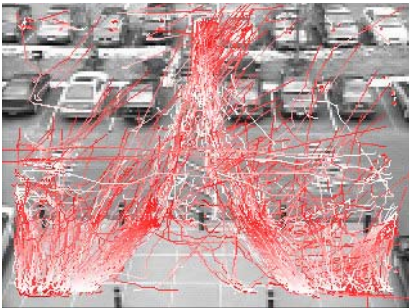
All this history in the end leads you to what is presently being used and what may lie in the future. The growing need for sophisticated surveillance systems and the move to digital surveillance infrastructure has altered and completely changed surveillance into a "large scale data analysis and management challenge." I believe that Smart Surveillance is the answer to all our problems. According to the IBM T.J. Watson Research Center, the IBM smart surveillance system (S3) is one of the few advanced surveillance systems which provides not only the capability to automatically monitor a scene but also the capability to manage the surveillance data, perform event based retrieval, receive real time event alerts through standard web infrastructure and extract long term statistical patterns of activity. There are many features of S3 middleware.

One of these key features is Local Real-Time Surveillance Event Notification. This set of functions makes available real-time alerts to the local application which is

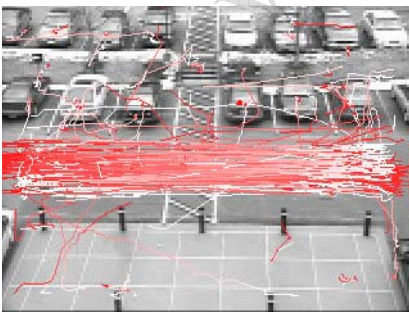
running the Smart Surveillance Engine (SSE). Users are notified in real time upon the occurrence of certain selected events. For example, when a large vehicle drives into the lot that should not be there, an alert is sounded. Another feature of this is event retrieval, which allows users to retrieve a variety of events from the parking lot. For example, all cars that arrived between 10am and 11am. One more feature of this would be event statistics which allows users to get the statistics of certain events that are occurring in the parking lot. For example, the arrival and departure distribution of people at the Watson center on a given day. Below are images from the Smart Surveillance System at work.



This Image tracks the movement of all objects during a 24 hour period.



This images tracks objects of a certain smaller size resulting in an image of the tracks of only people walking through the parking lot.



This image tracks the objects of a certain larger size, resulting in an image of the tracks of only cars driving through the parking lot.



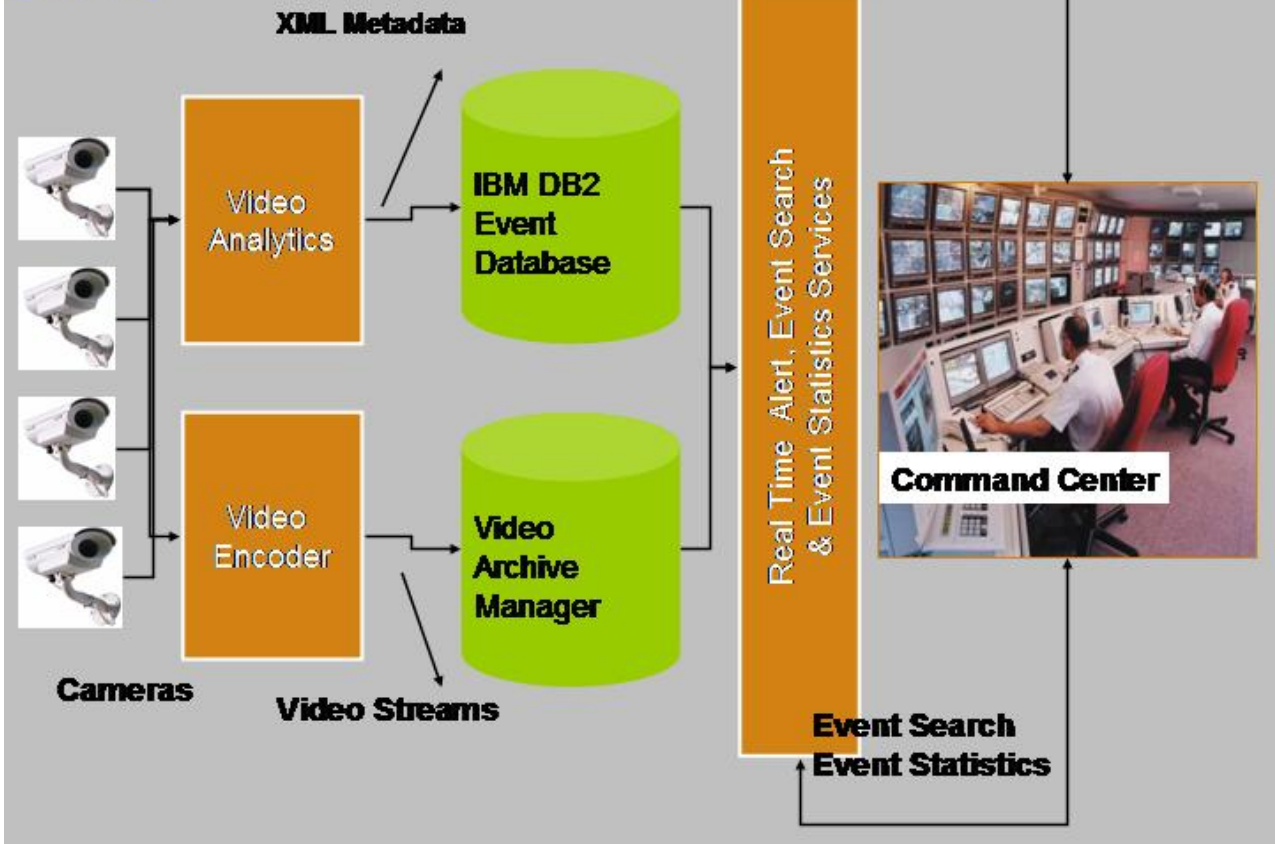
This image tracks a speeding vehicle. It does this by setting velocity preferences such as an object covering 10 meters in 2 seconds. The older the tracks, the whiter they are. Therefore we can assume the speeding vehicle was traveling towards the left of the screen.

In conclusion, it is only a matter of time before this technology is going to be second nature to all security guards. With this new and emerging technology there will be almost no need for security guards at all. No one will need to sit and watch the monitors because the software will be watching it for them. If there is something out of place, something unusual, or something that is not normal, someone will be alerted to this occurrence using a preferred method such as a pager. With this new and emerging technology, all of our banks, airports, and super markets will be much more secure than ever before. Only time will tell who uses the technology and if it works as well as they say it will.

Listed below is a catalog of the features gathered from IBM's website. As you can see, this technology is great and will be very a very powerful tool for capturing the wrong-doers in the future.

- **Object Detection** in the presence of distraction motion
- **2D Object Tracking:** Multi-object tracking with occlusion resolution.
- **Object Classification:** View independent object classification.
- **3D Object Tracking:** Precise 3D location using standard cameras.
- **Multi-scale Tracking:** Automatic PTZ Camera control to track objects.
- **Multi-camera Handoff:** The ability to track an object across cameras.
- **Face Cataloging:** Captures faces at large distances from the camera.
- **XML Metadata Representation** for object and its motion attributes.
- **Extensible Engine Architecture** for plug and play video analytics.
- **Real Time Event Indexing:** Scene events are instantaneously available for searching in a distributed database environment.
- **Web service interfaces for Event Search & Retrieval** support the rapid application development of customer specific applications.
- **Scalable Backend System:** COTS database technology allows for both distributed surveillance and scalability.

IBM Smart Surveillance System (S3-R1)



-image from IBM's website: <http://www.research.ibm.com/peoplevision/SSESystem2.jpg>

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