Industry White Paper

Behavioral Recognition: An Innovative Approach to Mass Transit Security and Public Safety

Technology Guide for Public Safety and Security Professionals

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Behavioral Recognition: *An Innovative Approach to Mass Transit Security and Public Safety*

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Executive Summary

Mass transit operators face an increasingly serious security dilemma. On the one hand, they have to continually enhance safety and protection – for passengers, for employees and for facilities. These improvements must come in spite of an increasing range of threats, ranging from the simple – people walking across rail right of way – to the expensive – copper wiring theft – to the worst-case – potential terrorist attacks.

At the same time, transit budgets are being squeezed as never before. Ridership has increased across the United States, but budgets haven't kept pace with the growth. Many operators face budget cutbacks due to the economic slowdown or popular aversion to government transportation subsidies. With fewer resources available for daily operations, let alone critical security challenges, operators need to find a simple, cost-efficient means to improve protection for people and facilities and increase productivity for security staff.

There is a new approach that is helping meet this challenge. Most mass transit operators have invested in large-scale video surveillance systems. Too few have successfully leveraged these systems to build an intelligent and self-learning network that acts like a massive team of human operators working 24 hours a day to examine every video frame from every camera. This solution finds unusual and suspicious behaviors automatically, doing the hard and tedious monitoring for the human staff, and then alerts security teams in real-time, for faster, more appropriate response.

This paper describes the benefits of applying a new category of video surveillance technology, known as behavioral recognition, to a wide range of transit security challenges. Behavioral recognition autonomously learns which on-camera behaviors are either "normal" or suspicious. Solutions based on behavioral recognition enable transit agencies to allocate security personnel far more efficiently as it identifies critical threats to passengers, employees and facilities in real-time. Its self-learning nature means that transit operators no longer have to spend large amounts of time and money to program and manage each individual camera. The software itself knows how to define what is normal and what isn't – and how to refine what constitutes acceptable behaviors over time.

Advantages of AISight®

AISight teaches itself to recognize and alert on abnormal behavior visible within video streams from surveillance systems.

Markets Served

Subways and Metropolitan Systems
There are 15 major subway systems operating in the U.S. The largest of these are in New York, Chicago, Washington, D.C., Philadelphia, Boston, and San Francisco. More than 20 smaller scale suburban and commuter rail systems operate in large U.S. urban hubs, as well as at least 30 light rail and tram systems.

These mass transit systems carry almost 15 million passengers each weekday, not including inter-city services. New York alone services more than eight million journeys per weekday. Washington, D.C., Chicago and Boston support more than half a million workday passengers.

Most transit systems are funded through a variety of government grants that directly address everything from general expenses to physical security. State and local taxes, grants, advertising rights and fare tolls cover capital and operational expenses not covered by federal subsidies.

Inter-City Rail
In the U.S., Amtrak operates inter-city passenger services on 21,200 miles of track, running more than 300 trains daily to as many as 500 destinations, including three Canadian provinces. While Amtrak is a for-profit corporation, it is partially funded through government aid.

Safety and Security Concerns
The potential of reduced government funding for Amtrak and state and municipal transit systems, along with wider economic pressures, mean that transit organizations need to be mindful of how they can most efficiently deploy their workforces to ensure that public safety and security are not compromised.

These concerns exist along with more conventional public worries about crime and safety issues, such as thefts, muggings and unauthorized people accessing the tracks. Transit agencies themselves are concerned with protecting their employees and infrastructure, especially from theft of wiring and equipment, and with avoiding exaggerated liability claims.

At the same time, the need for enhanced safety and security for passengers, employees and facilities has never been higher. An elevated threat of terrorist attacks on mass transit systems has existed since September 11, 2001, further heightened by Madrid, London and Moscow transit system bombings since then. At least six terror plots targeting U.S. rail and subway systems have been thwarted in the last decade.

Transit systems are attractive targets for terror groups because of their numerous points of vulnerability – at entrances and exits, and along tracks. Along with the potential for explosive attacks, there is concern over the potential use of chemical or biological weapons, similar to the Sarin gas attack on the Tokyo subway in 1994.

Advantages of AISight®

Adjusts automatically to changes such as new landscaping, different camera orientation, fresh construction, and new environments.

Approaches to Mass Transit Security
Video surveillance is a logical and popular tactic to improve safety and security. Significant investments have been made over the past 15 years to enhance video surveillance capabilities across most U.S. transit systems. As a result, mass transit organizations have begun to look at ways to use their security resources more efficiently. This includes partnerships with local law enforcement agencies for intelligence-led policing operations.

Video surveillance can help with many aspects of these challenges. And yet, almost every agency has learned is that it takes a very large number of cameras to view all critical areas across a system. It's also all but impossible to monitor the large volume of footage that these cameras record. One innovative approach that dramatically enhances the capabilities of both new and existing video surveillance networks is the use of an emerging technology known as behavioral recognition.

What is Behavioral Recognition?
Behavioral recognition is an artificial intelligence-based technology that teaches itself to recognize and alert on abnormal behavior visible within video streams from surveillance systems. This approach improves the effectiveness of existing video surveillance applications by automatically identifing abnormal or unexpected behavior within the field of view of any camera in real-time, without human monitoring or time-consuming and expensive custom programming. Behavioral recognition is highly accurate and produces very few false alerts.

Using behavioral recognition, security organizations gain increased situational awareness and lower costs for system deployment, management and operation. Real-time notifications advise operators when to look at suspicious activity on any camera, anywhere across the network.

Behavioral recognition technology detects and adapts to changing conditions like people do, but without fatigue, boredom or distraction. It enables real-time interdiction of developing threats across hundreds or thousands of cameras. Agencies and enterprises gain the ability to react sooner to unfolding events, expand networks without having to add more staff members, deploy existing staff more efficiently, and reduce associated expenses.

Scalability and Value
One key advantage of behavioral recognition technology is how easily it can be added to existing surveillance systems. It immediately begins developing a baseline understanding of a scene without human operators pre-programming defined rules.

For example, a camera supported by behavioral recognition can be aimed at a rail platform to learn what constitutes normal behavior for that scene. This process includes recognizing what is normal for various times of the day, different days of the week and the seasons of the year.

Once this baseline understanding is reached, the behavioral recognition software alerts operators when suspicious activity is detected. It continues to learn over time, avoiding false alarms, and becoming ever more accurate. This self-learning capability dramatically reduces the need for maintenance and reconfiguration as cameras are added or removed from service, or when items are changed within a camera's field of view, such as new construction or changes in landscaping.

Advantages of AISight®

Works with both new and existing cameras and security infrastructure.

Operator Efficiency
Anecdotal evidence suggests that video control room operators are able focus on the numerous monitors in the room for only 20 to 45 minutes per shift. In his 2004 study, "Behind the Screens: Examining Constructions of Deviance and Informal Practices among CCTV Control Room Operators in the UK," Gavin J.D. Smith describes this as the "boredom factor."

"The boredom factor arises principally from the monotonous viewing of hours of routinized, uneventful televisual images," Smith writes.

Smith also notes, "perhaps in hospital, city center, international airport and shopping mall control rooms, the boredom factor would be less, as there would be action occurring at all times, and continuous events to focus on."

While this may also be true of mass transit surveillance systems at certain times of the day, the inverse of the boredom factor my apply. There is often too much action, and the security guard's attention is overwhelmed by over-stimulation.

Behavioral recognition technology addresses both boredom and over-stimulation by alerting control room operators only when it detects something unexpected. It's at that point that the operator's judgment becomes critical in determining whether an incident is worthy of a response or is of no genuine concern.

This form of highly-targeted monitoring is how behavioral recognition enables transit authorities to more efficiently allocate monitoring and response resources. The result is increased productivity that controls costs while dramatically improving safety and security through video monitoring effectiveness.

Metal Theft
The last decade – particularly since the beginning of the global financial crisis – has seen a marked increase in the number of incidents of metal theft from rail systems. The problem persists, as reported at the American Public Transportation Association's Rail Conference in June 2012, where metal theft was highlighted by Los Angeles County Sheriff Department's Holly Perez as "a major challenge."

Behavioral recognition is useful in instances like this by providing a proactive response – identifying suspicious behaviors on tracks, identifying individuals who may be scoping out potential sites for metal theft, and alerting security teams before thefts occur.

Surveillance Paradigm Shift
The move toward integrating behavioral recognition into existing video surveillance systems offers an intriguing and desirable prospect: the use of surveillance as a proactive asset as well as a more traditional forensic tool.

Previously, because of limited monitoring resources and the sheer volume of video data generated by large-scale surveillance systems, the majority of incidents that required investigation – criminal or otherwise – would be reviewed after the fact. A crime would be committed, then police or security staff would search through recorded footage in an effort to find images of the perpetrators.

Advantages of AISight®

Reduces the costs associated with programming a comprehensive video surveillance solution while helping deploy staff more efficiently.

That process did nothing to prevent or interdict as an event unfolded. It also relied on the organization having retained the footage, and that is not always possible when masses of video data are being generated every day, and storage space is at a premium. Video of an incident that comes to light weeks after the event may be erased as new footage takes its place.

By focusing operators on the video clips that the behavioral recognition system has highlighted as suspicious, security teams can act immediately to prevent or intercede at the time of the event, dispatching resources to preemptively investigate suspicious behaviors, individuals and vehicles.

Looking Forward

In an era dominated by threats of terrorism, widespread economic uncertainty and tightening budgets, forward-looking transit organizations must search beyond traditional approaches to security and safety to better protect passengers, employees and facilities.

Innovative technology such as behavioral recognition is an integral part of the solution. Through improved safety and security and more efficient operations, behavioral recognition is proving to be essential for well-managed security strategies that help transit operators optimize existing resources and work smarter to safeguard the future.

About BRS Labs

BRS Labs is the developer of AISight®, a powerful, award-winning artificial intelligence system that learns normal behaviors in complex video surveillance environments, then delivers real-time alerts for unexpected activity. Its patented processes automatically observe, analyze and alert without human intervention or custom programming. Scalable to thousands of cameras, AISight installs and is productive within days – and gets increasingly accurate the longer it's in use. AISight recognizes and adapts to changing conditions much like a human brain does, but without fatigue, boredom or distraction. This highly automated solution works with a wide range of cameras and networks, in new or existing infrastructures, dramatically improving risk assessment and response to better protect borders, facilities, assets and people.

If you'd like to discuss the technology described in this paper, or meet with one of our solutions experts to help you expand upon these concepts, please feel free to call or write:

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Advantages of AISight®

Shortens time to deployment and self-educates in as little as two weeks.