Department of Homeland Security (DHS) Science and Technology (S&T)

Crowd Count and Analysis (CCA)

TECHNOLOGY SCOUTING
RESEARCH SUMMARY

Date: August 2019

Crowd Count and Analysis

Overview: Commercial datasets and open-source research were utilized to compile a list of solution options. A summary of the request is outlined below, and the top identified solutions thus far are displayed on the following pages.

Problem Description:

There is a need to identify technologies that can effectively manage large crowds during both planned and unplanned events. This gap can cause delayed, inadequate, or misplaced responses, crossing the spectrum of Public Safety (PS) personnel to include law enforcement and EMS personnel. Major events such as concerts, sporting events, and festivals can be extremely difficult to monitor manually, leading to lack of situational awareness which in turn places the public as well as PS personnel at risk.

In addition, it is currently very challenging to analyze and learn from threats faced in past incidents, which makes it even more difficult to effectively plan for potential threat vectors for future events. Being reactive instead of proactive puts PS personnel at a disadvantage in providing protection and response. Furthermore, the internet and social media channels have exacerbated the potential for future threats since information spreads at such a rapid pace.

Desired Use Case:

Identified technologies should be able to be used for both planned and unplanned events (e.g., inaugurations vs. riots) and should be capable of actively monitoring and analyzing event crowds in real-time. This will help PS managers deploy the most effective resources in a timely manner. Technologies would be used both indoors and outdoors, and they should be able to assess not just counts of people but also changes in peoples' movement over time.
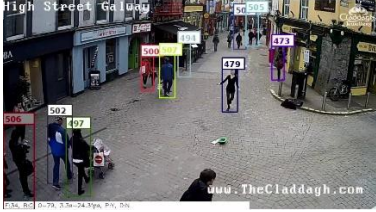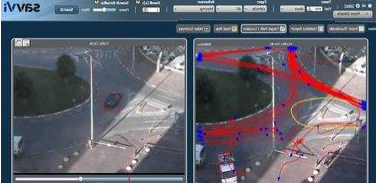
Technology Requirements:

While a variety of requirements (or Key Performance Parameters, KPPs) have been identified, this report will highlight a few in greater detail.

The list of the requirements assessed for this report are listed below:

- Operate in all environments (indoor, outdoor)
- Determine and monitor counts, movement, location, and status of crowds
- Identify potential hazards (i.e. chokepoints, crowd health)
- Differentiate between public safety assets (i.e. vehicles vs. personnel)
- Analyze video data before, during (real-time), and after respective use case

Crowd Count and Analysis

Homeland Security
Science and Technology

Solution Options			
#	Solution	Description	Requirements
1	**Sentinel** by Accuware (USA)	Camera-based Real-Time Locating System (RTLS) that recognizes people inside video streams and can follow their movement through indoor and outdoor venues over time. Applying object recognition techniques, recognizes human shapes from images in video streams based on their appearance, including features like bulk, clothes color and height. This enables Sentinel to discern people from the background and to enable implementing capabilities such as people counting, tracking people's movements, searching for a like match among individuals previously "seen" by the video cameras.	Operate in all environments — Yes; Monitor crowd counts and movements — Yes; Identify potential hazards — Yes; Differentiate between PS assets — Yes; Analyze available data before, during, and after event — Yes
2	**Dynamic Crowd Measurement (DCM)** by ACES Group (Australia)	Provides autonomous real-time data driven intelligence for informed decision making on crowds. Based on automated data collection of two quantitative metrics and one qualitative assessment using intelligent technology systems. An algorithm analyses the data and visualizes the results to keep decision makers informed in real-time.	Operate in all environments — Yes; Monitor crowd counts and movements — Yes; Identify potential hazards — Yes; Differentiate between PS assets — Yes; Analyze available data before, during, and after event — Yes
3	**savVi** by Agent Video Intelligence Ltd. (Israel)	A set of automated video analysis tools that provide for the immediate detection and extraction of events and data from surveillance footage, replacing the manual tasks traditionally employed to monitor live video feeds or sift through recorded video. Users can make use of their surveillance systems and allocate their time and attention in a more effective manner.	Operate in all environments — Yes; Monitor crowd counts and movements — Yes; Identify potential hazards — Yes; Differentiate between PS assets — Yes; Analyze available data before, during, and after event — Yes
4	**Rekognition** by Amazon (USA)	A video analytics platform that can perform facial recognition, license plate reading, and other video analysis functions using real-time camera feeds. Users provide an image or video to the API, and the service can identify the objects/people across a database of identity profiles.	Operate in all environments — Yes; Monitor crowd counts and movements — Yes; Identify potential hazards — Yes; Differentiate between PS assets — Yes; Analyze available data before, during, and after event — Yes

Crowd Count and Analysis

#	Product	Description	Capability	
5	**Ronin Platform** by Coolfire Solutions (USA)	Ties existing systems and infrastructure together. Includes GPS, two-way communication, dashboard visualization, situational awareness, integration, and real-time tracking capabilities. For venue and large crowd security, allows security organizations to leverage and connect all their existing security technology into one common operating picture delivering real-time information.	Operate in all environments	Yes
			Monitor crowd counts and movements	Yes
			Identify potential hazards	Yes
			Differentiate between PS assets	Yes
			Analyze available data before, during, and after event	Yes
6	**Crowd Vision** by Crowd Vision, Ltd (UK)	Software shows what is happening to an entire pedestrian population, in real time. Outputs live data about everything from flows, queues and wait times to processing times, occupancies, and asset utilization. Live dashboards reveal actionable insights to improve real-time operations. Accumulated historical data provides evidence for planning and investment decisions.	Operate in all environments	Yes
			Monitor crowd counts and movements	Yes
			Identify potential hazards	Yes
			Differentiate between PS assets	Yes
			Analyze available data before, during, and after event	Yes
7	**SmartVis Face** by Digital Barriers (UK)	Automated facial recognition provides the ability to detect, track, and recognize faces from a list of known individuals in unstructured environments (e.g. crowds, airports, Time Square). The analysis occurs in real-time and does not need to be fed into a central database for the analysis to occur. For its Smart Cities and Major Events applications allows for integration into most CCTV cameras (wired or wireless), discreet "stand-off" live ID authentication, alarm options (local, remote, security-access filtering, etc.), real-time 1:N identification of subjects against watch-lists, subject enrolment via legacy databases or connected cameras, anonymization & Privacy filters, and multi-device support (CCTV, body-worn cameras, access control).	Operate in all environments	Yes
			Monitor crowd counts and movements	Yes
			Identify potential hazards	Yes
			Differentiate between PS assets	Yes
			Analyze available data before, during, and after event	Yes
8	**Matrix Video Surveillance** by Matrix Security Solutions (India)	Crowd management capabilities, can maintain a count of people entering/leaving the premises, as well as the number of people present inside, and prevent unauthorized people from entering the premises.	Operate in all environments	Yes
			Monitor crowd counts and movements	Yes
			Identify potential hazards	Yes
			Differentiate between PS assets	Yes
			Analyze available data before, during, and after event	Yes

9	**Domain Awareness System** by Microsoft (USA)	A surveillance system developed via a partnership between the New York Police Department (NYPD) and Microsoft to monitor New York City. The surveillance network spans the entire city, including bridges and tunnels. DAS can identify subjects based on visual characteristics: age, weight, clothing, and skin color. Identification then allows DAS to track targets and gain detailed information about them. The surveillance network of more than 18,000 interconnected cameras is coupled with thousands of license plate readers deployed around the city, as well as readers mounted on roving patrol cars.	Operate in all environments	Yes
			Monitor crowd counts and movements	Yes
			Identify potential hazards	Yes
			Differentiate between PS assets	Yes
			Analyze available data before, during, and after event	Yes
10	**Metropolis** by Nvidia (USA)	AI-based video analytics allows users to speed up their investigations by capturing and classifying objects such as vehicles, bicycles, pedestrians, and identify interactions in real-time. Deep learning-based video synopsis and analytics solutions intelligently compress days of camera footage to minutes for quick review.	Operate in all environments	Yes
			Monitor crowd counts and movements	Yes
			Identify potential hazards	Yes
			Differentiate between PS assets	Yes
			Analyze available data before, during, and after event	Yes
11	**Patternizr** by NYPD (USA)	Based on machine learning, was trained using manually identified patterns for burglaries, robberies and grand larcenies in New York City to find relationships among them. The final models were incorporated into NYPD's Domain Awareness System -- a citywide network of sensors, databases, devices, software and infrastructure. All historical pairs of complaints were then processed in the cloud against 10 years of records of burglaries and robberies, and three years of grand larcenies data. To keep the software up-to-date, similarity scores were calculated and updated for new and revised complaints three times a day, and each was scored against the existing crime data before being incorporated into DAS.	Operate in all environments	Yes
			Monitor crowd counts and movements	Yes
			Identify potential hazards	Yes
			Differentiate between PS assets	Yes
			Analyze available data before, during, and after event	Yes
12	**Proximus** by Proximus Analytics (Belgium)	Real-time Crowd Management allows users to monitor an event, a demonstration or a gathering during the specific time window of the activity and react to unexpected situations. The aggregated data reports on both national and international number of people in an area.	Operate in all environments	Yes
			Monitor crowd counts and movements	Yes
			Identify potential hazards	Yes
			Differentiate between PS assets	Yes
			Analyze available data before, during, and after event	Yes

Crowd Count and Analysis

13	**F20** by Regal (Germany)	These services and solutions enable total flow optimization of any facility. Has developed recommendations and training for users to address emergency situations as well as normal operations. SAFETY Act Developmental Testing and Evaluation designated software solutions and services.	Operate in all environments	Yes
			Monitor crowd counts and movements	Yes
			Identify potential hazards	Yes
			Differentiate between PS assets	Yes
			Analyze available data before, during, and after event	Yes
14	**SensorInsight** by SensorInsight (USA)	Provides insights into vehicle and pedestrian movement patterns and trends through monitoring of public and private areas. There are several solutions, which result in a combined technology approach to monitoring people and traffic in high volume areas, using video, beacons, and phone detection to provide dynamic estimates of how people are moving through a space. It helps users understand flow, density, direction, and activity.	Operate in all environments	Yes
			Monitor crowd counts and movements	Yes
			Identify potential hazards	Yes
			Differentiate between PS assets	Yes
			Analyze available data before, during, and after event	Yes
15	Sensority 360˚ Detection Analysis Solution by Sensority (Israel)	Develops video analytics technology for sensing and analyzing the physiological parameters of individuals observed in real-time via video stream from any camera. Uses technology to enhance current CCTV infrastructure. Helps security personnel with crowd flow management and spectator moods and emotions.	Operate in all environments	Yes
			Monitor crowd counts and movements	Yes
			Identify potential hazards	Yes
			Differentiate between PS assets	Yes
			Analyze available data before, during, and after event	Yes
16	**Wise** by Viisights (Israel)	Automatic real-time analysis of video content captured by widespread surveillance cameras for crowd management. The system provides understanding of real-time and closed-feed videos originating from various surveillance devices. Automatic behavioral understanding of object, actions and events includes both context and scene understanding. The system's core artificial intelligence can learn and recognize behavior that can then be defined and characterized. The system can be used in a private cloud or via on-premise deployment. The system is scalable and efficient with GPU and CPU hardware. Real-time mode configuration supports thousands of channels per single account, where data intelligence is generated in near real-time (a few seconds). Is camera manufacturer agnostic and supports a wide range of video surveillance camera types.	Operate in all environments	Yes
			Monitor crowd counts and movements	Yes
			Identify potential hazards	Yes
			Differentiate between PS assets	Yes
			Analyze available data before, during, and after event	Yes

Crowd Count and Analysis

17	**Zepcam Software** by Zepcam (Netherlands)	Performs live viewing and remote managing of crowds. Live video and data streams can be integrated in existing video management software or command & control infrastructure. Has integrations with the leading Video Management Systems like Genetec Security Center, Milestone, Cisco VSOM, OnSSi/Seetec and several others. The software takes care of automatic file transfer of recorded video and data from bodycams to computer and Cloud or Server Software.	Operate in all environments	Yes
			Monitor crowd counts and movements	Yes
			Identify potential hazards	Yes
			Differentiate between PS assets	Yes
			Analyze available data before, during, and after event	Yes
18	**Flowity Crowd Management** by Flowity (Sweden)	Analyzes large open areas with flying drones in real time and provides a count of the number of persons gathered. By real-time analysis of crowd data users can make last minute adjustments of crowd control barriers or temporary fencing and determine whether extra security personnel will be needed.	Operate in all environments	*
			Monitor crowd counts and movements	Yes
			Identify potential hazards	Yes
			Differentiate between PS assets	*
			Analyze available data before, during, and after event	Yes
			More Information Required for Detailed Product Specifications	