

## Relevance

- Counterflow in the exit lane of an airport is a major security concern by the TSA, who employs one or more officers stationed to monitor each exit.
- If an exit breach occurs, the airport must be evacuated and searched. This process can cost millions of dollars.
- Video Analytics make it possible to leverage extensive video surveillance systems in real-time to increase security in airports.

## Our Vision

REAL-TIME MONITORING OF PASSENGER MOVEMENTS WITHIN AN AIRPORT FOR FAULT-FREE, AUTONOMOUS DETECTION OF COUNTERFLOW EVENTS USING COST-EFFICIENT VIDEO ANALYTIC SOLUTIONS SUPPORTING TIMELY RESPONSE TO MANAGE AIRPORT SECURITY

## Transition Strategy

- Focus research on overcoming key technical issues holding back a robust operational solution for the TSA and Airports.
- Collect data, perform experiments in real-world operational environments, and improve algorithms to achieve acceptable performance from an operational perspective.
- Work with industrial partners from the outset to develop robust testbed infrastructure and ensure commercial viability.

## Accomplishments

- The testbed is fully operational and allows researchers to access digitized, real-time video feeds from the airport.
- The system uses existing camera hardware to detect counterflow events and alert TSA if an event has occurred.
- Algorithms engineered and deployed by RPI, BU, and NEU each achieved 100% detection during the 10 week test cycle:

Overall Results	Prob. Detection (% in-the-exit events)	Probability False Alarms (=FA*100/people exiting)	~FA/week
BU Lab	100%	0.004%	2
NEU Lab	100%	0.002%	1
RPI Lab	100%	0.002%	1
Overall	100%	0.003%	1.33

## Future Work

- The current In-The-Exit system will be duplicated and transported to other exit lanes at Cleveland for testing.
- Tag-And-Track: a suspicious individual tagged and tracked through multiple cameras the airport.
- The prototypes will be licensed to commercialization partners.

## Testbed Equipment

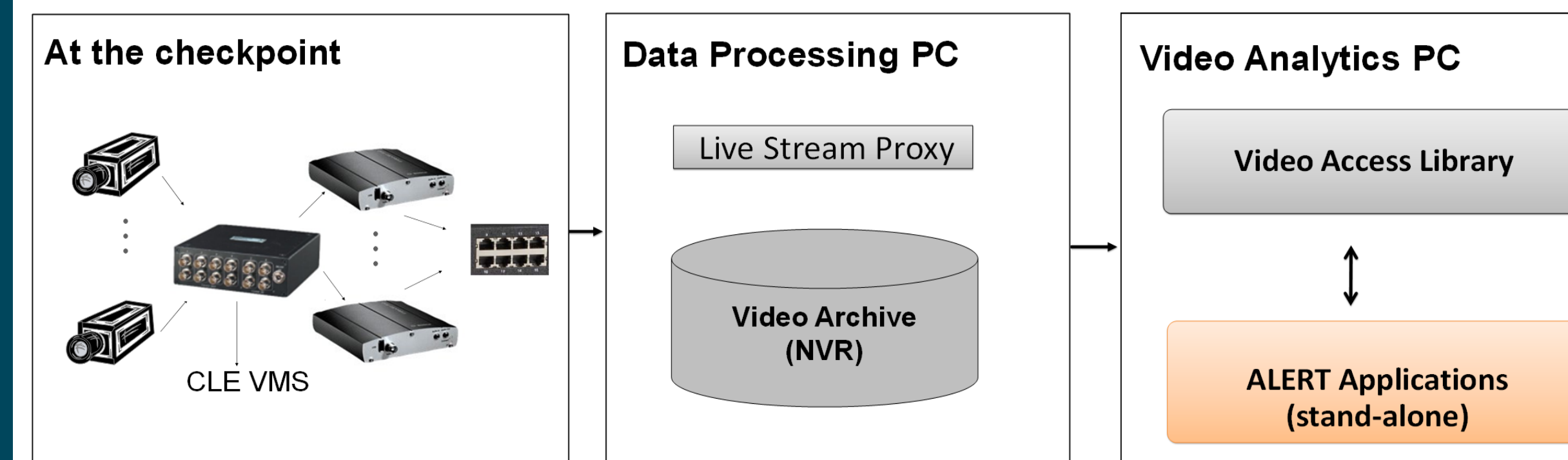


Figure 1: Diagram of current video analytics testbed in Cleveland

## Exit Lane Configuration

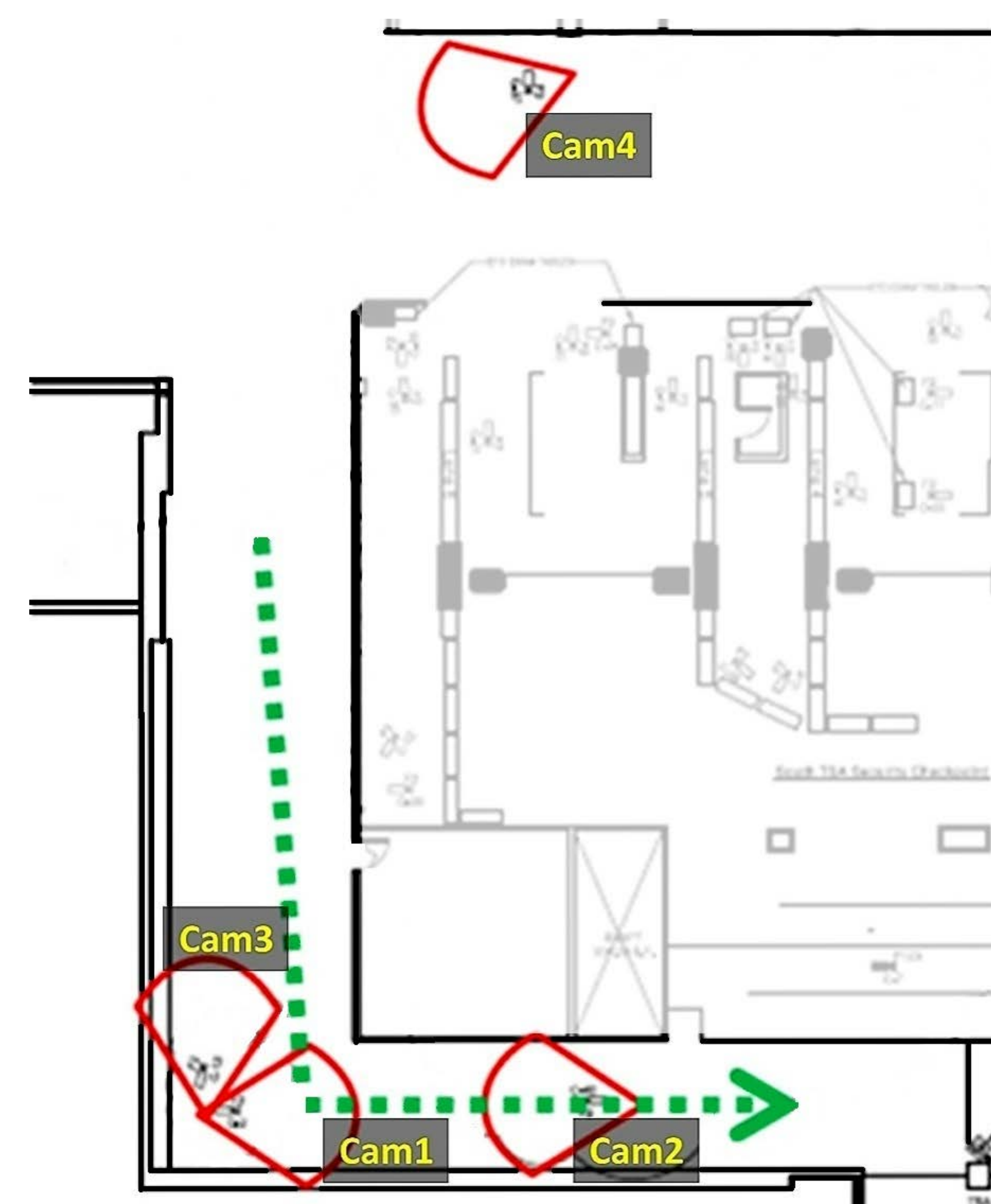


Figure 2: Plan view of exit with cameras (red) and exit lane (green) and corresponding camera fields of view

## Video Analytics



Figure 3: Decision algorithm steps for processing video

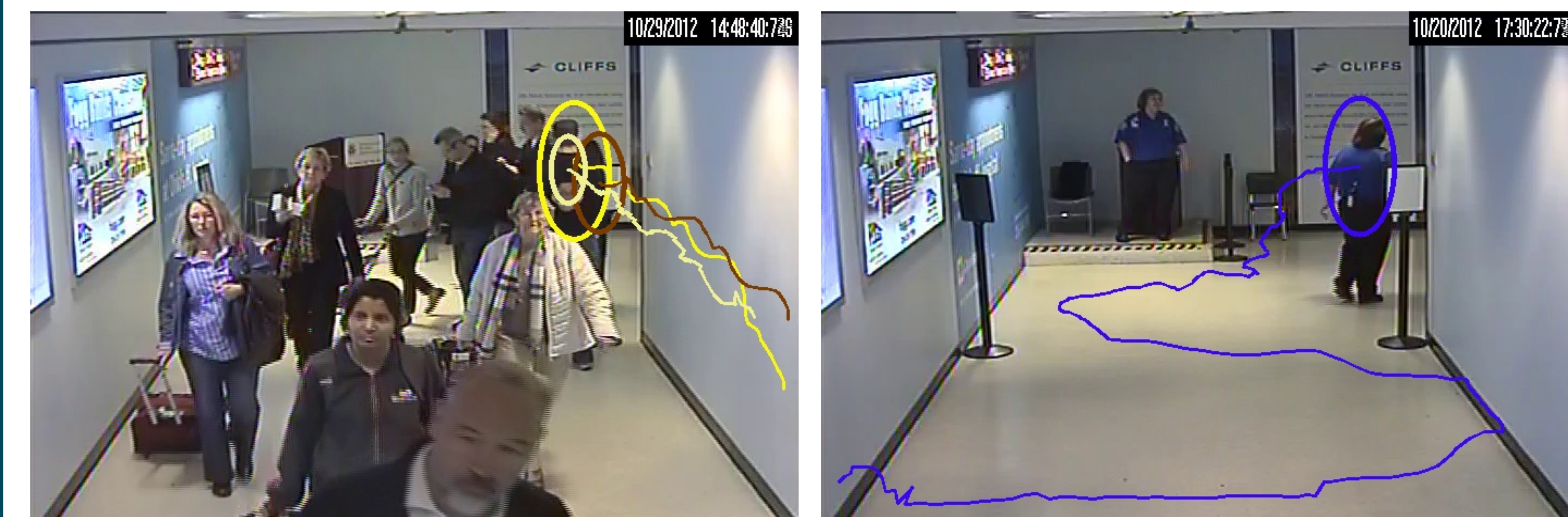


Figure 4: Tracking result visualization of individuals in the counterflow direction in the exit lane



Figure 5: Tracking result visualization of incorrectly classifying counterflow due to irregular movement

## Novel Development Approach

- Accelerating multi-object tracking with the use of graphics processing units (GPU) for above real-time video processing (average: 175 frames/second).
- Five sensitivity thresholds help rapidly find optimal settings for a given exit lane.
- Alerter Box delivers counterflow alarms to TSA officer monitoring the exit in real-time.

## Publications

J. Pearson, M. Young, E. Hertelendy, J. Beaty, "University/Industrial Collaboration to Develop a Real-World Testbed for Airport Video Security Technology at a Major Airport.", UIDP Case Studies. [http://sites.nationalacademies.org/PGA/uidp/PGA\\_072996](http://sites.nationalacademies.org/PGA/uidp/PGA_072996)

## Team

- TSA: Commissioner Fred Szabo; Federal Security Director Michael Young; Edward Hertelendy
- ALERT (NEU): Deanna Beirne, Can Yegen, Alyssa White, Rachel Shaffer
- ALERT (RPI): Rich Radke; Ziyang Wu; Austin Li
- ALERT (BU): Venkatesh Saligrama; Mohammad Elgharib; Yuting Chen
- Siemens: Scott Keneman; Jeffrey Johnson; Vivek Singh, Nazif Tas