

# Full Scale Airport Security Checkpoint Surveillance using a Camera Network

Srikrishna Karanam, Ziyang Wu and Rich Radke

Dept. of Electrical, Computer, and Systems Engineering, Rensselaer Polytechnic Institute, Troy NY



**Rensselaer**

This material is based upon work supported by the U.S. Department of Homeland Security under Award Number 2008-ST-061-ED0001. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied of the U.S. Department of Homeland Security.



**ALERT**  
AWARENESS AND LOCALIZATION  
OF EXPLOSIVE-RELATED THREATS

# Problem

- Real-time analysis of throughput at checkpoints is critical, e.g.:
  - How much did a change in protocol/queue design improve speed?
  - How many bags/bins for the average passenger?
  - Where did a lost/stolen bag event originate?
- We developed a computer vision system that automatically tracks passengers and bags



Photo: [oddharmonic/Flickr](#)



**Rensselaer**



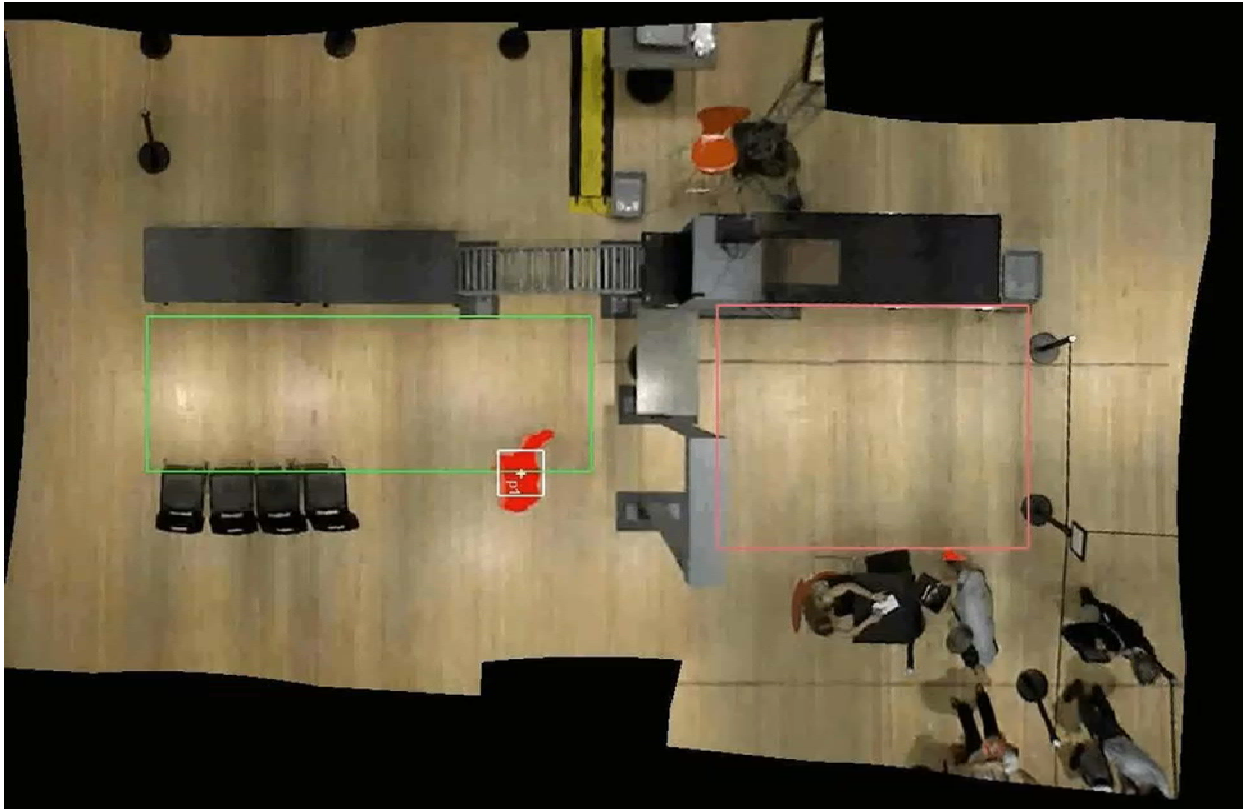
# Simulation environment



Rensselaer



# Results from our system



Video available from: <https://www.youtube.com/watch?v=BpxGXTcayBs>

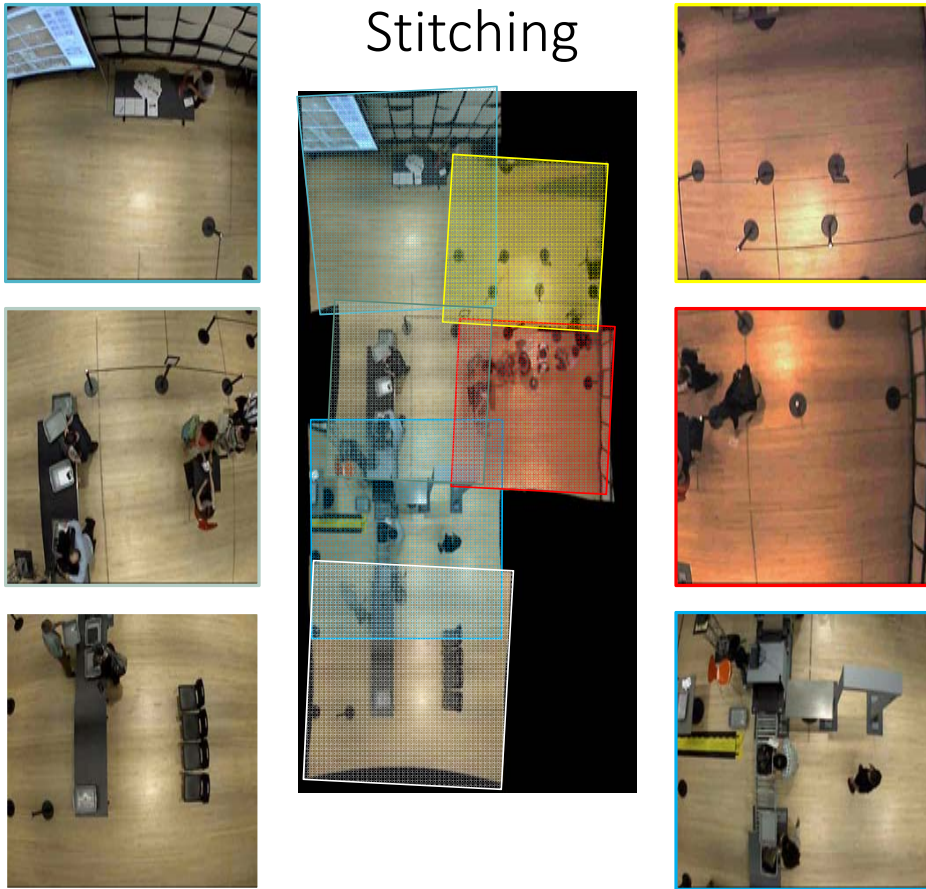


**Rensselaer**

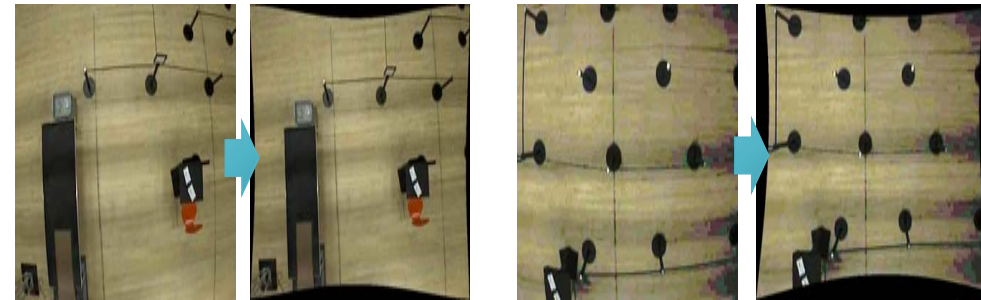


# Calibration, undistortion, color correction

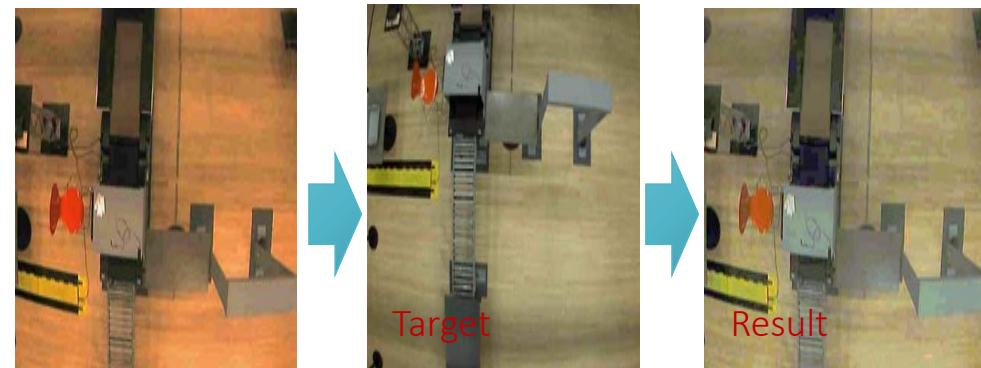
Stitching



Undistortion



Color Correction

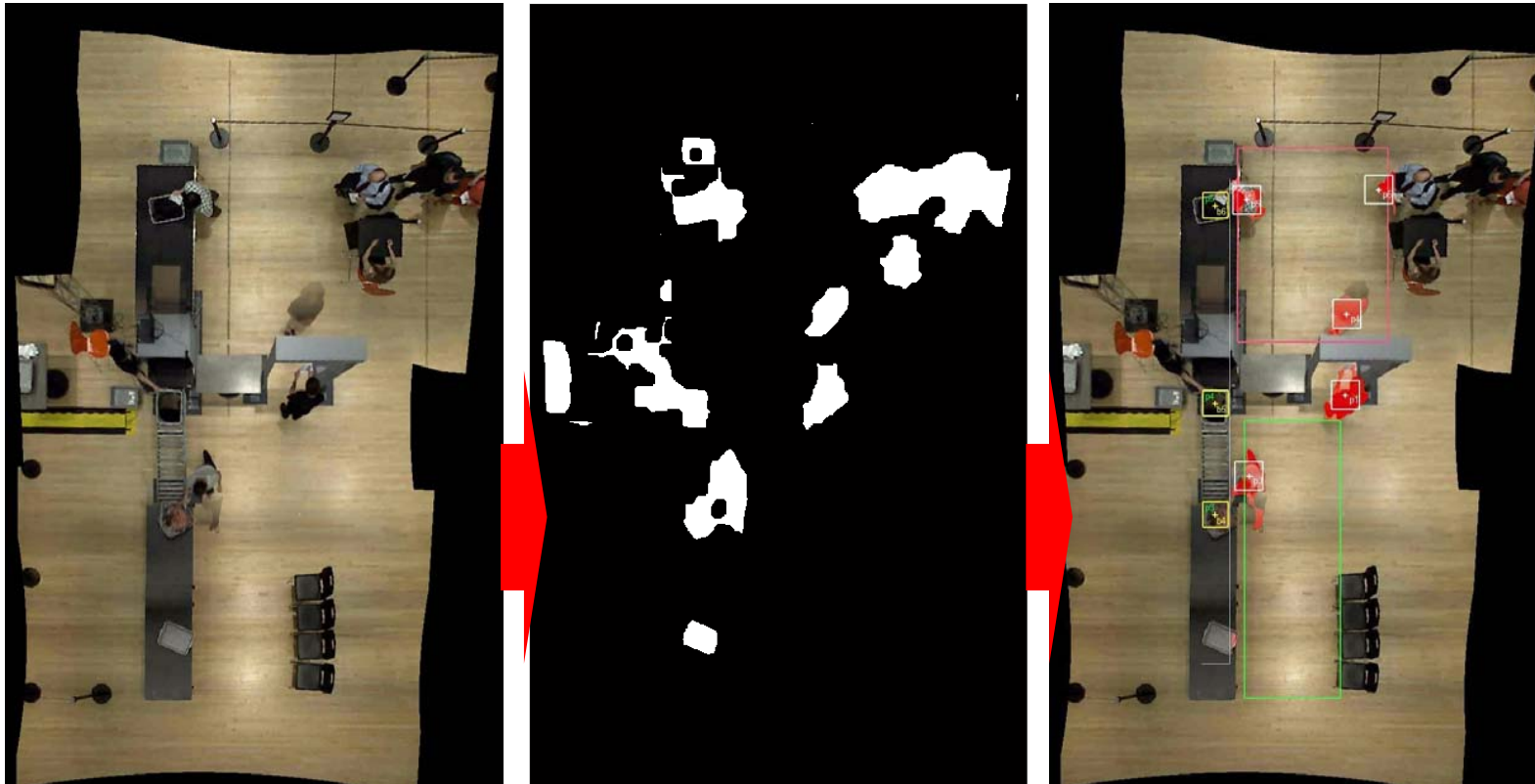


Rensselaer



**ALERT**  
AWARENESS AND LOCALIZATION  
OF EXPLOSIVES-RELATED THREATS

# Foreground detection



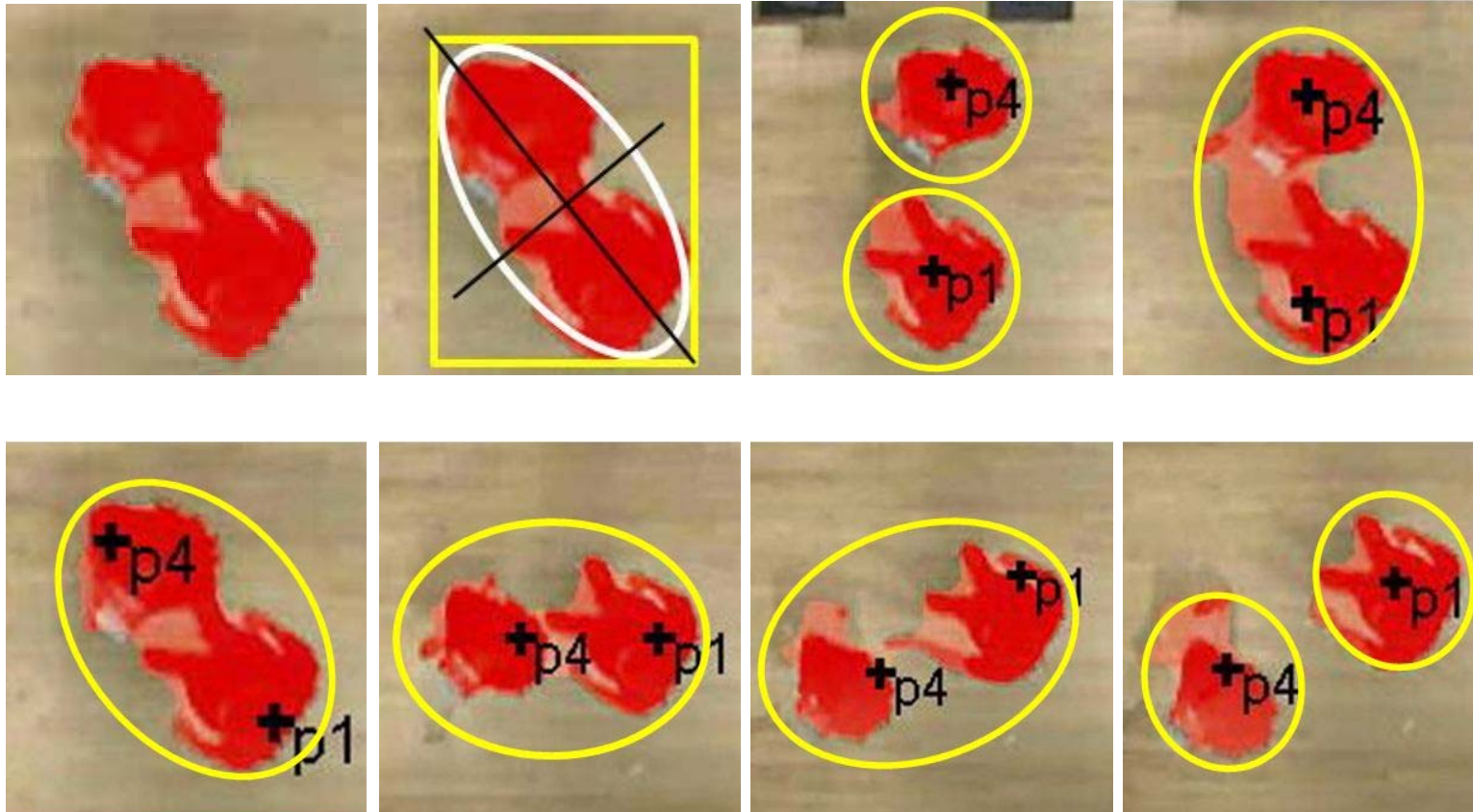
- Segment foreground to detect people
- Classify blobs into passengers and bags



Rensselaer



# Passenger tracking



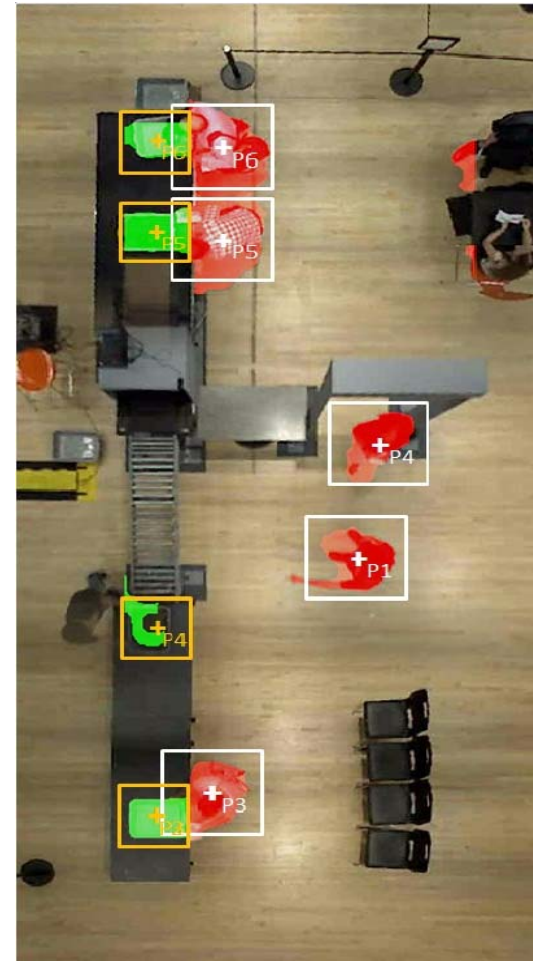
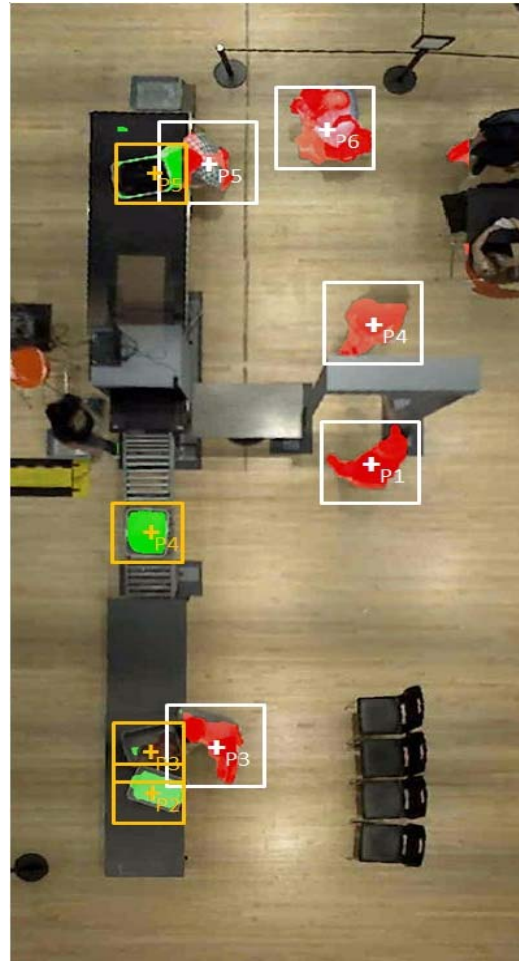
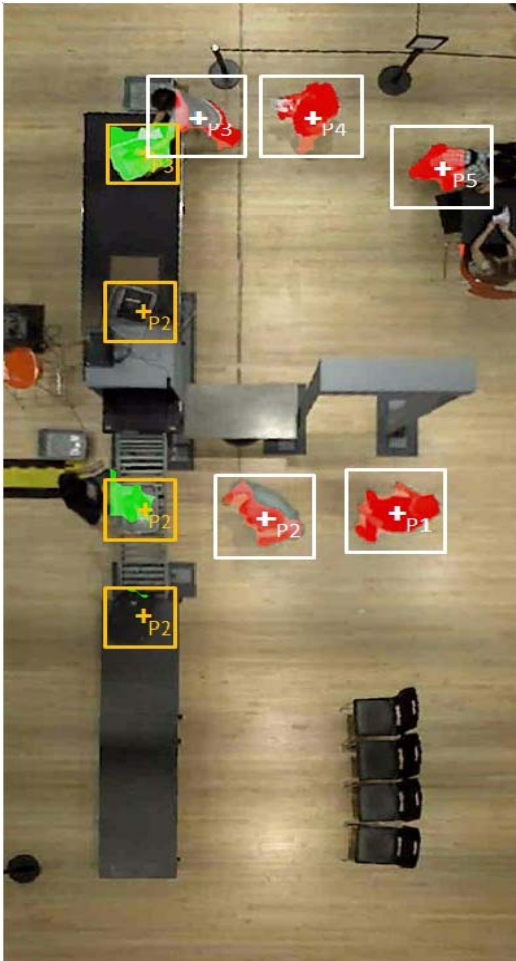
- Deal with passenger merging and splitting events



Rensselaer



# Baggage association



Rensselaer



**ALERT**  
AWARENESS AND LOCALIZATION  
OF EXPLOSIVES-RELATED THREATS



# Performance statistics

4 runs of simulation, 25 minutes

	Ground Truth	Detected	False Alarm
Passengers	47	47	0
Bags	71	67	3
Normal	69	64	0
Wrong	2	2	1



Rensselaer



# Next steps and limitations

- Partner with a real airport to design camera network and apply real-time, robust computer vision algorithms
- Extend to data aggregation and flow analysis
- Incorporate post-checkpoint analysis, e.g., “tag and track”
- Critical issues: camera height, angle, placement; lighting variations; crowd density; groups of people



Rensselaer



Thanks!



Rensselaer



**ALERT**  
AWARENESS AND LOCALIZATION  
OF EXPLOSIVES-RELATED THREATS