Awareness and Localization of
Explosives-Related Threats (ALERT)
A Department of Homeland Security Center of Excellence

Video Analytics For Seaport Applications

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ALERT
AWARENESS AND LOCALIZATION
OF EXPLOSIVES-RELATED THREATS

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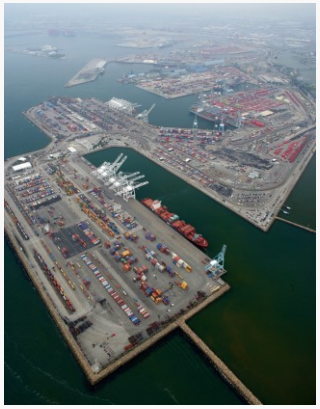
Why is this Important?

- Customs and Border Protection operations at LA/LB are extensive



- Hundreds of cameras of opportunity can provide video to CBP headquarters, and additional cameras can be added
  - Monitor areas of interest, support ongoing targeting operations, …
- Video surveillance for detection of interesting events is manpower intensive and difficult (boring?)
  - Potential benefits for automation, alerting operators when needed

Background

- This work is part of a task order sponsored by DHS S&T
  - Dr.. David Taylor and Dr. Laura Parker
- Focus: Explore opportunities for video analytics as part of a Command Center
  - Collaboration with CBP at LA/Long Beach
- Goals of task
  - Identify opportunities for video analytics
  - Determine required resources (computation, communications, manpower)
  - Focus on COTS software easily deployed with small customization

Cameras at LA/LB

- Majority of available cameras are deployed and managed by Ports of Los Angeles and Long Beach
  - Videos processed and stored at Port facilities
  - Access to video feeds and camera controls provided to CBP command center
- This created limits in accessing sample videos of interest for release in University settings
  - Needed for training, testing
- Pursued alternative approach: use public camera sources from other ports, plus local cameras monitoring Charles River boat, vehicle and pedestrian traffic

Development Approach: Exploit COTS AI Software with Small Customization

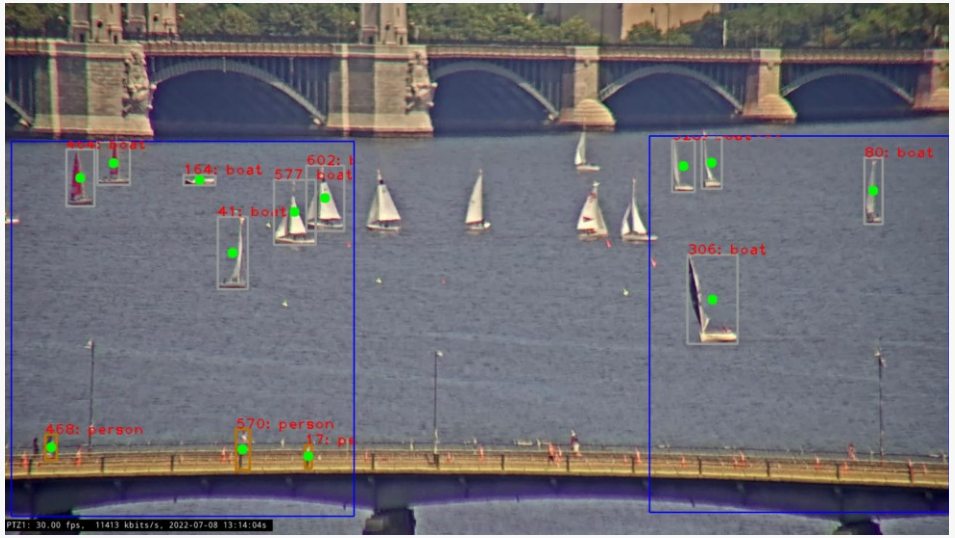
- Deep networks trained to recognize people, boats, cars, other objects of interest
- Tools to implement rapid real-time solutions on different platforms
  - NVIDIA's Metropolis framework, TensorRT, other NVIDIA frameworks
  - Can choose to implement video analytics at the edge (by cameras) or at command center
- We avoided development of specialized algorithms for activity recognition and detection of unusual actions
  - Requires significant amounts of task-specific training data not readily available
  - Requires problem specific definition of activities of interest

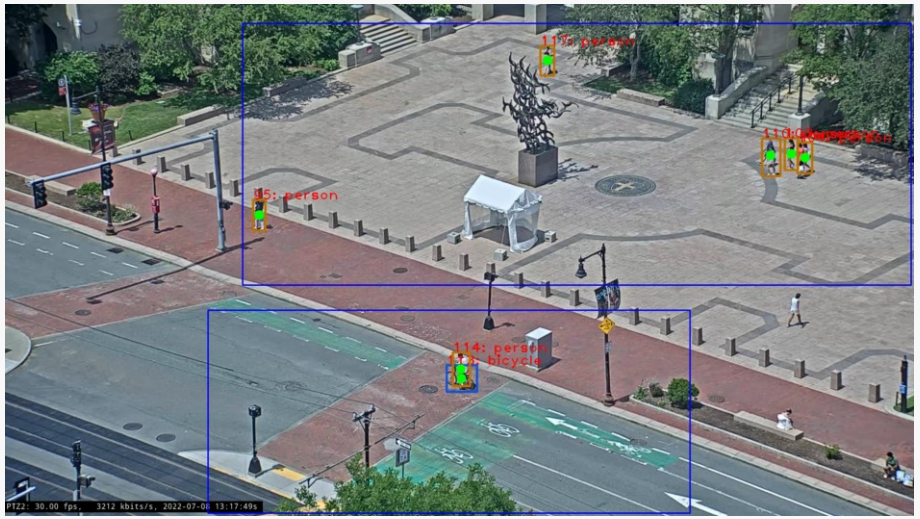
Sample Results

- Marina monitoring for new boat moorings, passenger traffic
  - Distance: 1/3 mile; using pre-trained network for all object types for detection/tracking
  - Speed 60 frames/sec; easy real-time implementation

Sample Results - 2

- Monitoring of river basin, bridge traffic
  - Distance: 2 miles, full zoom
  - Watercraft, people, cars, other vehicles
- Detection of crowds in restricted areas
  - Detect, track, and count to determine size
  - Detect loitering if desired
  - Run time 60 frames/sec

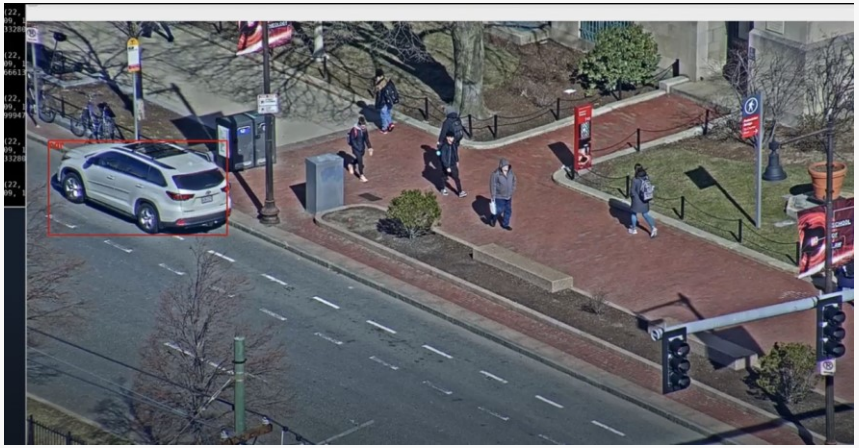




What is missing? Added logic to detect events of interest

Watercraft entering restricted area

Illegal parked vehicle



Basic detection and tracking of vehicles done with COTS algorithms.

Need definition of anomalies of interest relevant to CBP cameras to develop specific anomaly detection

Summary

- Existing COTS AI algorithms can be readily extended with minor modifications to detect and track objects of interest in Seaport scenarios
- These algorithms can be extended to develop video analytics that alert on important events
  - Detection of unusual activities, identification of suspicious vehicles/boats, …
- Such video analytics algorithms have the potential to provide valuable at the command center
  - Needs careful integration with minimal disruption of current operations – can have large comms and computation reqs.
- Items of concern: Scalability to hundreds of cameras
  - COTS algorithms can run 2-4 cameras in GPU
  - May need lightweight algorithms, specialized computing