Pacific Northwest
NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

Visual Analytics Dataset Generation

MARCIA KIMURA
REBECCA ERIKSON
NICK LOMBARDO

Pacific Northwest National Laboratory

Improving Biometric and Forensic Technology: The Future of Research Datasets

U.S. DEPARTMENT OF ENERGY

Toyota Center in Kennewick, WA

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

Multipurpose venue serving as a test-bed for wide range of security technologies

- Live testing and collection with crowds
- GIS calibrated coordinates down to 3 inches for hundreds of locations

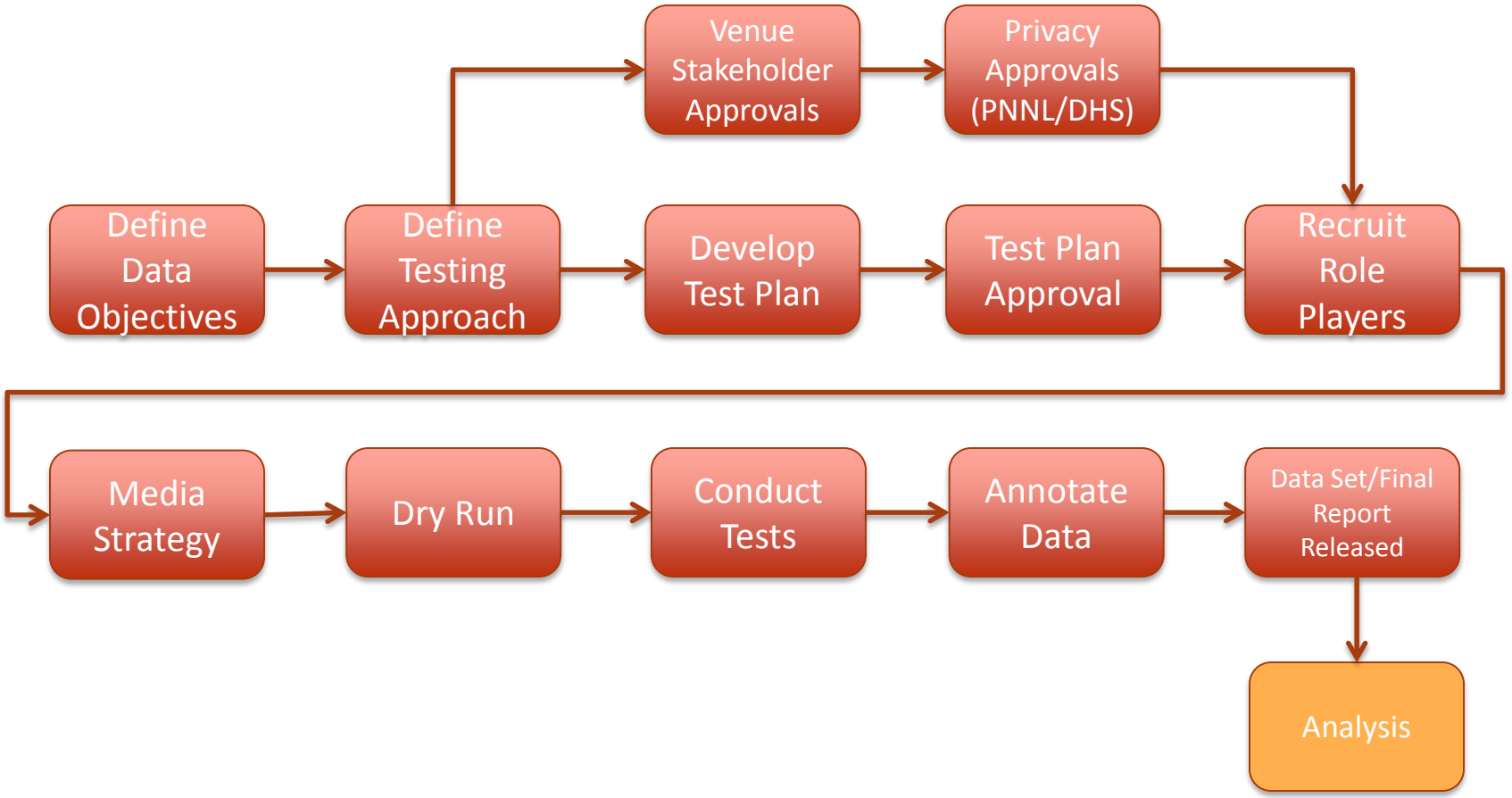
Datasets from this location:

Human Tracking at a Distance

Facial Recognition in Live Crowds

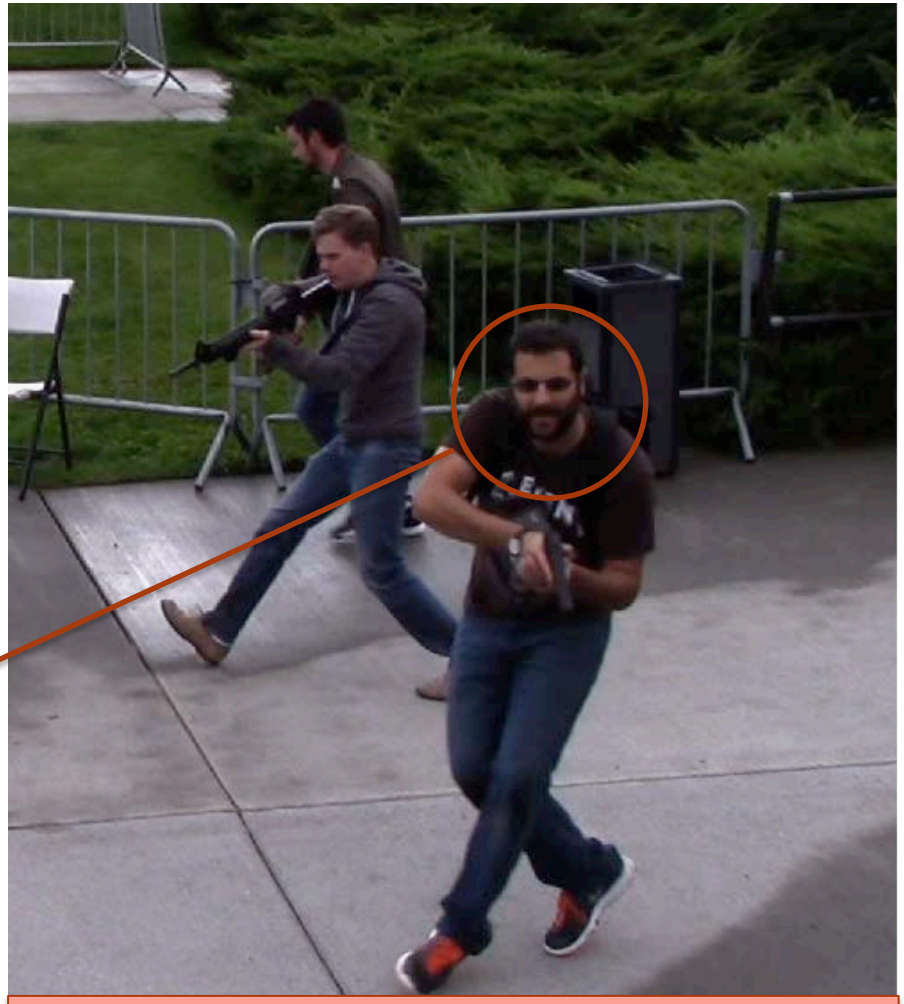
Building Threat Scenarios

Dataset Collection Overview



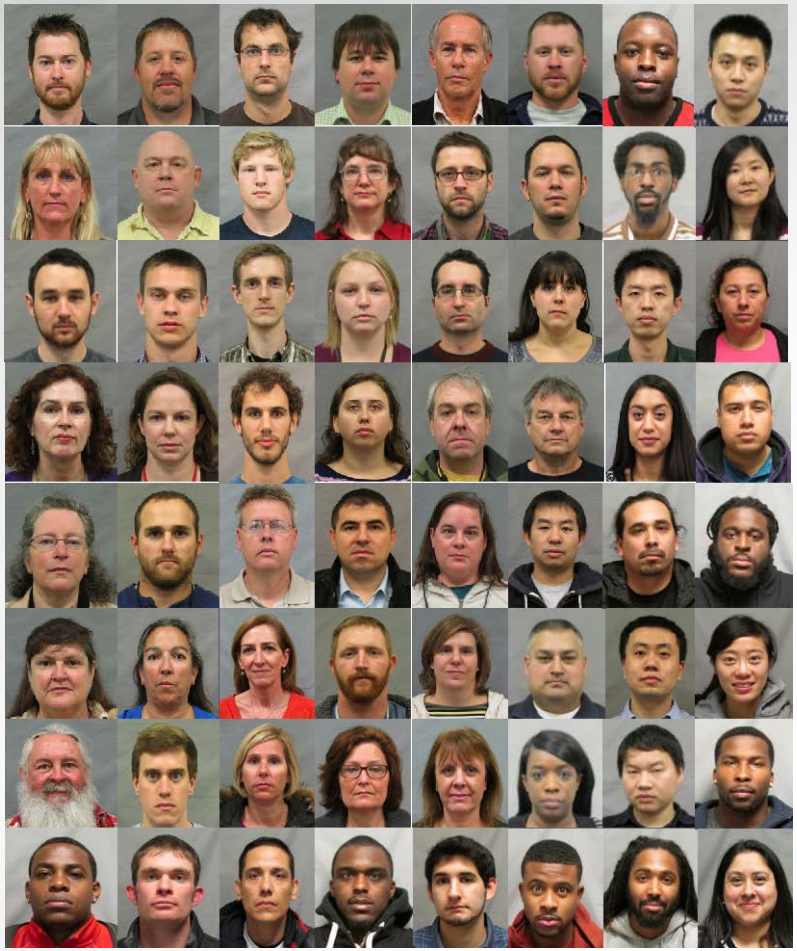
Simple Ideas for making a dataset useful for multiple purposes

- Multiple cameras
  - Vary camera heights
  - Vary FOV
- Collect extra data
  - Background/empty video
  - Mugshots at multiple angles
  - Collect candid images
  - Annotate extra information as time allows



Building Threat Scenario Data Collection

Data Collection Summary



Facial Recognition Video Dataset

"Non-Cooperative"

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

- Operationally realistic corpus of video data to support the evaluation and enhancement of facial recognition systems technology
- PNNL role players with public crowds in 5 indoor live events
  - 1) one-way crowd flow
  - 2) two-way crowd flow
  - 3) linear and serpentine queues
- 147 hours of video data
  - 11 cameras – consumer grade with SD memory
  - Pixels on target
  - Varied pitch and yaw
  - 24 fps at 1920 x 1080
  - H.264 .mp4
- Collected 2153 still photographs for "Watch List" of the 64 unique role players

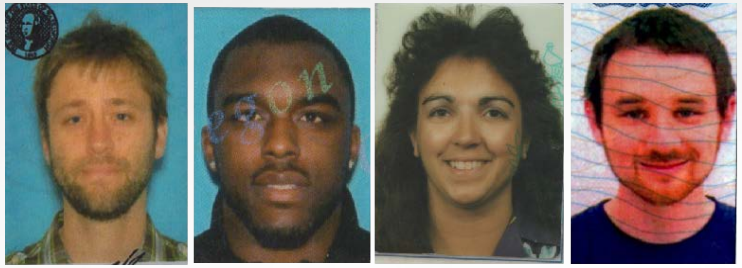
Watchlist Composition

"Non-Cooperative"

Pacific Northwest
NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

16MP mugshots at 14 angles, repeated with eyeglasses if available

600 ppi scans ID images



Low resolution "port of entry" for 2 angles

976 images of 64 individuals spanning up to 20 years

FR Video Dataset Cameras

"Non-Cooperative"

Pacific Northwest
NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

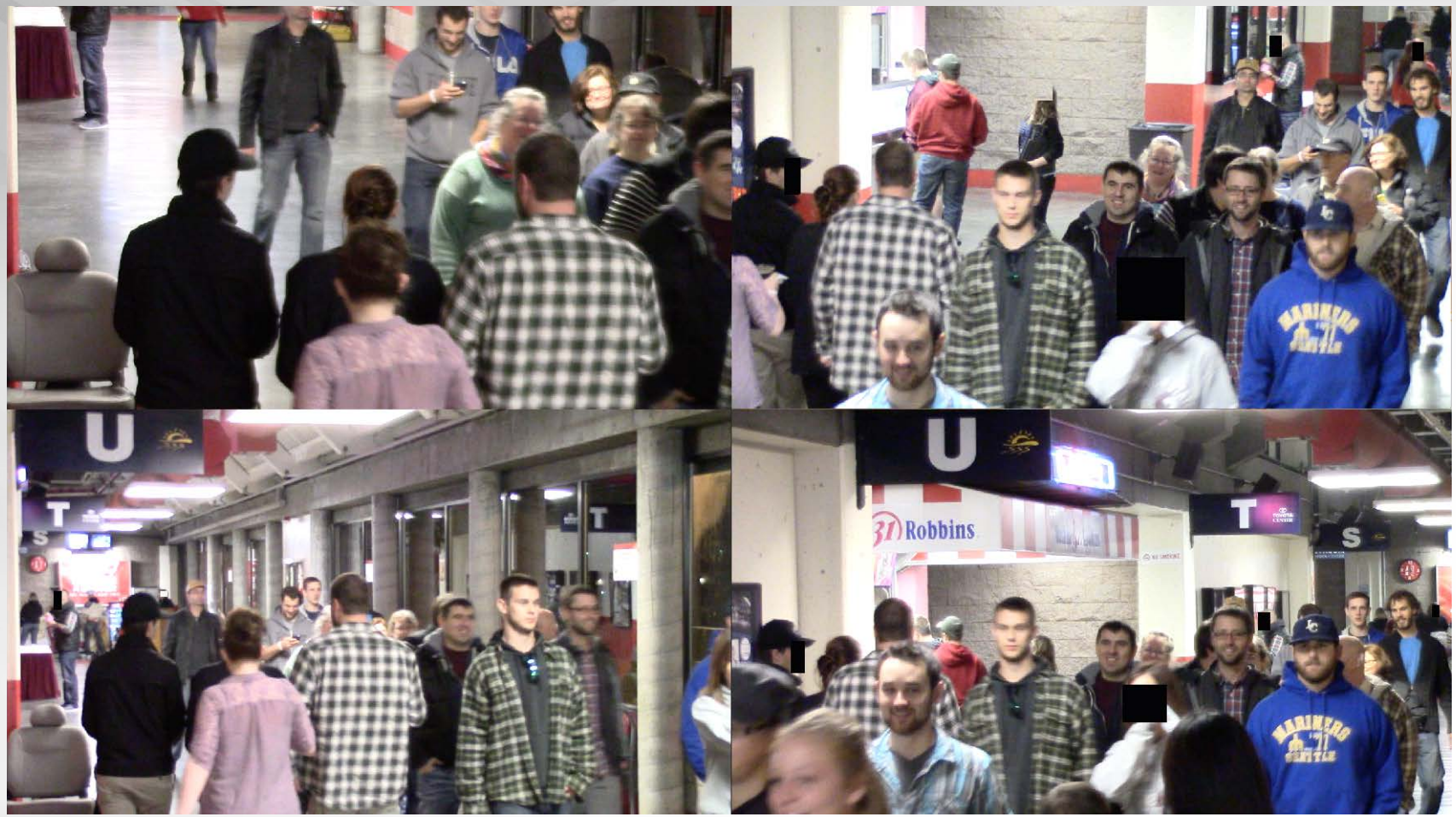
Queue Cameras

FR Video Dataset Cameras

"Non-Cooperative"

Pacific Northwest NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

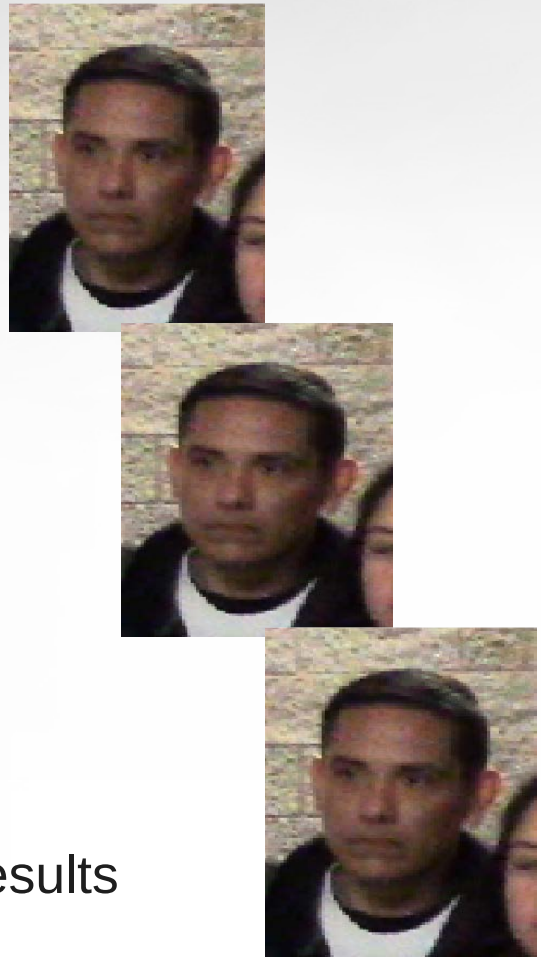


Hall Cameras

FR Video Dataset Annotation

"Non-Cooperative"

- 14,401 annotated presentations
- Ground truth annotation includes:
  - Role player alias
  - FOV entry/exit times of each role player
  - Qualitative assessment of
    - Face detection viability of presentation
    - Reason if low viability (occlusion, angle, etc.)
    - Duration of each best face presentation
    - Number of role players in FOV
    - Crowd density
- Detailed report of video collection activities and results



3 separate presentations.

Building Threat Video Dataset

"Resilient Buildings"

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

- Video analytics systems and human operator evaluation for enhanced building security during observable threat events
- Up to 12 role players in
  - Event scenarios that include
    - Active shooter (single and multiple weapons and persons)
    - Unauthorized entry
    - Unauthorized parking
    - Leave-behind packages
  - Continuous video of background that contains no events
  - Sparse video that contains occasional events
- Variations in crowd density, dynamics, and clothing contrast
- Variations in lighting conditions
- 250 video clips (1-5 minutes each); >150 hours of raw video
- 8 cameras at various distances, elevations, and FOV, with some overlapping FOV
- Data could be used for FR evaluations

Building Threat Video Dataset

"Resilient Buildings"

Pacific Northwest NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

- Video clip ground truth includes:
  - Role player alias
  - Video clip event scenario details (props/posture etc. as scripted)
  - Video clip length
  - Event time
  - Number of people in clip
  - Lighting, weather, and other parameters

Standoff Tracking Video Dataset

"Microcorpus"

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

- Scripted video data to support ***vendor*** development and testing of people tracking technology
- Up to 27 role players in scenarios that include
  - 1 way, 2-way, and random crowd flow
  - Variations in crowd density, dynamics, and clothing contrast
  - Variations in lighting conditions (dawn through dusk, sunny and cloudy)
- Total of 231 video clips (1-3 minutes each); 25 hours of raw video
- Recorded outdoors at 30 fps at 1920 x 1080 H.264 .mp4
- 3 cameras each at standoff distances from elevations of ~30 feet and partially overlapping fields of view
- Video was collected in a geospatially-mapped region

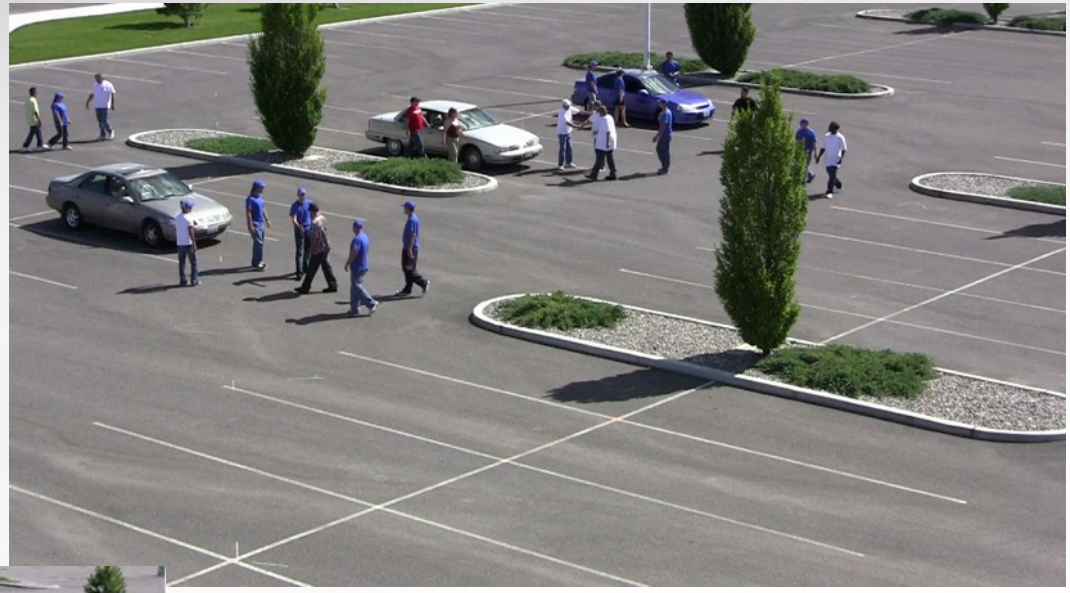
Standoff Tracking Video Dataset

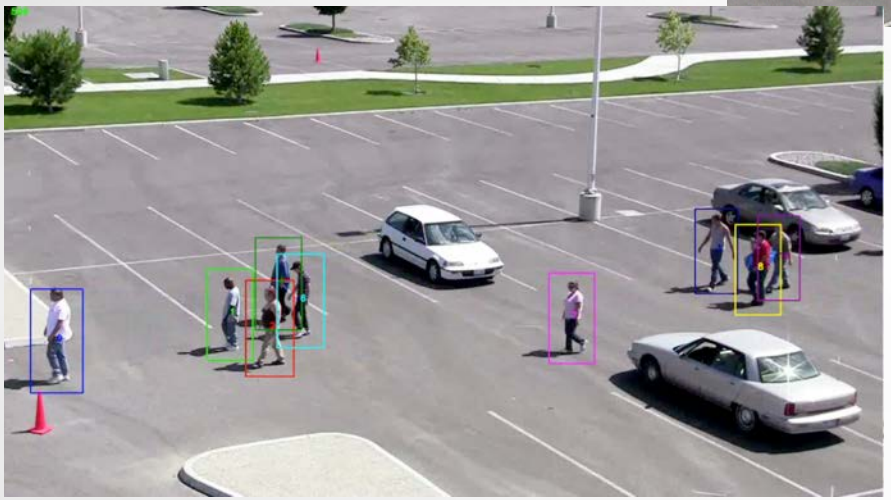
"Microcorpus"

Pacific Northwest NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965

- Video clip ground truth includes:
  - Video clip scenario
  - Video clip length
  - Number of role players
  - Light conditions
  - Contrast of attire
  - Crowd density
  - Props (bags, coolers, etc.)
  - People-to-people interactions





Extended annotation of select clips include ViPER formatted XML of individual bounding boxes that can be used in the F4DE Toolkit for performance evaluation of systems.

Summary

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

- PNNL has access to a unique venue that can accommodate a wide range of video data sets needs, including those with live crowds
- A repeatable process has been developed to enable a cost-effective collection of video data for forensic video analytic needs
- Extensive experience in the annotation of data sets ensures that data sets can be used for benchmarking AND enhancement of video analytics technologies
- Highly annotated non-cooperative, resilient building, and standoff tracking data sets are available for government partners (subject to DHS S&T PM approval)

Contact Information

Pacific Northwest
NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

PNNL Points of Contact

Nick Lombardo
PNNL Project Manager
nick.lombardo@pnnl.gov

Marcia Kimura
PNNL Project Manager
marcia.kimura@pnnl.gov

DHS Point of Contact

Patricia Wolfhope
DHS S&T Program Manager
patricia.wolfhope@dhs.gov