Visual Analytics Dataset Generation

MARCIA KIMURA
REBECCA ERIKSON
NICK LOMBARDO

Pacific Northwest National Laboratory

Improving Biometric and Forensic Technology: The Future of Research Datasets
Toyota Center in Kennewick, WA

- 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

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

- Define Data Objectives
- Define Testing Approach
- Develop Test Plan
- Test Plan Approval
- Recruit Role Players
- Venue Stakeholder Approvals
- Privacy Approvals (PNNL/DHS)
- Media Strategy
- Dry Run
- Conduct Tests
- Annotate Data
- Data Set/Final Report Released
- Analysis
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”

- 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”

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
Queue Cameras
FR Video Dataset Cameras

“Non-Cooperative”

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”

- 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”

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”

- 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”

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

- 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

**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