Using Infrared Video to Detect Humans and to Improve Nuisance Alarm Rejection

LDRD
LABORATORY DIRECTED RESEARCH & DEVELOPMENT

Sandia National Laboratories
Mark W. Koch & Robert J. Fogler, Sensor Exploitation Applications Department
Hung D. Nguyen, Exploratory Real-Time Systems

Problem & Significance

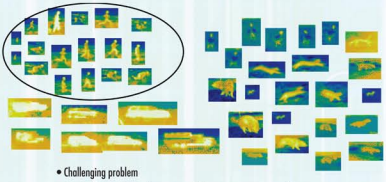
Use Unattended Sensors to Protect our Borders and Facilities

- Surveillance using an unattended sensor system
  - Virtual perimeter & extended defense (VPED)
- Reduce nuisance alarms (NAR) from wildlife, vegetation and weather
- Dramatically improve the utility of current VPED systems and technologies
  - Acoustic, seismic & magnetic, pyroelectric infrared motion sensors

Uncooled infrared video imager

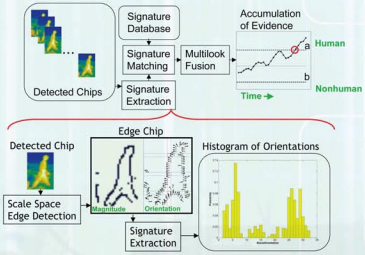
- Detect only humans
- Ignore other moving objects such as animals and vehicles
- Combine results from multiple frames

Human Classification

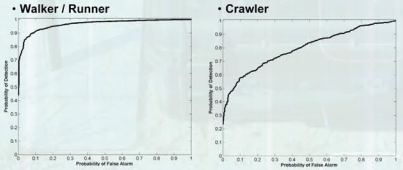


- Challenging problem
  - Humans can take on many different appearances and sizes
- Algorithm Requirements
  - Capture commonality of objects
  - Must account for the endless variability
  - System works over a large range of object scales

Approach

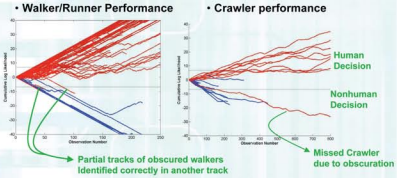


Single Look Performance Results: Receiver Operating Characteristics



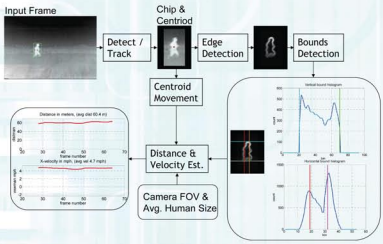
- **Confusers**
  - Vehicles
  - Animals

Multiframe Performance



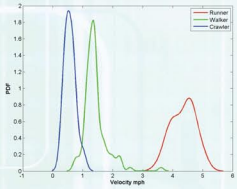
Red – Human (target)
Blue – Nonhuman (nontarget)
$\alpha=\beta=1x10^{-3}$ (tunable error rates)

Distance and Velocity Estimation Given Classification Decision



Velocity Density Functions

- **Can use velocity estimates to help verify classification hypotheses**



Conclusion

Summary

- Augment current VPED sensors with infrared video
  - Reduce NAR from animals, vegetation, and weather in unconstrained and unengineered environments
- Developed preliminary algorithms to detect, track and classify humans in infrared video
- Combined results from multiple frames to improve single look performance
- Estimated velocity & distance based on classification

Future Work

- Investigate blob & ridge features to improve crawler performance
- Combine results with other sensors
- Use algorithms to determine response to a stimulus to help determine intent

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