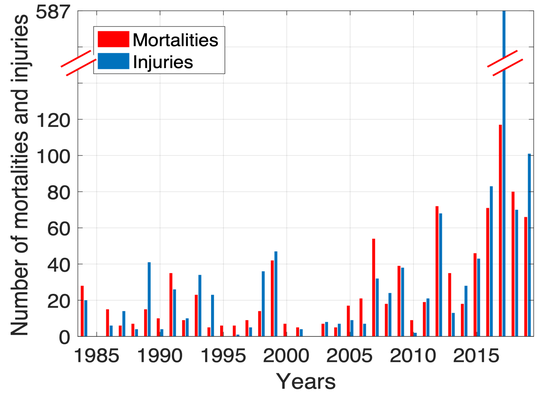
Active Shooter Tracking and Evacuation Routing for Survival (ASTERS)

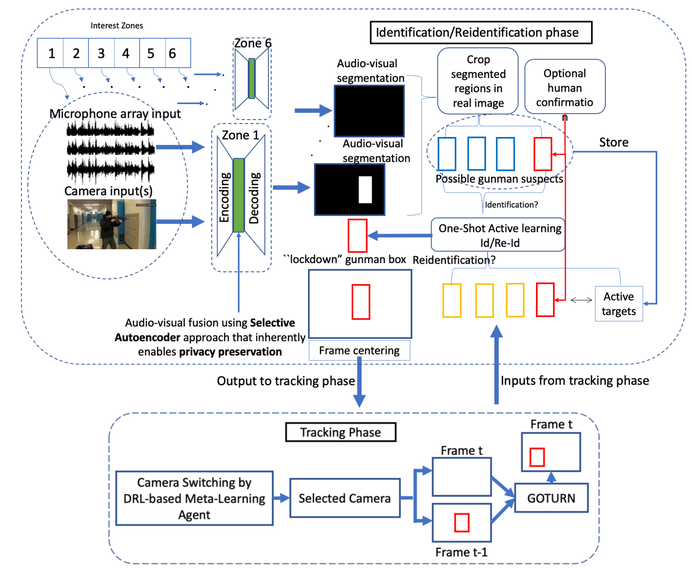
Subhadeep Chakraborty, Mech. Eng. Univ. of Tennessee
Michael Olson, Psychology, Univ. of Tennessee
Stephen Gilbert, Ind'l & Manuf'g Systems Eng., Iowa State Univ.
Joanne Marshall, Education, Iowa State Univ.
Soumik Sarkar, Computer Science, Iowa State Univ.

Mass Shootings Across the Country

- More than 110 active shooter incidents across the country since 1982
- Individuals facing active shooters are provided vague guidance like generalized directives such as the "Run-Hide-Fight" protocol
- Project will integrate sensors, communication, and control algorithms to provide lifesaving information in real time



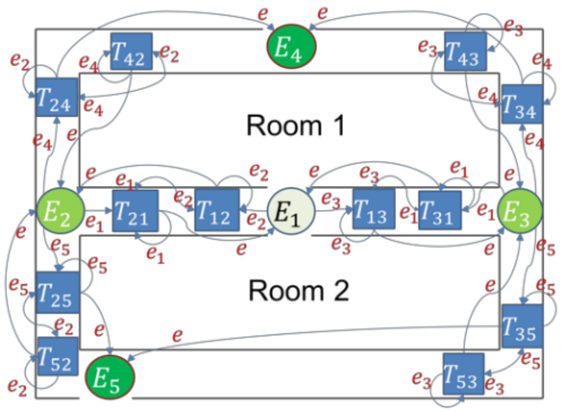
Shooter Position Estimation, Identification, and Tracking



- Multi-modal identification and tracking through non-invasive acoustic sensors and cameras
- Research focus on the challenges of developing algorithms for localization and tracking

Response Planning and Evacuation Optimization

- Dynamic response plan to guide evacuees along a set of near-term routes to destinations
- Accounts for capacity along routes and at destinations
- Maximize safety and minimize time exposed to danger for all evacuees



CPS Research Focus

- **Autonomy** – Through development of novel autonomous methods for shooter position estimation, identification, re-identification and tracking,
- **Control and Optimization** – Through solving an optimized network flow problem on a nonstationary graph with human-factor constraints
- **Human-in-the-loop** – Through inclusion of human-factors in the control problem specification, design process as well as an integrated part of the cyber-physical system.

Participatory Design of User Experience/Social Psychology

- Iterate and refine the design of a communication system to provide the optimal egress routes
- Provide optimal information to first responders on the scene
- Take into account behavioral tendencies of varying sized groups

Evaluation/Experimentation Plan

- Training of shooter tracking algorithms with experimentation for audio and video learning
- Virtual reality aided assessment of evacuation in active shooter scenarios
- Controlled experimentation in academic buildings testing communications or tracking methods.

ASTERS Broader Impacts

- Benefits of enabling "smart safety systems" will provide potentially life-saving information to vulnerable people
- Impacts students and stakeholders through education and computing outreach, a part of experimentation and evaluation of ASTERS.

2019 NSF Cyber-Physical Systems Principal Investigators' Meeting
November 21-22, 2019 | Crystal City, Virginia

Award ID#: 1932505