

# Active Shooter Tracking and Evacuation Routing for Survival (ASTERS)

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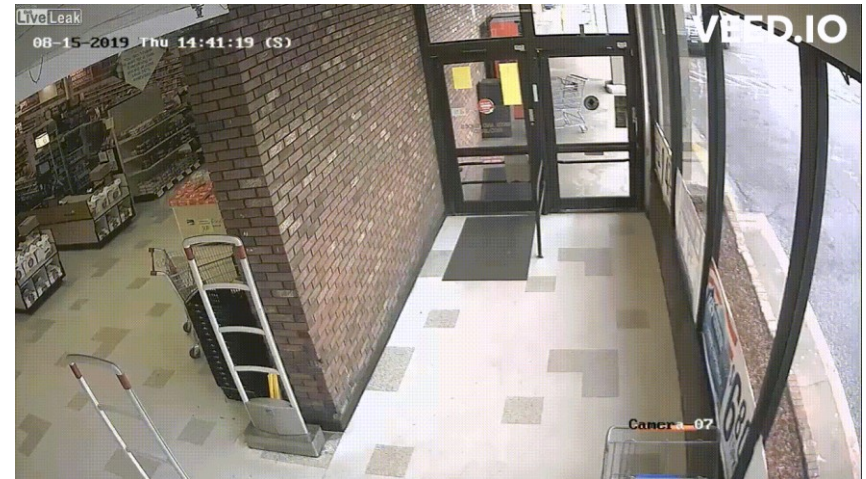
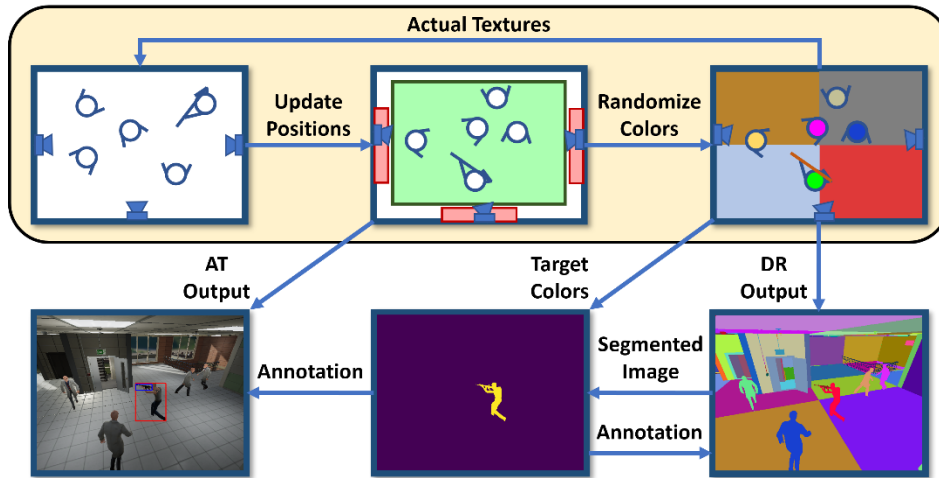
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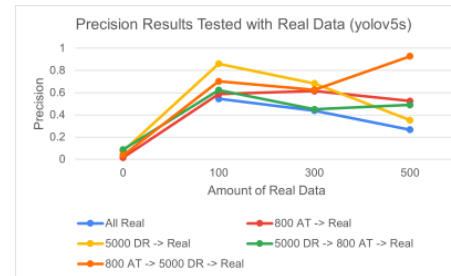
# ASTERS – Active Shooter Tracking and Evacuation Routing for Survival

- Space:
  - Response to active shooting events in schools
- Problem:
  - *Uncertain knowledge about shooter's location and lack of guidance while escaping leading to fatal outcomes*
- Solution:
  - *Computer Vision based Gunman Detection and Tracking*
  - *Optimized Routing of evacuees to evade shooter and prevent crowding*
  - *Communication to Evacuees of Plans/Status*
  - *Education and Interaction with School Officials and security experts*
- Results:
  - *Training with a combination of actual texture, domain randomized synthetic data and real data produced highest precision (0.928)*
  - *ASTERS algorithm can reduce casualties by 56% , the time spent by evacuees in the shooter's line of sight by 52% and crowding by 53.3% compared to an intuitive natural response.*
  - *Participants (n=123) escaped significantly more quickly with dynamic signs compared to static (p=0.07) and reverse crowd (p=0.04)*

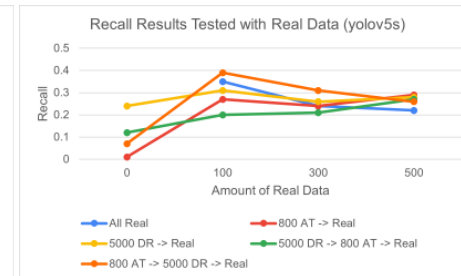
# Computer Vision based Gunman Detection



Training with a combination of synthetic data (both actual texture and domain randomized) and real data produced highest precision (0.928).

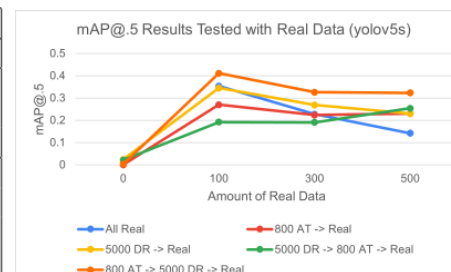


(a)

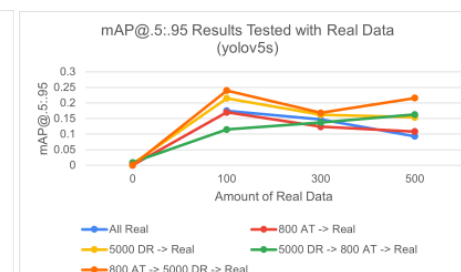


(b)

Combination	Number of images			Gunman detection			
	Real	AT	DR	P	R	mAP@.5	mAP@.5:.95
Real Only	100	-	-	0.545	0.350	0.354	0.175
	300	-	-	0.438	0.240	0.228	0.147
	500	-	-	0.266	0.220	0.142	0.093
AT→DR→Real	-	800	5000	0.036	0.070	0.004	0.001
	100	800	5000	0.702	<b>0.390</b>	<b>0.411</b>	<b>0.240</b>
	300	800	5000	0.626	0.310	0.326	0.168
	500	800	5000	<b>0.928</b>	0.259	0.323	0.216

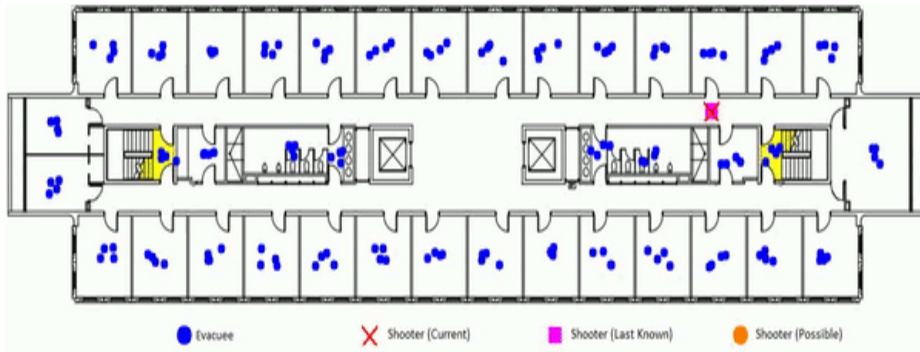


(c)

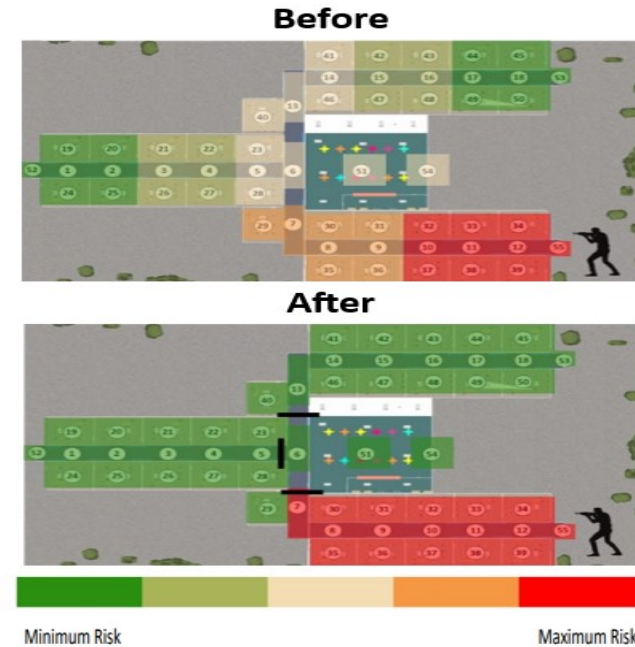
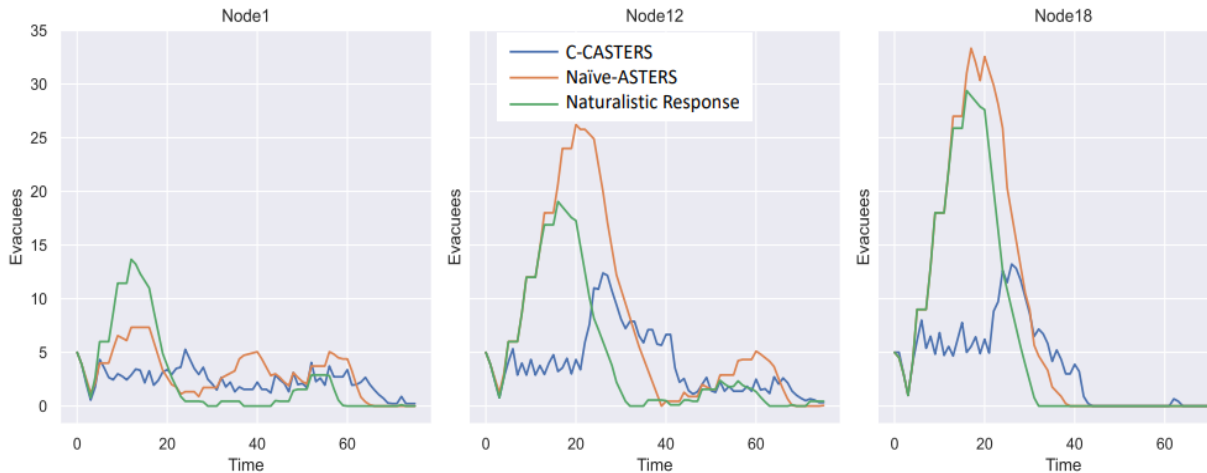
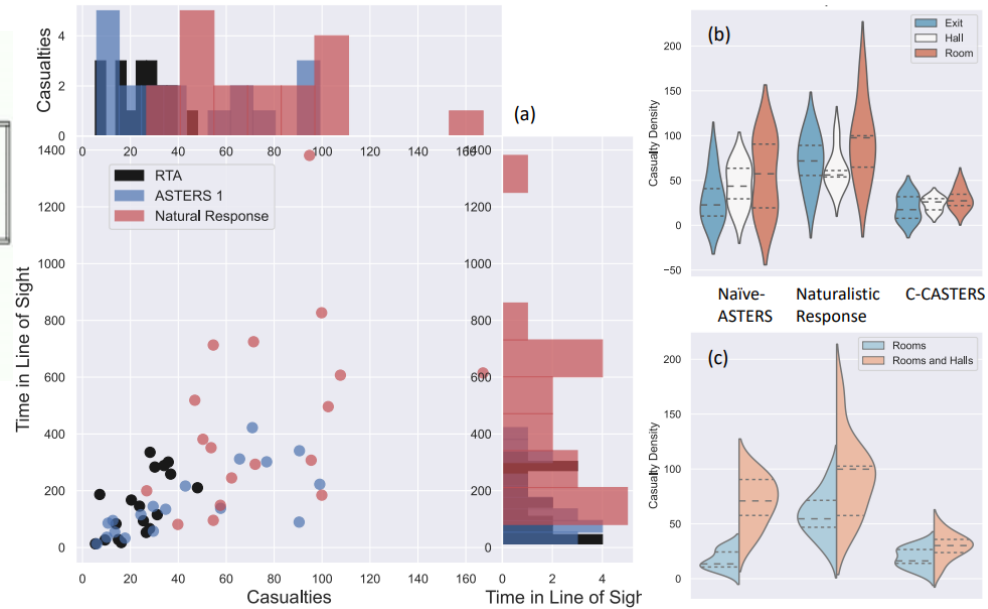


(d)

# Optimized Evacuee Routing



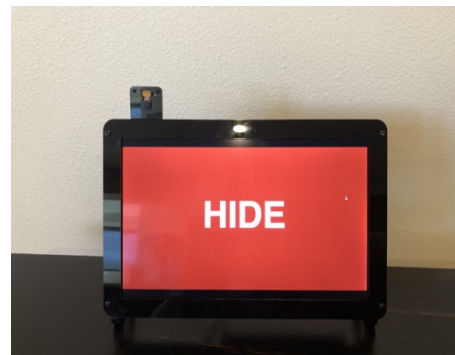
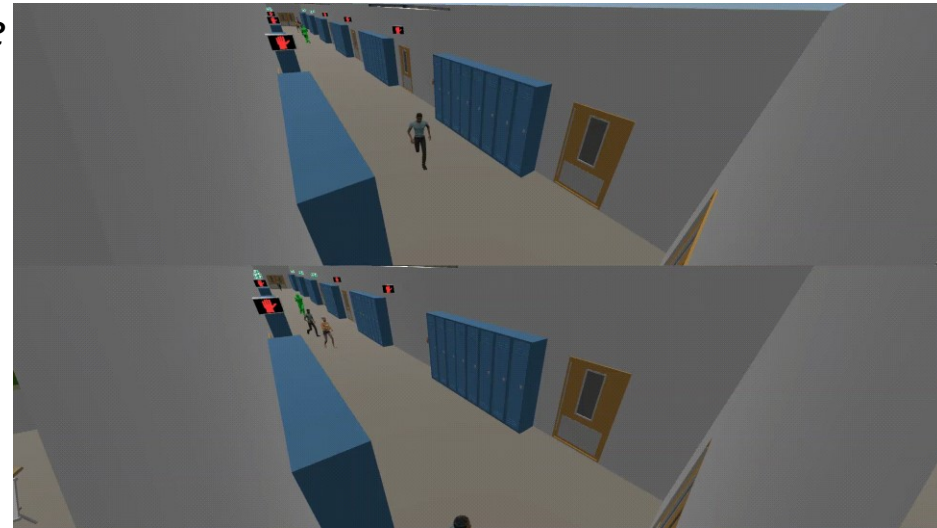
*ASTERS algorithm can reduce casualties by 56%, the time spent by evacuees in the shooter's line of sight by 52% and 53.3% reduction in crowding compared to an intuitive natural response.*



# Communication to Evacuees

*Participants (n=123) escaped significantly more quickly with dynamic signs compared to static (p=0.07) and reverse crowd (p=0.04)*

*Participants (n=123) encountered the shooter significantly more in the static signs (p=0.037) and reverse crowds (p=0.020)*



# Lessons learned

- Current practices leave a lot to be desired.
- In general, school personnel are very accepting of this idea and quick to see the value in this activity.
- Most feel more comfortable with a human-in-the-decision loop.
- Ethical dilemmas are too real for comfort.
- Funding drives most of the adoption decisions.
- But, if done right, there is immense potential for something like ASTERS to have a real impact.