

Meta-Scenario Generation

Base Scene



[Prompt]
The ego car is driving straight.

Driving Knowledge



Driving Regulations



Driving Licensing



Pre-crash Scenarios



LLM Reasoning

Safety-critical Description

The ego is driving straight when a pedestrian suddenly rushes out from a parked car by the roadside.

Scenic Executable Simulation Code

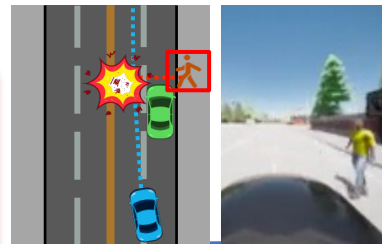
```
# Spawn the adversary  $a_{adv}(c^*, p^*, b^*)$ , where  $c^*$  is 'Pedestrian',  $p^*$  is 'right of IntPt by OPT_X_DIST',  $b^*$  is 'AdvBehavior'.
AdvAgent = Pedestrian right of IntPt by OPT_X_DIST,
with heading IntSpawnPt.heading + 90 deg,
with behavior AdvBehavior()

behavior AdvBehavior():
do CrossingBehavior(ego, OPT_V, OPT_D) until (distance from self to egoTraj) < OPT_DIST
while True:
take SetWalkingSpeedAction(0)

IntPt = OrientedPoint following roadDirection from EgoPt for OPT_Y_DIST
```

a_{adv} :

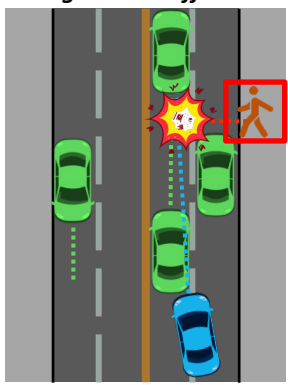
- c^* - pedestrian
- p^* - right front, behind a parked car
- b^* - rushes out and stop



Evolve

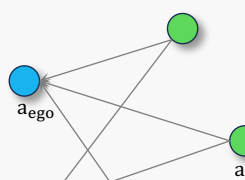
Complex Scenario Evolution

Background Traffic Flow



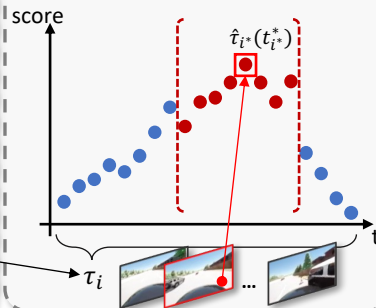
Collaborator Search

Agent Selection



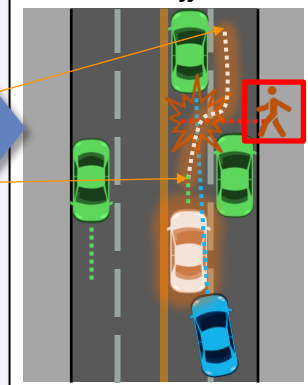
Adversarial Collaborator Graph

Trajectory Segment Selection



Black-box Optimization

Perturbed Traffic Flow



- a_{ego} (blue circle)
- a_{adv} (orange circle)
- a_i (green circle)
- a_i^* (white circle)
- τ_i (dashed line)