

Autonomous Urban Environment Navigation Using Reinforcement Learning

HERDR

Nathan Durocher

Outline

- Motivation
- Problem
- Method Pipeline
- Simulation Results
- Real-life Results
- Conclusion

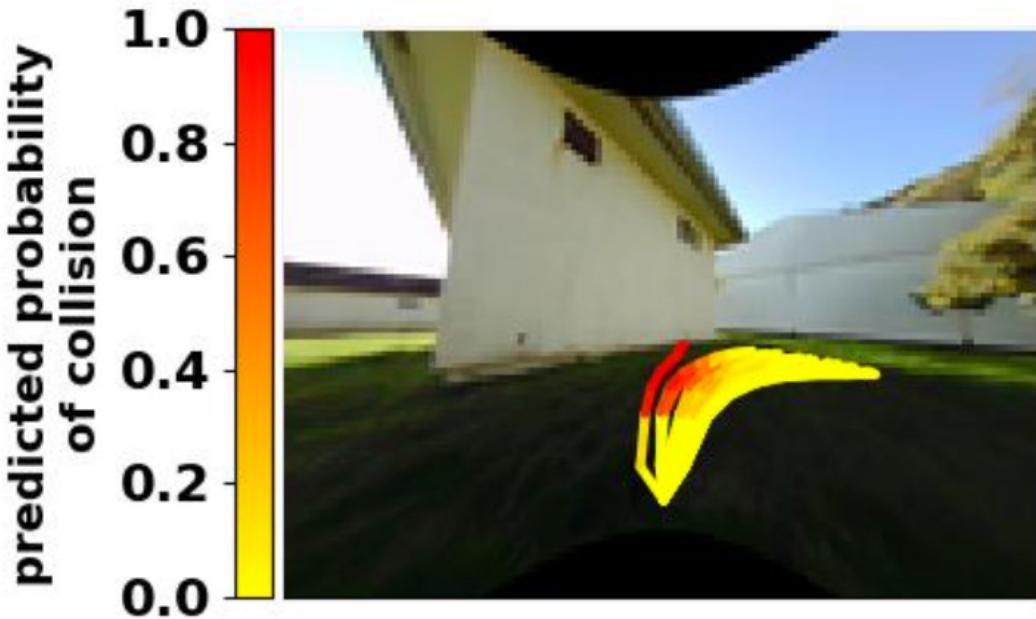


CAPRA ROBOTICS



BADGR: An Autonomous Self-Supervised Learning-Based Navigation System

Gregory Kahn, Pieter Abbeel, Sergey Levine
Berkeley AI Research (BAIR), University of California, Berkeley



LaND: Learning to Navigate from Disengagements

Gregory Kahn, Pieter Abbeel, Sergey Levine
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BADGR: An Autonomous Self-Supervised Learning-Based Navigation System, Gregory Kahn, Pieter Abbeel, Sergey Levine, <https://arxiv.org/abs/2002.05700>

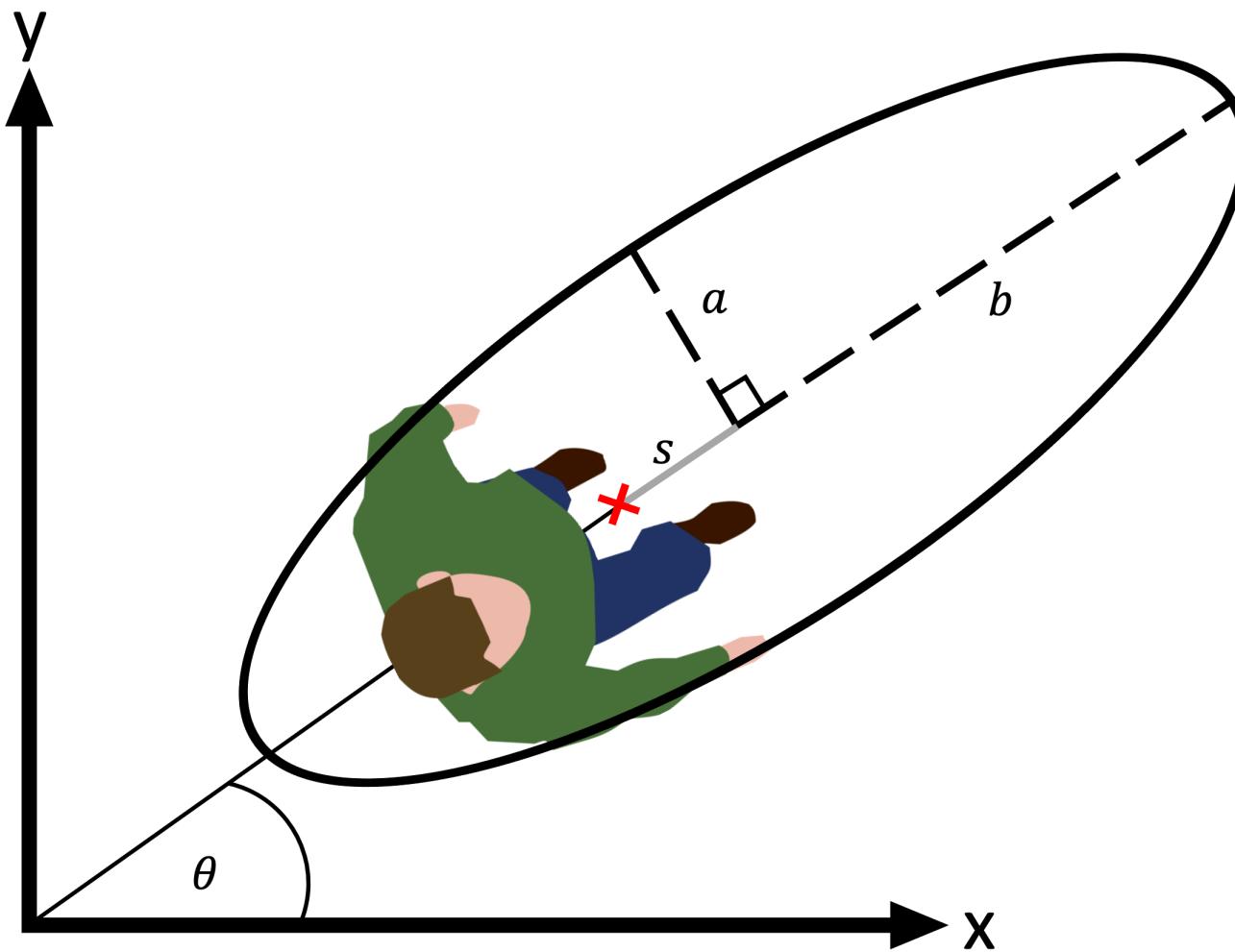
LaND: Learning to Navigate from Disengagements, Gregory Kahn, Pieter Abbeel, Sergey Levine, <https://arxiv.org/abs/2010.04689>

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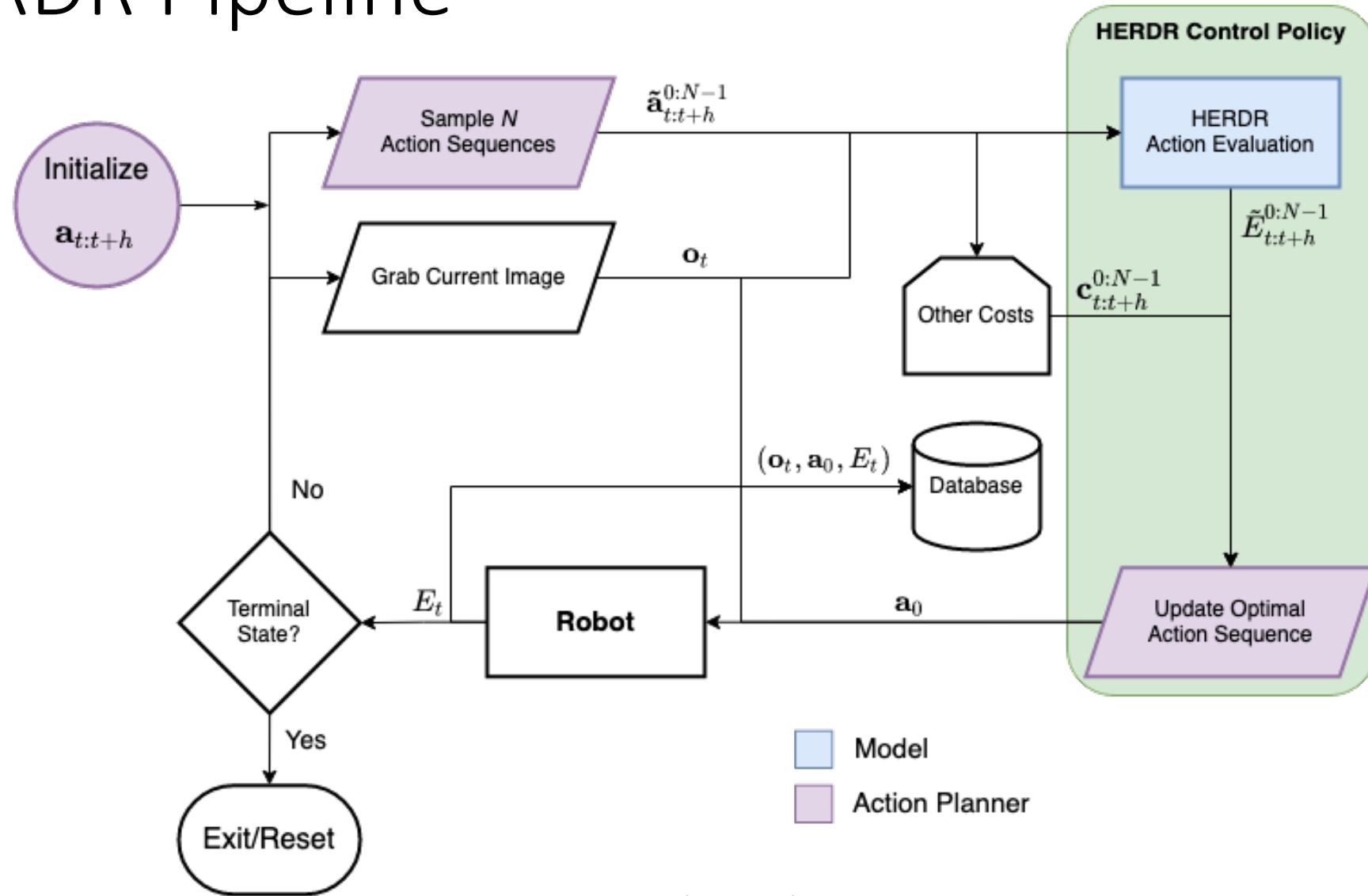
Problem Statement

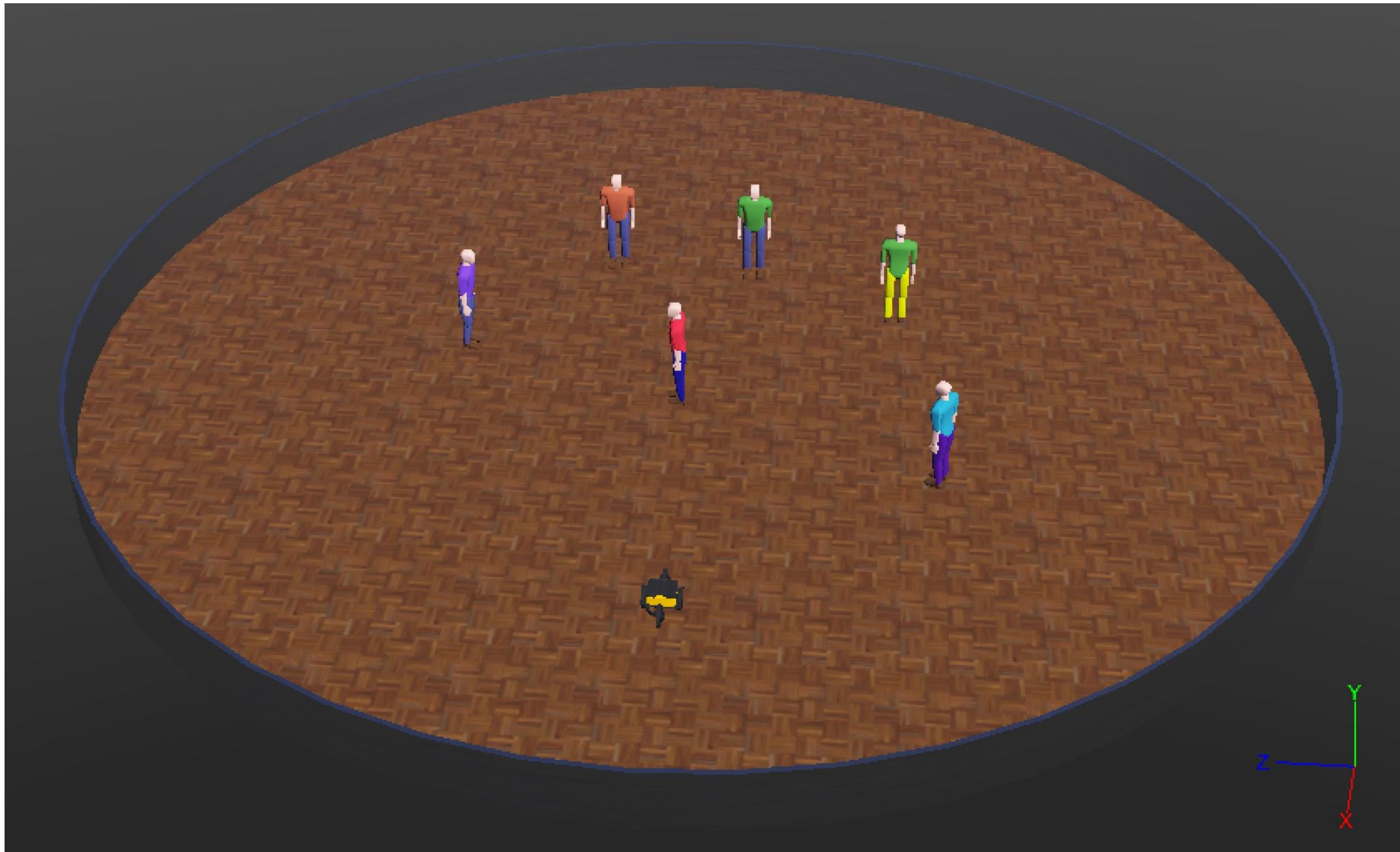
- Can the BADGR framework be extended to avoid pedestrians in socially acceptable way.

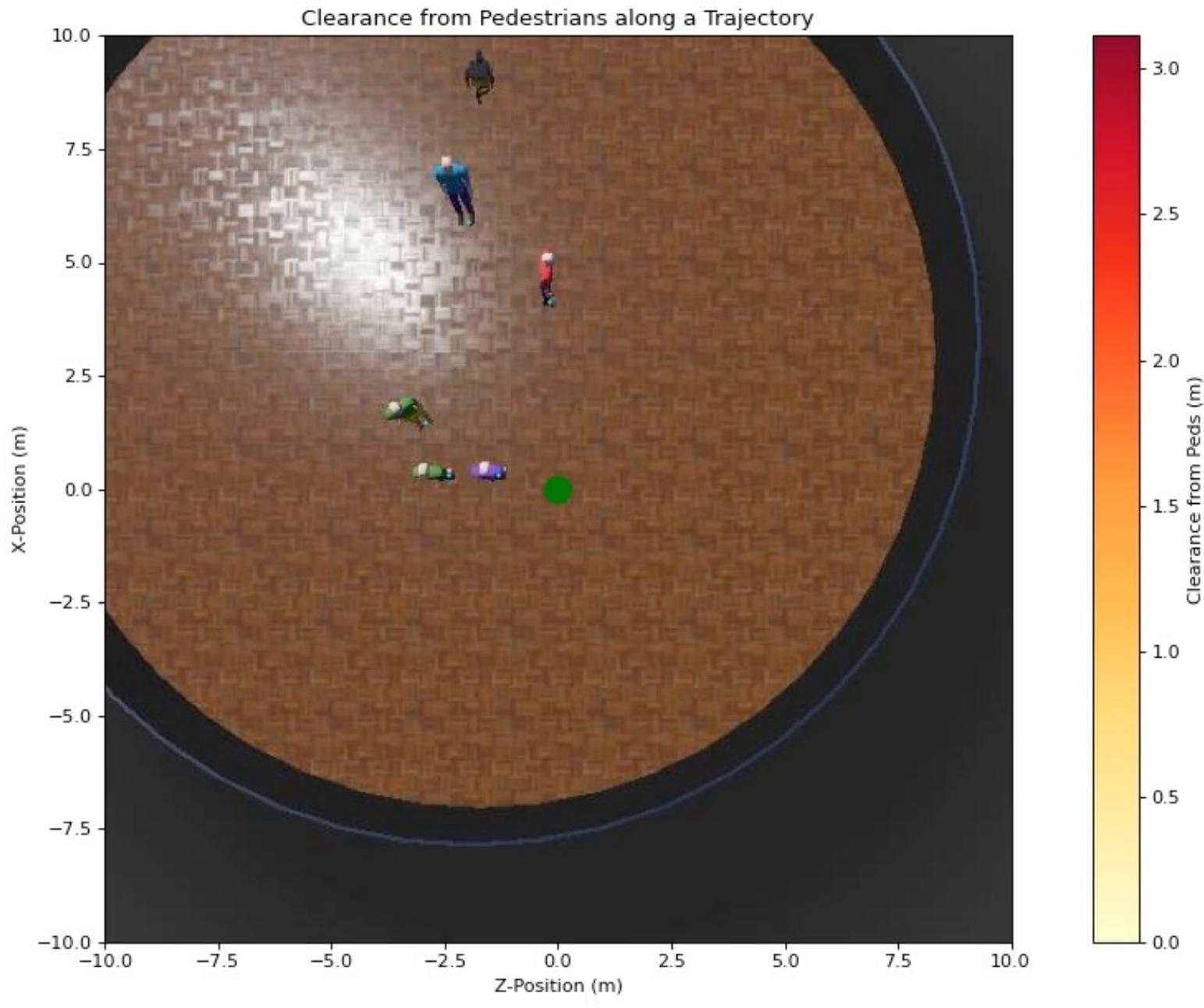
Personal Space



HERDR Pipeline

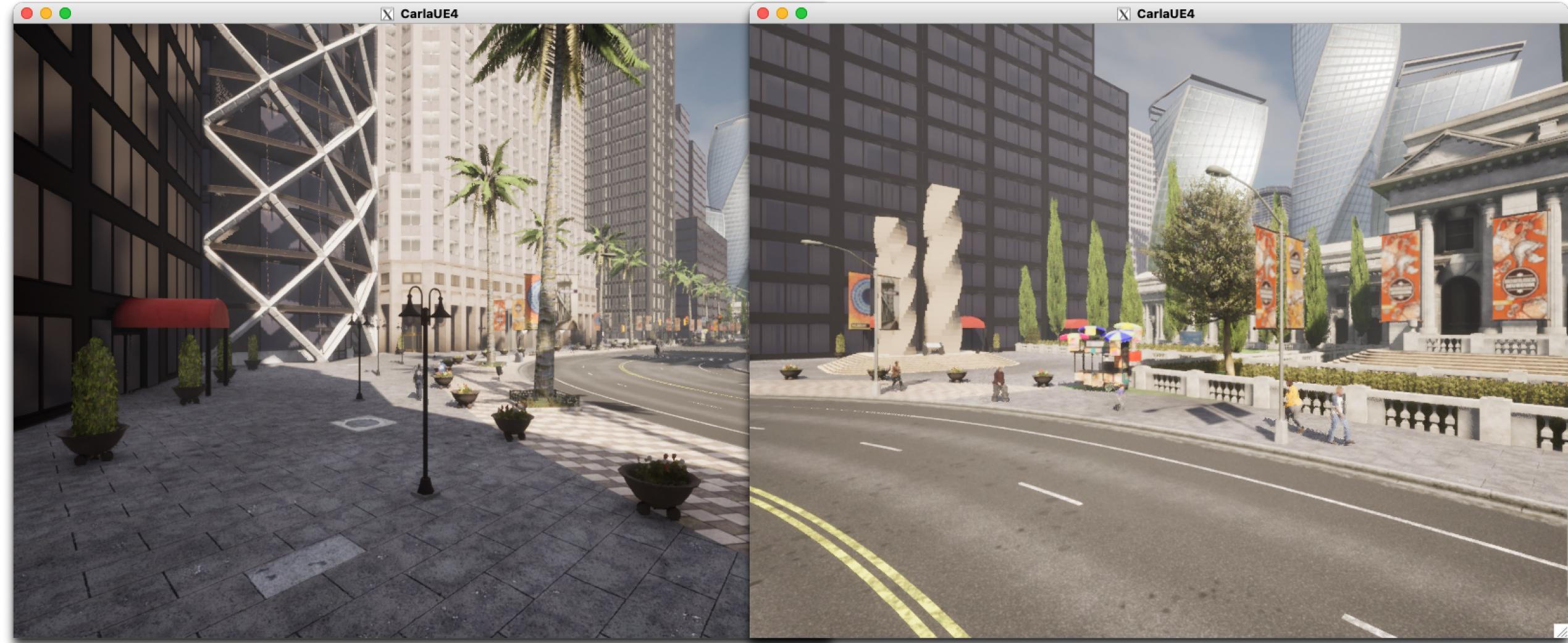




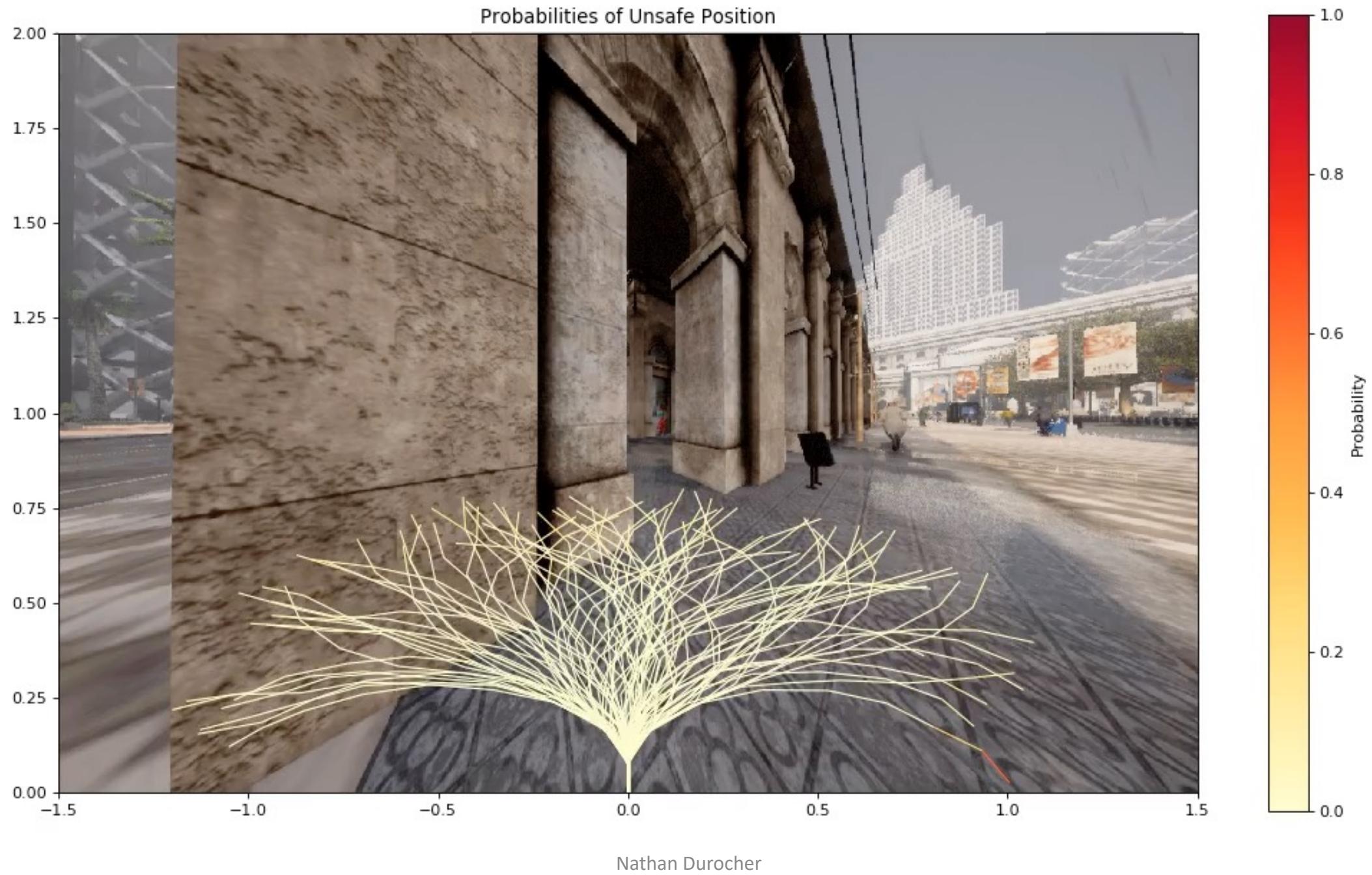


Webots Results

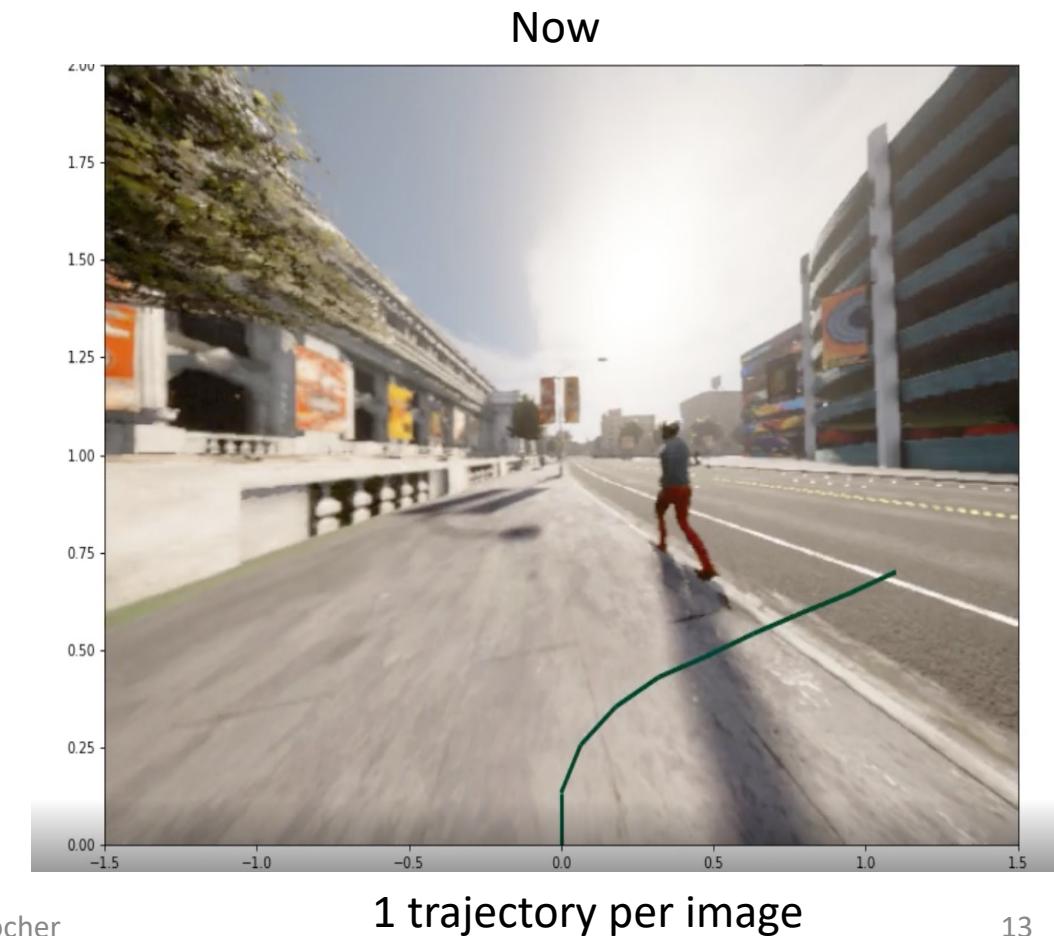
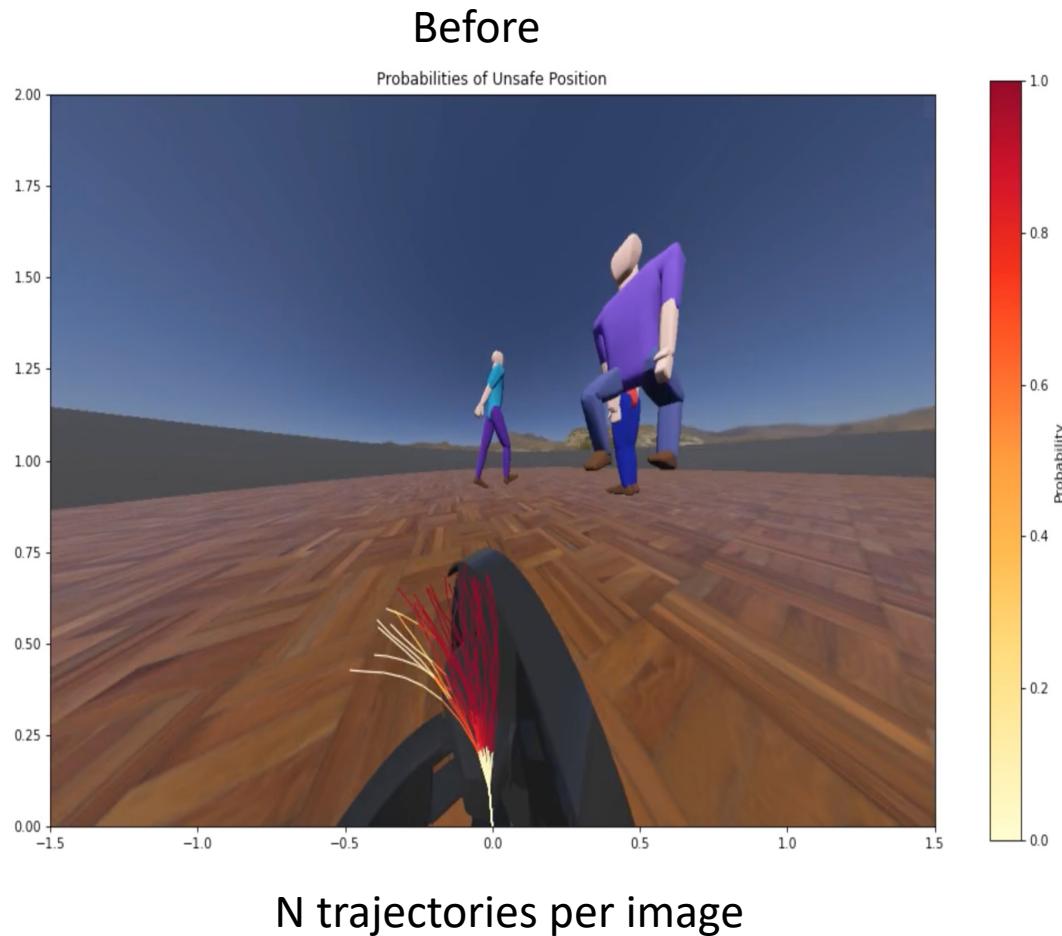
	HERDR	Untrained	ORCA
Avg. Minimum Distance to a Pedestrian (m)	2.28	1.97	1.98
Collision Rate (%)	0.47	0.77	0.53
Time in Personal Space (ms)	227	265	312



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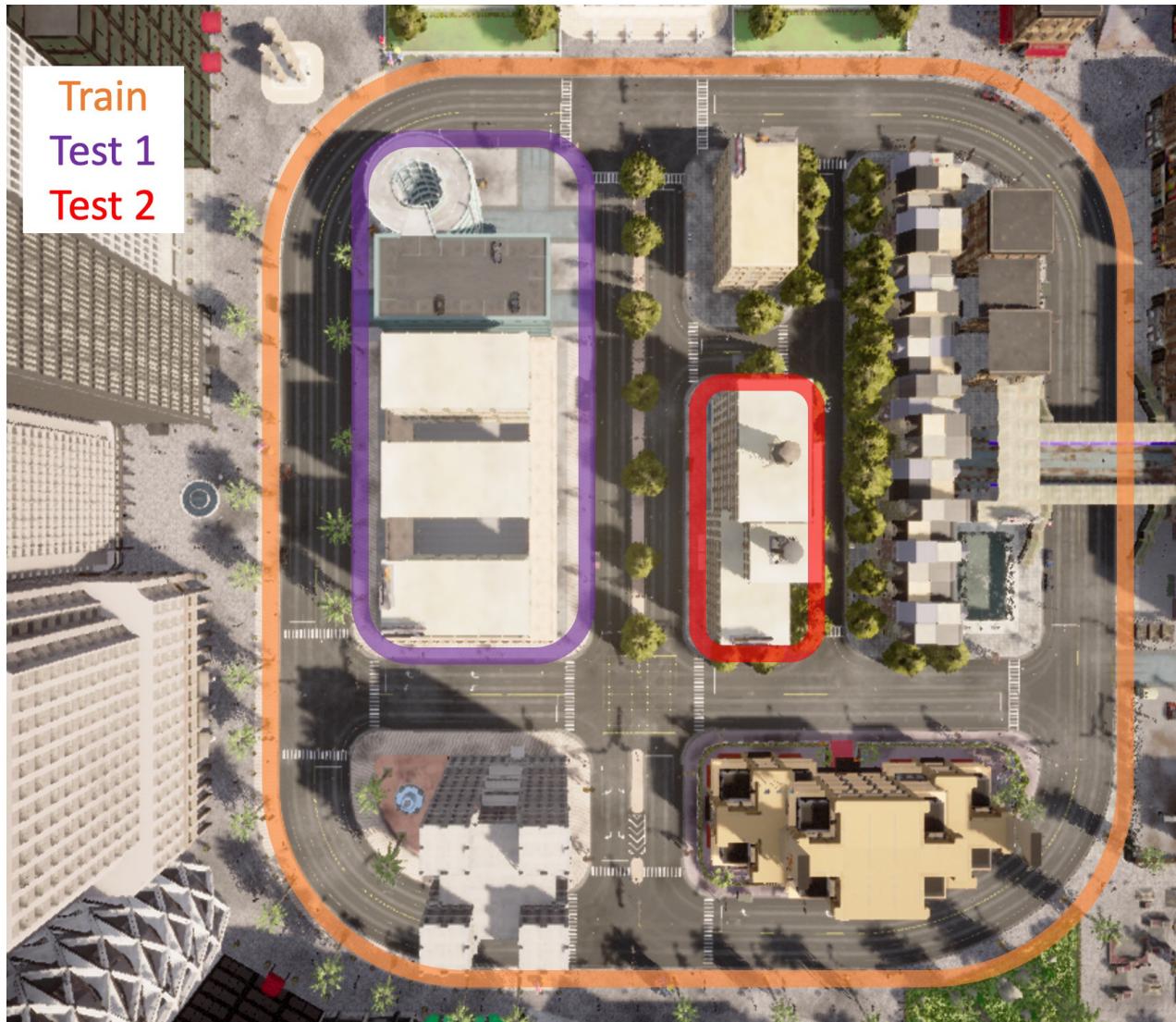
Difference In Approach



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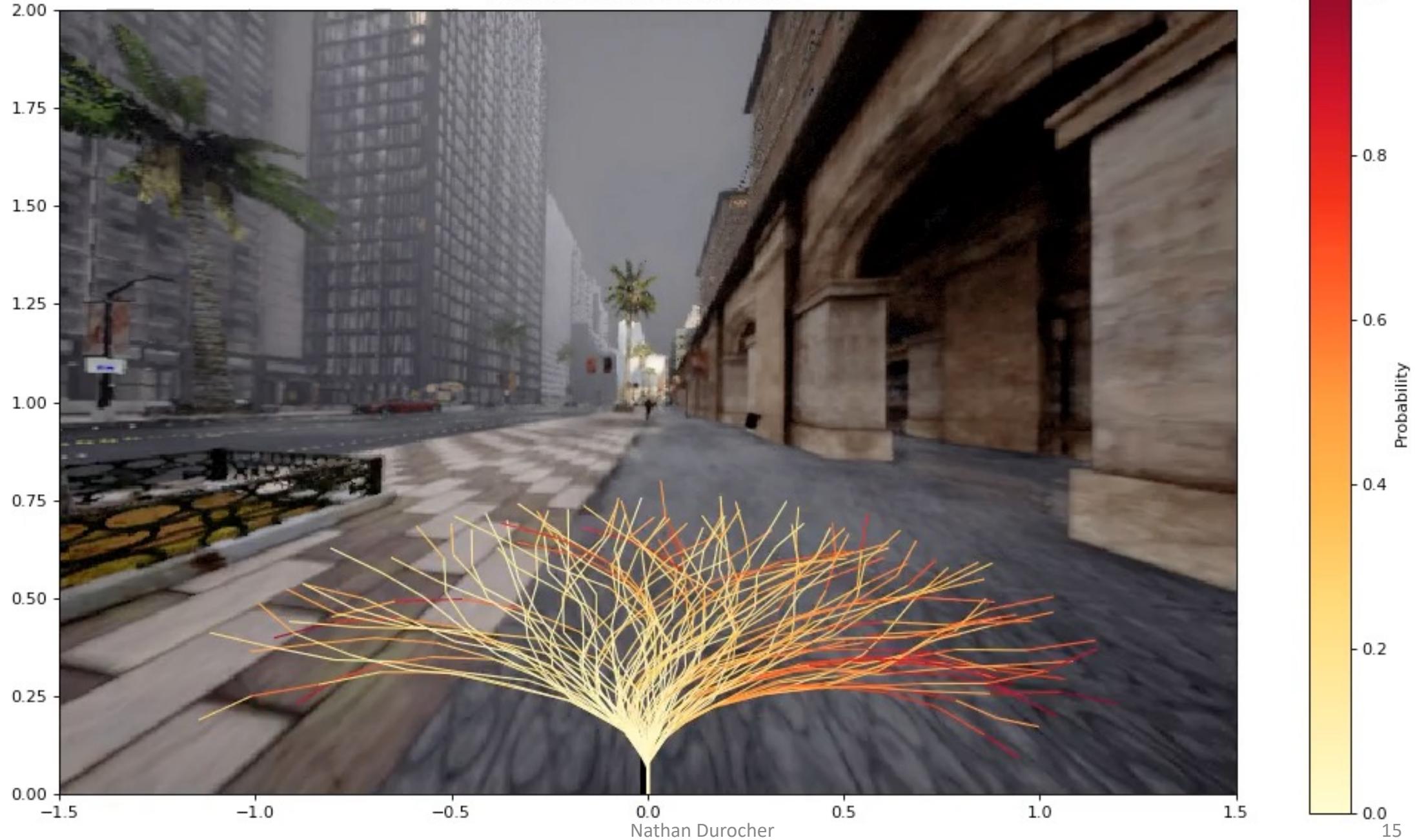
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CARLA Environment



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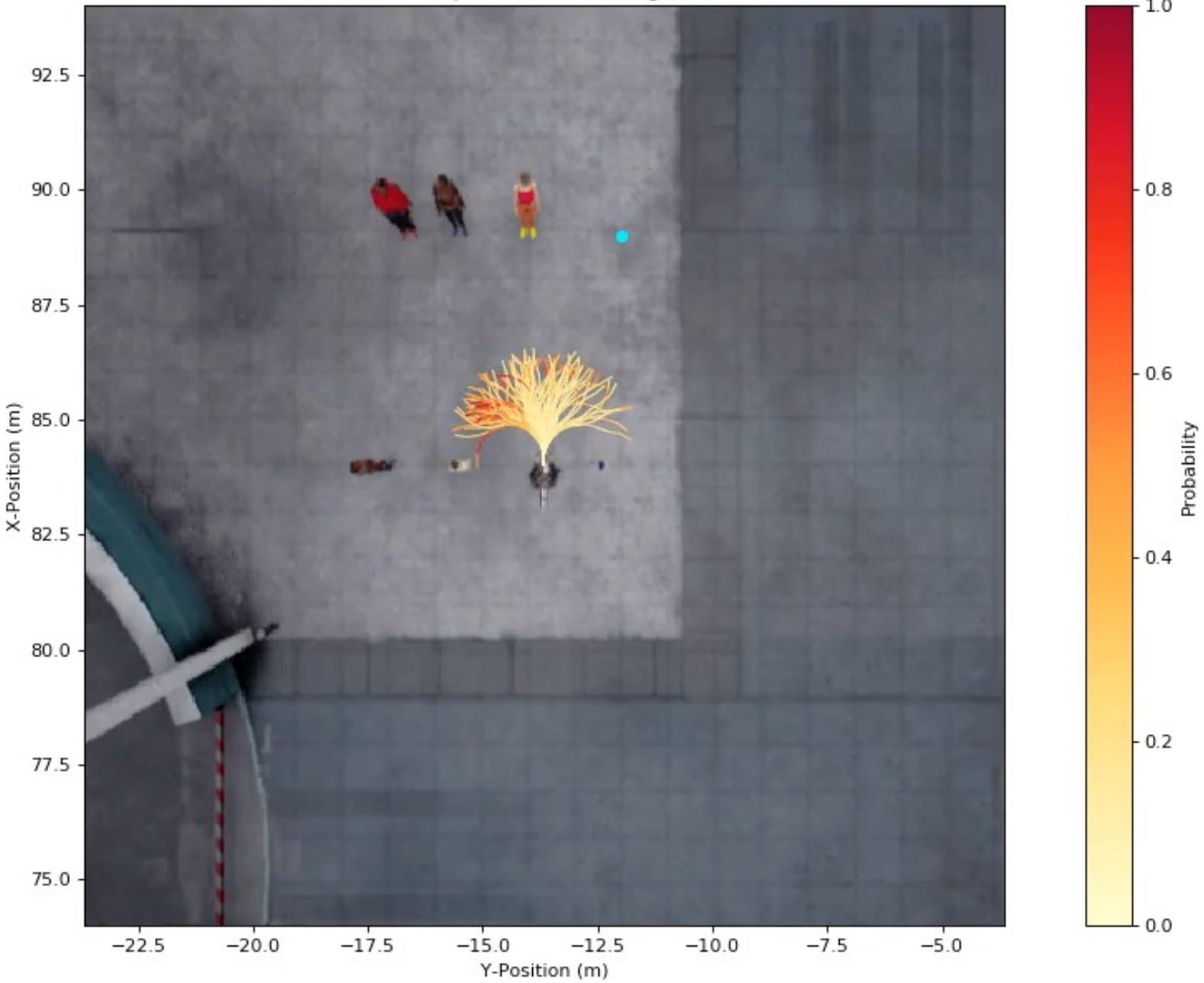
Probabilities of Unsafe Position





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Top view: Its working



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CARLA Results

	HERDR Carla-Only	HERDR Pre-trained	ORCA
Avg. Minimum Distance to a Pedestrian (m)	2.44	3.08	2.41
Collision Rate (%)	50.00	62.07	41.38
Relative Time in Personal Space (%)	20.52	17.41	18.49

Real life Results



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Conclusion

- Learned to respect personal space
- Outperformed a state-of-the-art method
- Shows potential for Sim-to-Real learning transfer