Interactive Pedestrian Simulation

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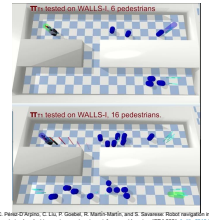
Robot Learning for Social Navigation

- Robot learning for social navigation requires better simulation of pedestrian behaviors.
- Current analytical models are limited:
  - No human-like behaviors
  - Challenged by indoor constrained environments

Pedestrian Simulation using ORCA



C. Perez-D'Arpino, C. Liu, P. Goebel, R. Martín-Martín, and S. Savarese. Robot navigation in constrained pedestrian environments using reinforcement learning. ICRA 2021. [arXiv:2010.08600]

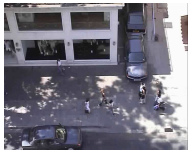
Van Den Berg, Jur, Stephen J. Guy, Ming Lin, and Dinesh Manocha. "Reciprocal N-Body Collision Avoidance." Springer Tracts in Advanced Robotics, 2011.

ORCA is commonly used in social navigation research. It is limited in several aspects:

- Additional global planner is required to perform in indoor environments.
- The collision avoidance responsibility is equally divided among agents.
- The protocol doesn't consider the multi-modality of pedestrian trajectories.

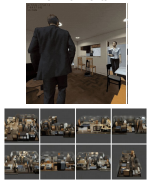
Learning-based pedestrian simulation (on-going work)

Datasets of pedestrians trajectories



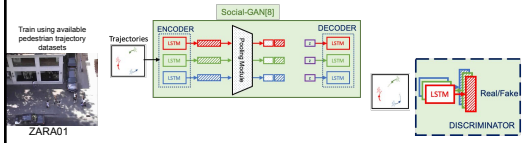
ZARA01

Simulation in realistic indoor environments

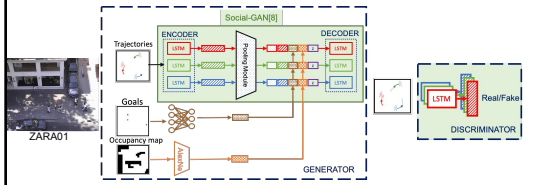


Bokui Shen, Fei Xia, Chengshu Li, Roberto Martín-Martín, Linxi Fan, Guanzhi Wang, Claudia Perez-D'Arpino, Shyamal Buch, Sanjana Srivastava, Lyne P Tchapmi, Micael E Tchapmi, Kent Vainio, Li Fei-Fei, Silvio Savarese. iGibson, a Simulation Environment for Interactive Tasks in Large Realistic Scenes. IROS 2021. [arXiv:2012.02924]

Pedestrian Prediction

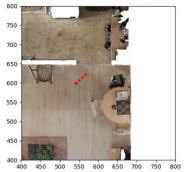


Pedestrian Prediction -> Generative model for simulation

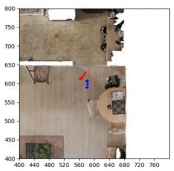


Agrim Gupta, Justin Johnson, Li Fei-Fei, Silvio Savarese, and Alexandre Alahi. Social GAN: Socially acceptable trajectories with generative adversarial networks. CVPR 2018.

Pedestrian simulation in iGibson



ORCA (radius = 0.1 m)



Proposed model