



From Crowd Motion Prediction to Robot Navigation in Crowds

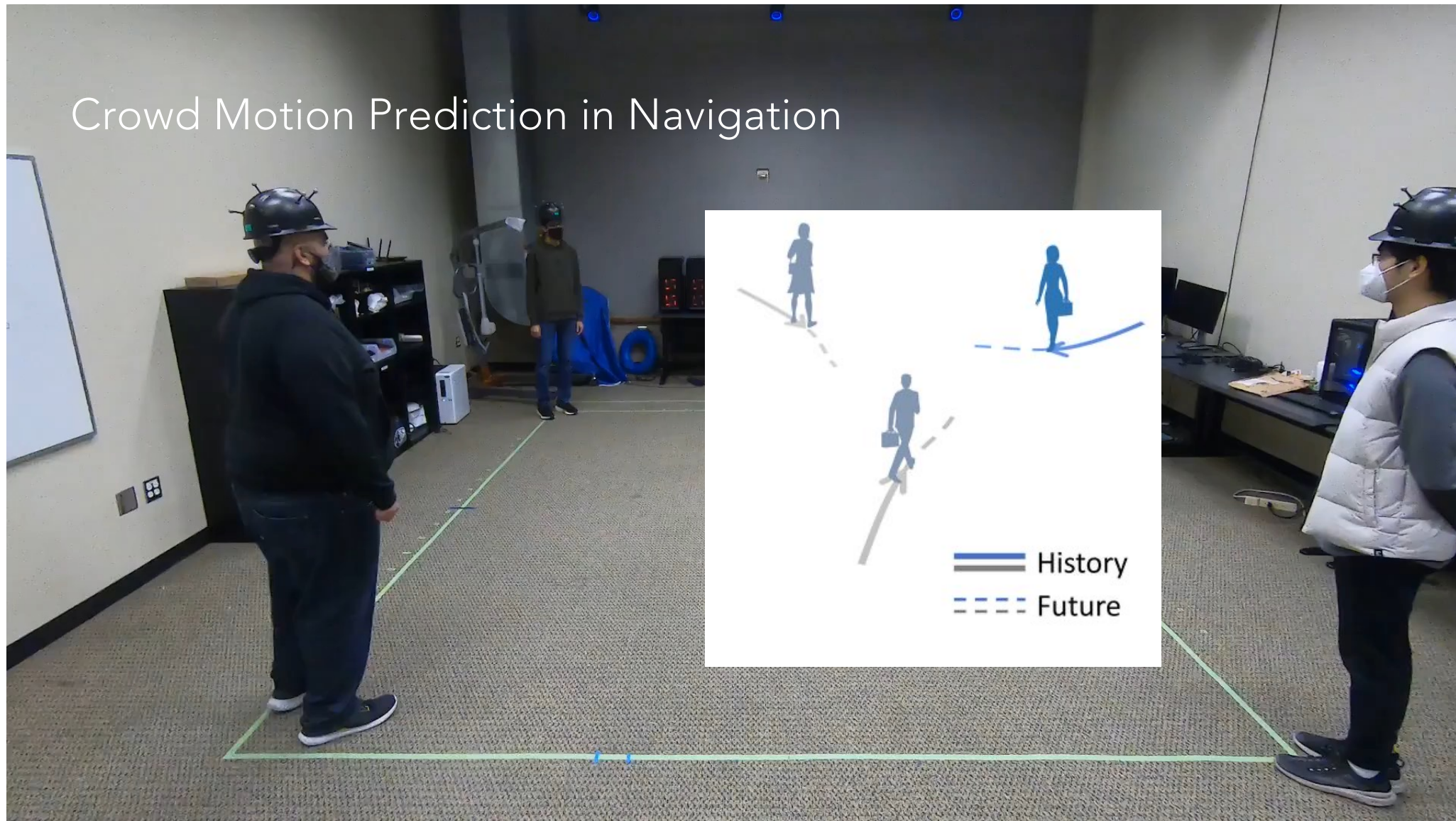
Sriyash Poddar, Christoforos Mavrogiannis, Siddhartha S. Srinivasa



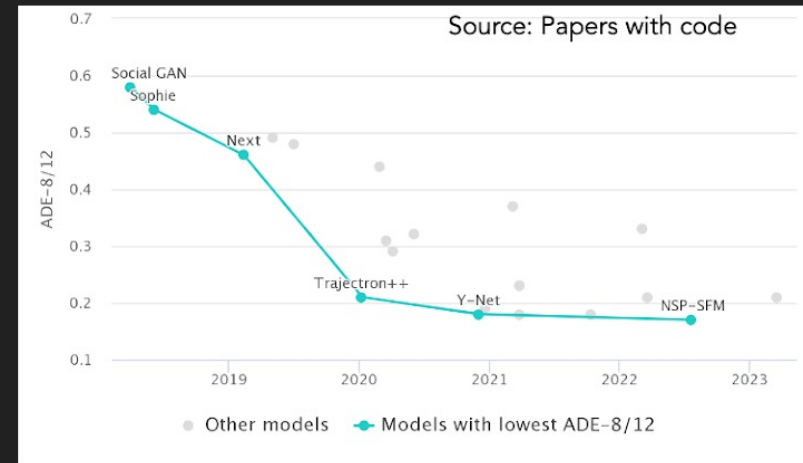
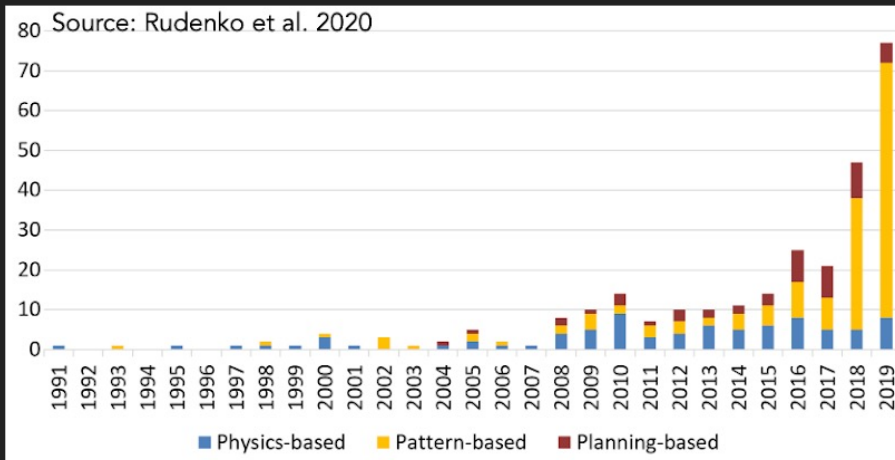
PAUL G. ALLEN SCHOOL
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Crowd Motion Prediction in Navigation



Increasing accuracy of crowd navigation models



Increasing accuracy of motion prediction models

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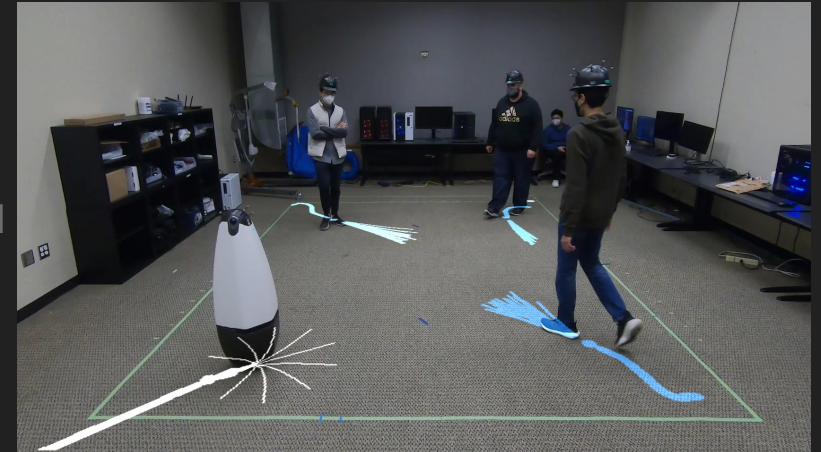
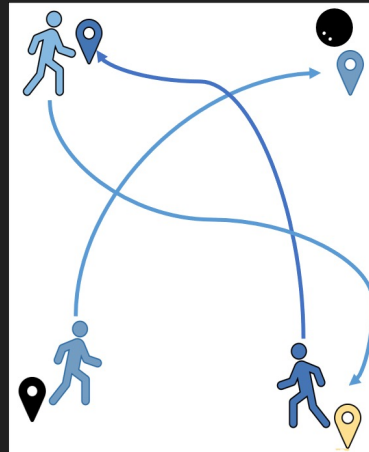
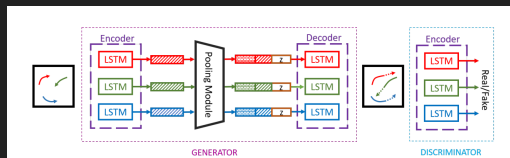
IEEE ROBOTICS AND AUTOMATION LETTERS, VOL. 5, NO. 2, APRIL 2020

What the Constant Velocity Model Can Teach Us About Pedestrian Motion Prediction

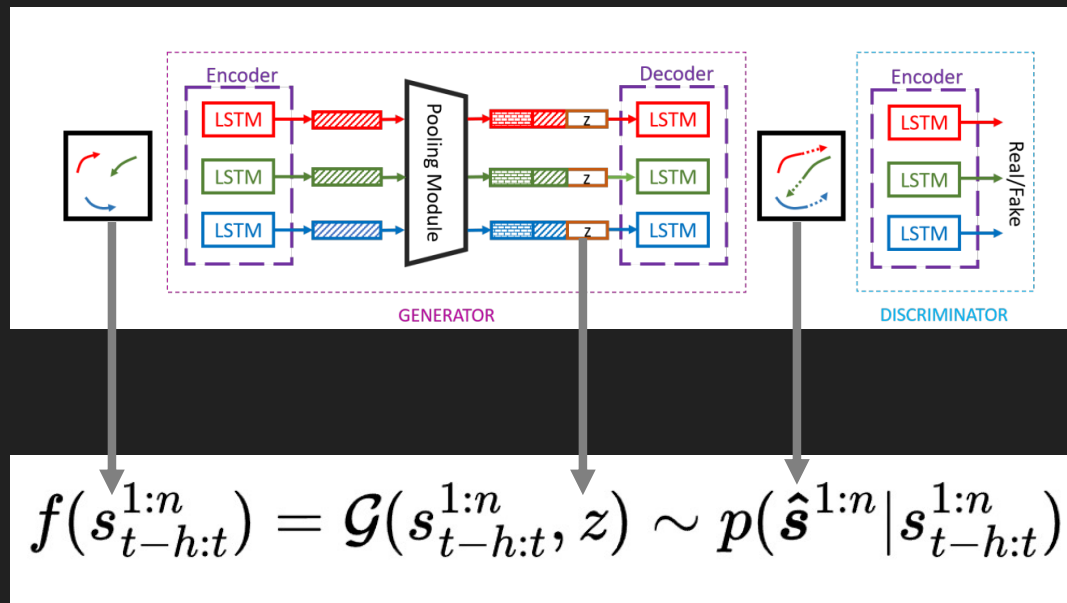
Christoph Schöller , Vincent Aravantinos, Florian Lay, and Alois Knoll

To what extent does crowd motion prediction accuracy translate to robot navigation performance in crowd navigation tasks?

Investigating transfer of prediction accuracy to navigation

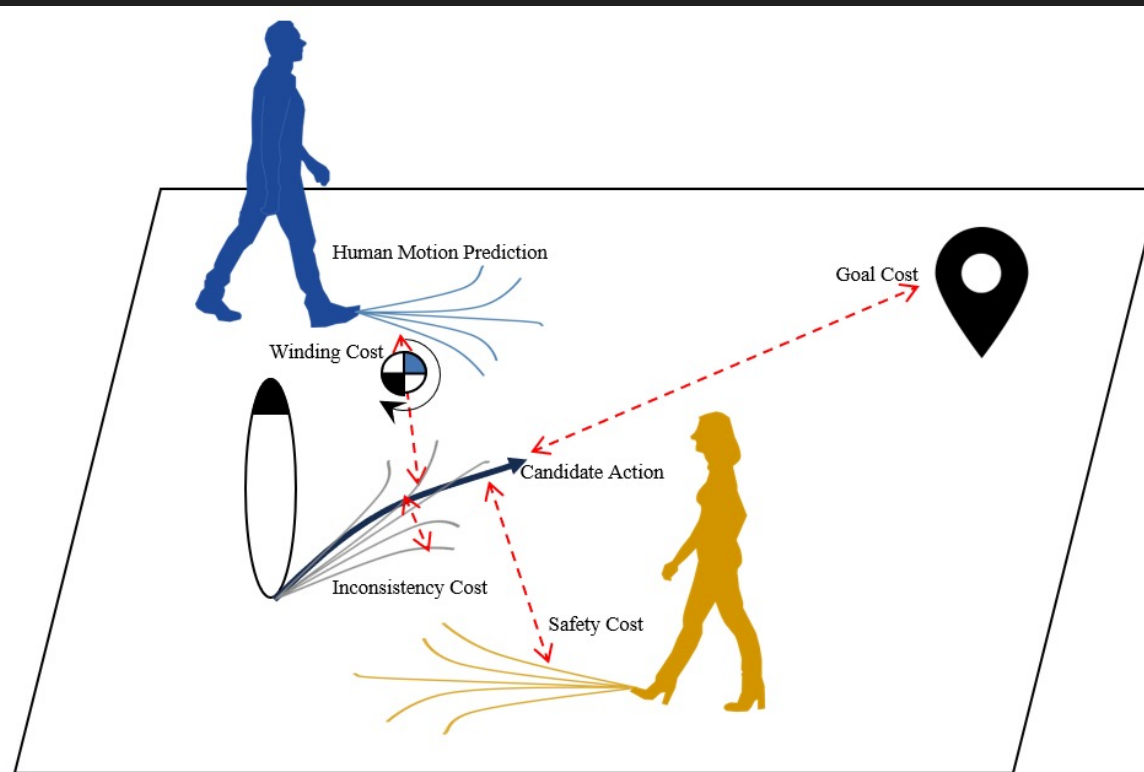


Probabilistic Motion Prediction using Social GANs



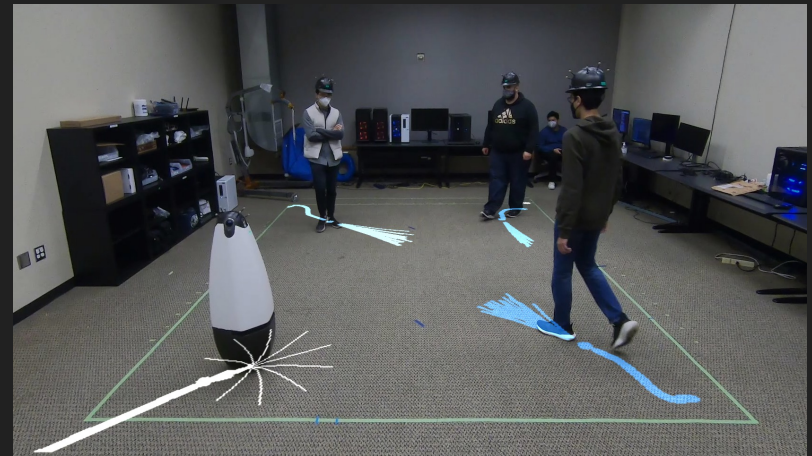
- Training a generative model (Gupta et al.) for probabilistic trajectory prediction
- Predict conditional distribution over future trajectories (T) given past trajectories (t).

Model Predictive Control with Probabilistic Multiagent Prediction

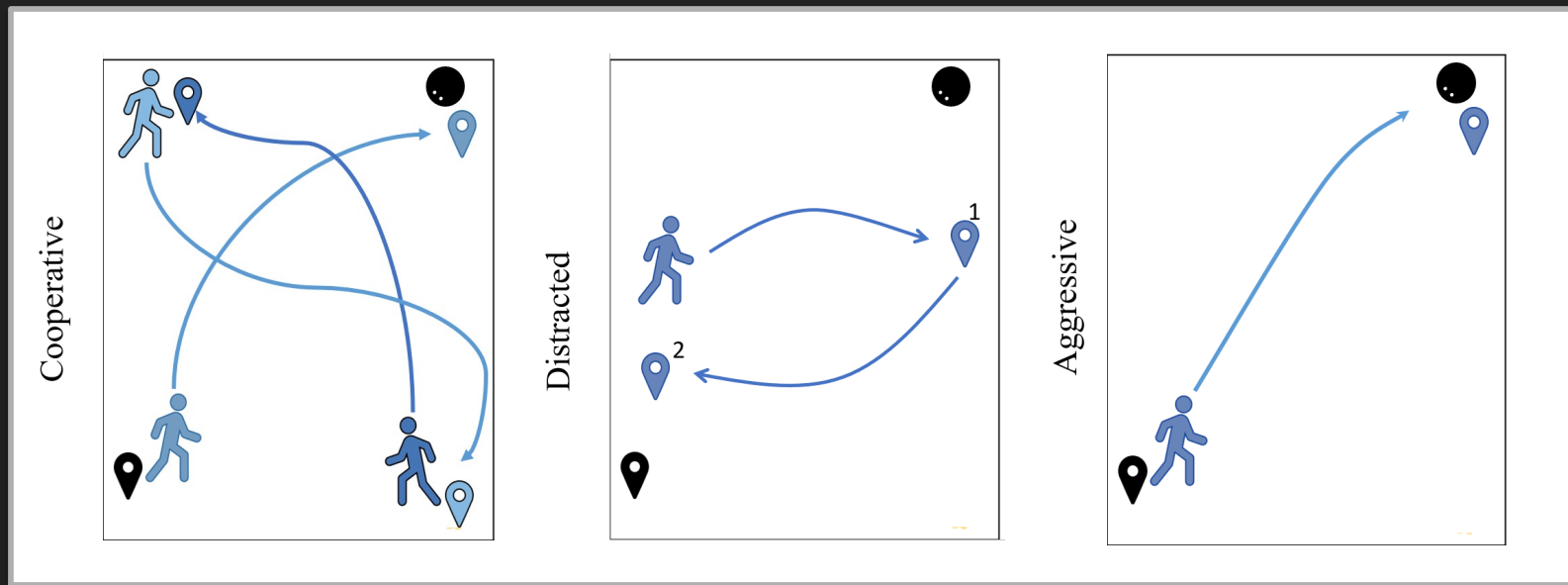


Real World Experiments

- Honda's P.A.T.H Bot
- Human behaviors
 - Cooperative
 - Aggressive
 - Distracted
- Three controllers
 - MPC with CV
 - MPC with SGAN – 1
 - MPC with SGAN – 20



Human behaviours during navigation



Experiment Videos



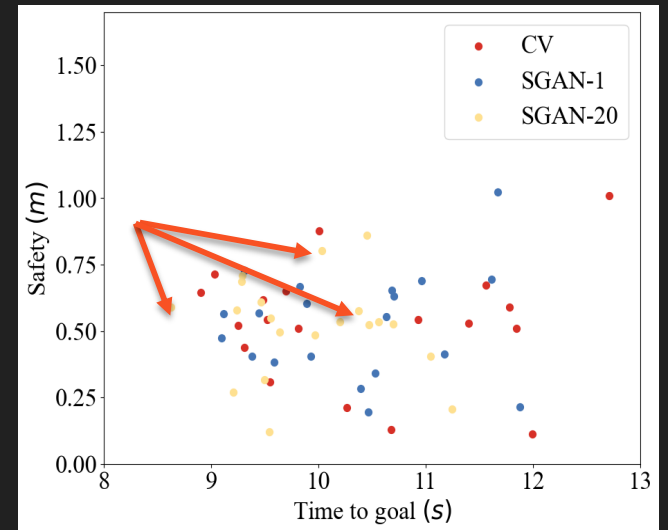
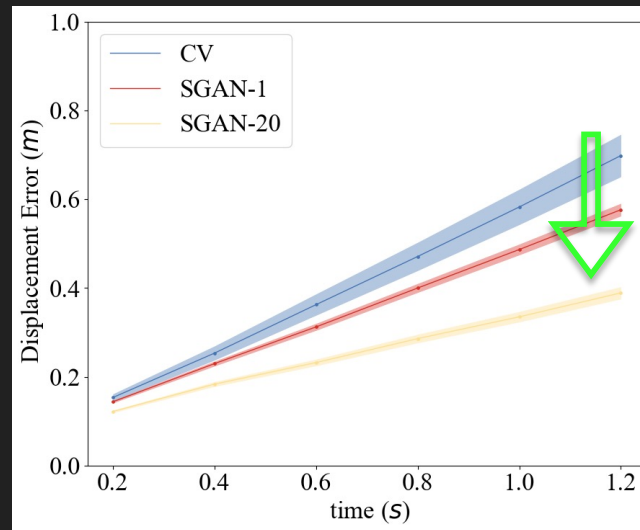
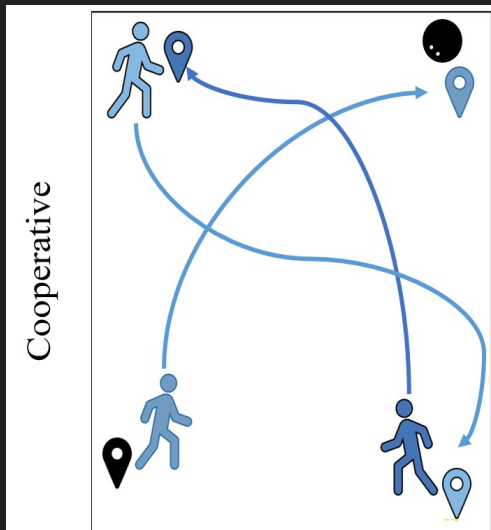
Experiment Videos



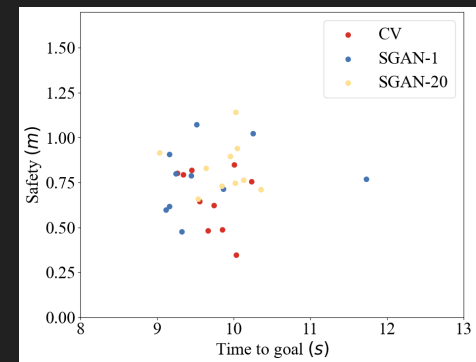
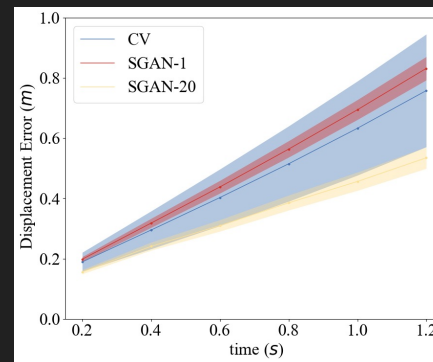
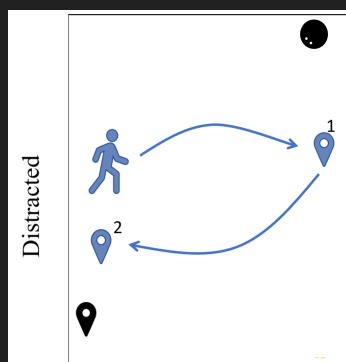
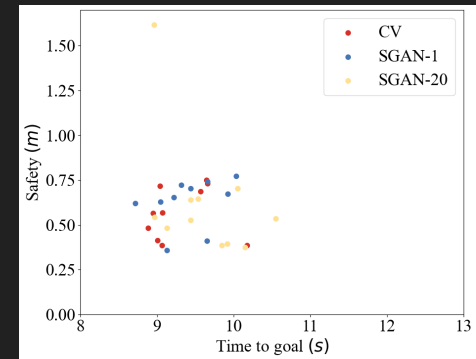
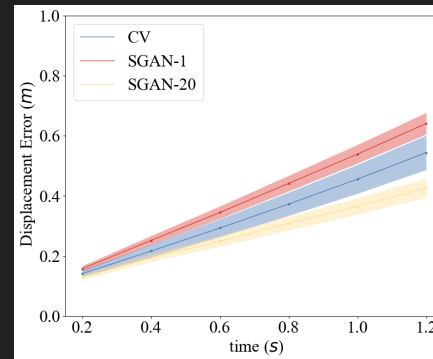
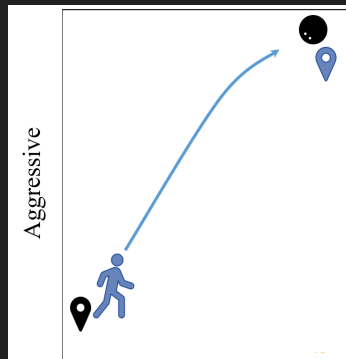
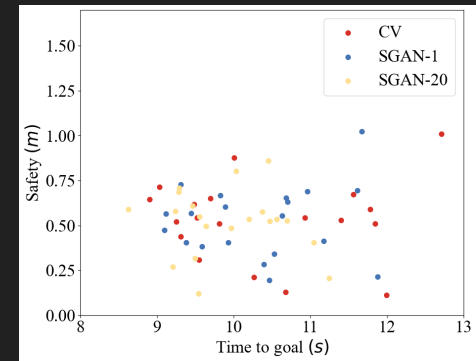
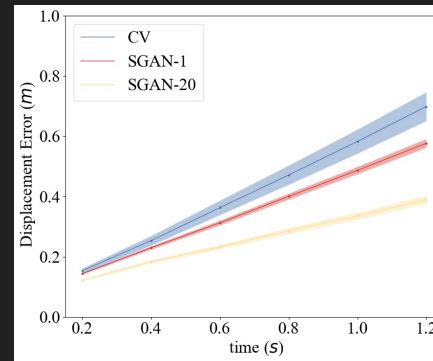
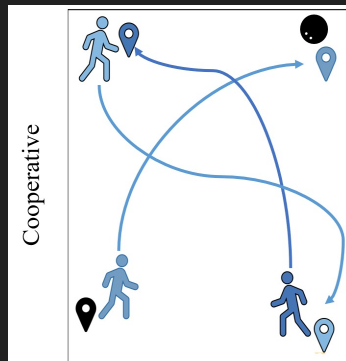
Experiment Videos



Results



Results



Discussion

Key takeaway: SOTA models are able to make higher accuracy predictions across all conditions but this superiority doesn't translate to real world navigation performance in terms of safety and efficiency.

✓ Improving cost functions by inducing structure for navigation

✓ Trajectory forecasting conditioned on future robot action

✓ Better metrics beyond safety and efficiency

Limitations

- ✓ Better prediction models for human robot interaction
- ✓ More extensive experiments in diverse settings
- ✓ Feedback from users to extract qualitative insights



Paper



Code



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