Towards robots that seamlessly navigate around people

Christoforos Mavrogiannis, University of Michigan
https://chrismavrogiannis.com

Goal: Enable robots to navigate seamlessly in unstructured, dynamic environments where humans are simultaneously performing other tasks or activities. Examples domains fulfillment, manufacturing, healthcare and transportation.

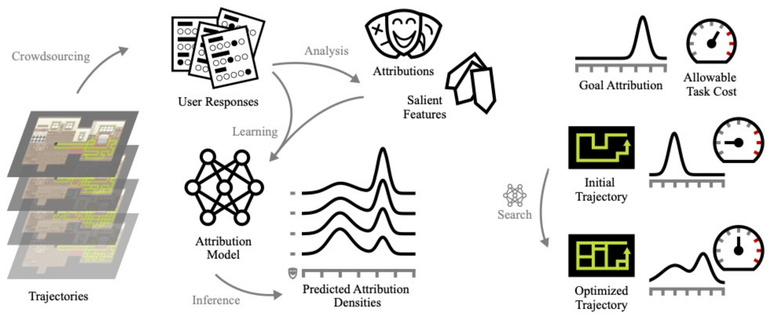
Challenges

- End users have limited mental models about robots.
- Robots have limited models of scene and context understanding.
- This mismatch of expectations and capabilities results in robot failures disrupting human activity, causing discomfort, and posing dangers [1].

Lab studies on social navigation [2,3].

Approach

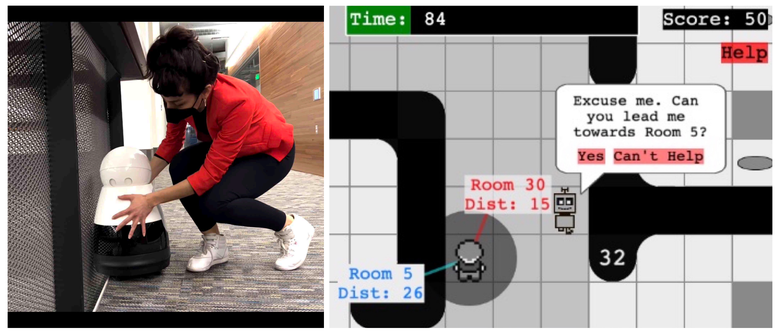
- Conduct user studies to understand human (dis)comfort when sharing a space with robots.
- Develop models mapping robot behavior to human response (e.g., motion, impressions).
- Develop strategies to effectively elicit human help from bystanders when a robot fails.
- Integrate models into planning algorithms, deploy and validate on robots.



Pipeline for learning to map robot behaviors to user attributions [3].

Highlights

- Experimental insights on comfort via lab study on crowd navigation (N=105) [2].
- Algorithm for generating robot motion to elicit desired user attributions (e.g., competent, broken, curious) [3].
- Planning effective human help requests by reasoning about contextual and individual factors. [4]



A robot gets unstuck via bystander help in virtual and real worlds [4,5].

Society: Enable robots to increase human productivity by completing their tasks seamlessly alongside humans.

Education: Inclusion of undergraduate in research; open-source course materials: https://courses.cs.washington.edu/courses/cse478/20wi/

Outreach: Demos for school students, open-house events for the broader public, open-source software and hardware: https//mushr.io.

Potential impact: Accelerate adoption of robots in unstructured, dynamic environments in sectors that are often understaffed like healthcare and fulfillment.

References

[1] Mavrogiannis et al. Core challenges of social robot navigation: a survey. T-HRI 2023.

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[2] Mavrogiannis et al. Social momentum: design and evaluation of a framework for socially competent robot navigation. T-HRI 2022.

[3] Walker et al. Influencing behavioral attributions to robot motion during task execution. CoRL 2021.

[4] Nanavati et al. Modeling human helpfulness with individual and contextual factors for robot planning. RSS 2021.

[5] Nanavati et al. Not all who wander are lost: A localization-free system for in-the-wild mobile robot deployments. HRI 2022.

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