

FRR: Towards Robust and Perceptual Inclusive Mobile Robots

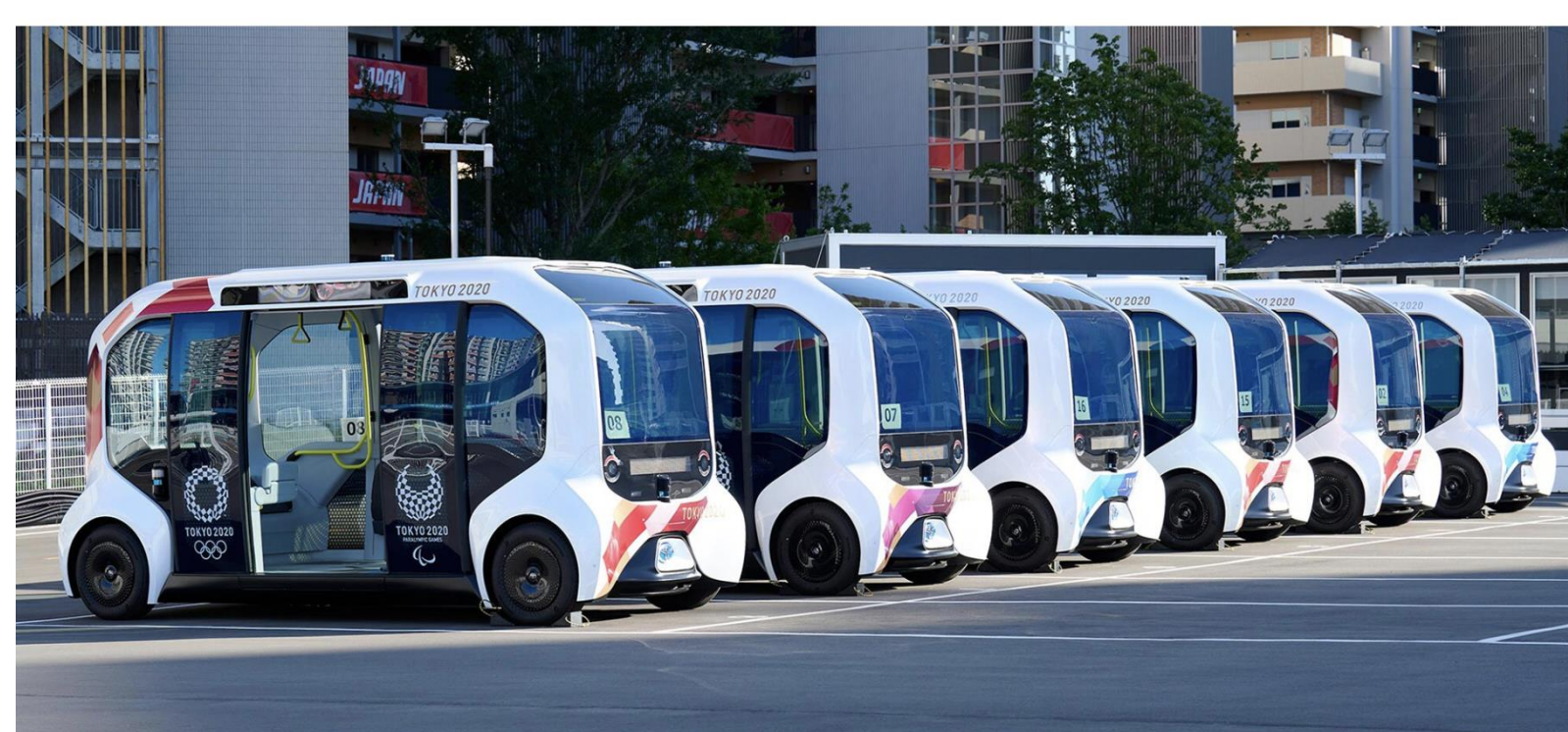
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Motivation and Challenge

- Individuals with disabilities are **generally absent** from large-scale robotics benchmarks [1].
- How can we realize systems that seamlessly interact with all people in their environment?

Toyota suspends all self-driving vehicles at Paralympic Games after collision with athlete



Pitt suspends delivery robots after wheelchair user reports safety hazard



Approach

- Standardized development environment with detailed recognition tasks and comprehensive scenarios relevant to accessibility.
- Develop holistic models of multi-task perception for effectively reasoning over mobility aids.
- Learn seamless interaction policies with effective customization based on a mixture-of-experts formulation.



Findings (Year 1)

- Collected a large-scale simulation (500K+ images) and real-world (13 participants), Performed two user studies in order to understand in-situ navigation challenge.
- We find nuanced mobility strategies (e.g., cane holding and environmental context interaction), currently used to inform and improve simulation design.
- Failure of state-of-the-art perception models on individuals with mobility aids

Method	Person	Person-WChair	Person-WCane	WChair	Cane
R-CNN	66.1%	30.0%	51.8%	23.5%	0.53%

- Set-up a running evaluation server and competition [2] (up to 8% on cane currently).

Impact

Societal Impact:

- Improved quality-of-life for individuals with disabilities through more robust and accessibility-aware robotic systems.

Research Impact:

- Introduced shared development tools and data to engage of researchers and engineers in concepts needed to tackle multifaceted problems at the intersection of robotics, scalability, and accessibility.

Educational Impact:

- Incorporated accessibility-related benchmark as a module in an undergraduate course on smart systems, and graduate robot learning class.
- Two senior design projects on assistive and autonomous mobile navigation alongside individuals with disabilities.

[1] X-World: Accessibility, Vision, and Autonomy Meet, International Conference on Computer Vision (ICCV), 2021

[2] AVA: Accessibility, Vision, and Autonomy Workshop at Conference on Computer Vision and Pattern Recognition, 2023

<https://accessibility-cv.github.io/>

[3] ASSISTER: Assistive Navigation via Conditional Instruction Generation, European Conference on Computer Vision (ECCV), 2022