Robotics: A Quest for Intelligence

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RobIn: Robot Interactive Intelligence Lab
The AI Revolution

What kind of “I”? [Krizhevsky et al. ‘12, Deng et al. ‘09, Silver et al. ‘16, Ouyang et al. ‘22]
No robot can do this!
Moravec’s paradox (1988):

“it is comparatively easy to make computers exhibit adult level performance on intelligence tests or playing checkers, and difficult or impossible to give them the skills of a one-year-old when it comes to perception and mobility”
Physically Interactive Intelligence:

the resourceful use of physical interactions in embodied agents that results in autonomy to perform physical tasks

[Gibson 1979, Mason’81, Bajcsy 1988, Brooks’90, Ballard’91, Ziemke’04, Noe’04, Pfeifer’06, Levine’16, Bohg’17, Batra’20]
Research in my lab:
Creating learning methods that exploit physical interactions to increase autonomy in robotic systems
Some of our Future Directions

Physically Interactive Intelligence

- Causal and semantic understanding of the effect of interactions
- From skills to long-horizon interactive activities
- Error awareness and recovery
Algorithmic Foundations and Methodology

robotics foundations:
• (optimal) control
• motion planning
• task planning
• 2D and 3D perception
• prob. theory
...

robot learning:
• reinforcement learning
• imitation learning
• representation learning
• foundation models
...

Physically Interactive Intelligent Solution
Domains and Problem Settings

- stationary and mobile manipulation
- simulation, benchmarking, sim2real
- human-in-the-loop

[Zhu et al. ‘20, Li et al. ‘23, Srivastava et al. ‘22, Zhang et al. ‘22]