Data will solve Robotics?

Is the Robotics Handbook Obsolete?

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We have been at it...
For a while now!

Structure

Structure of the Problem

- Priors
- Inductive Biases
- Models of { X }
- Modularity

1968: Aspirational Robotic Assistant

We have been at it...
For a while now!

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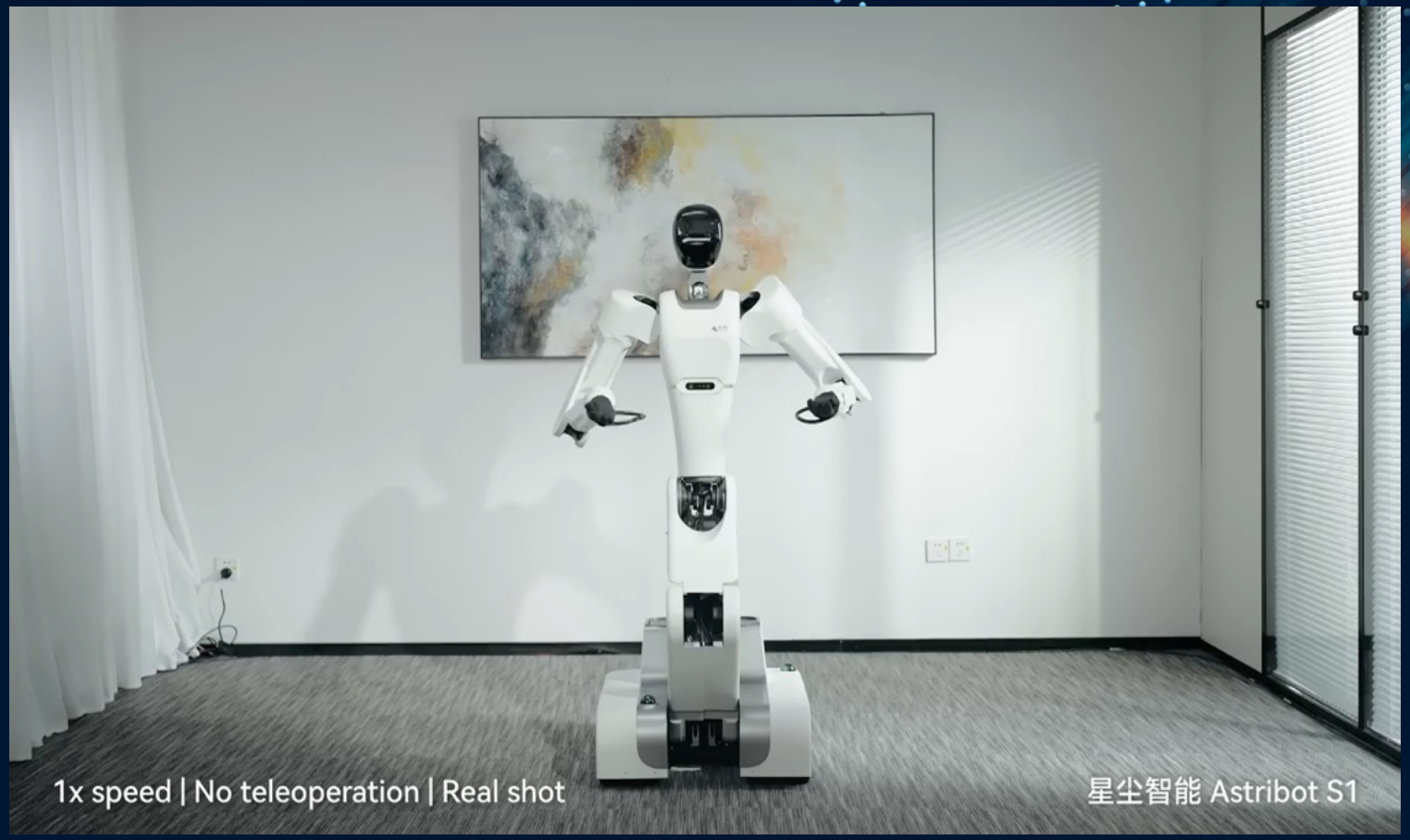


2023: Astribot Robot Demo

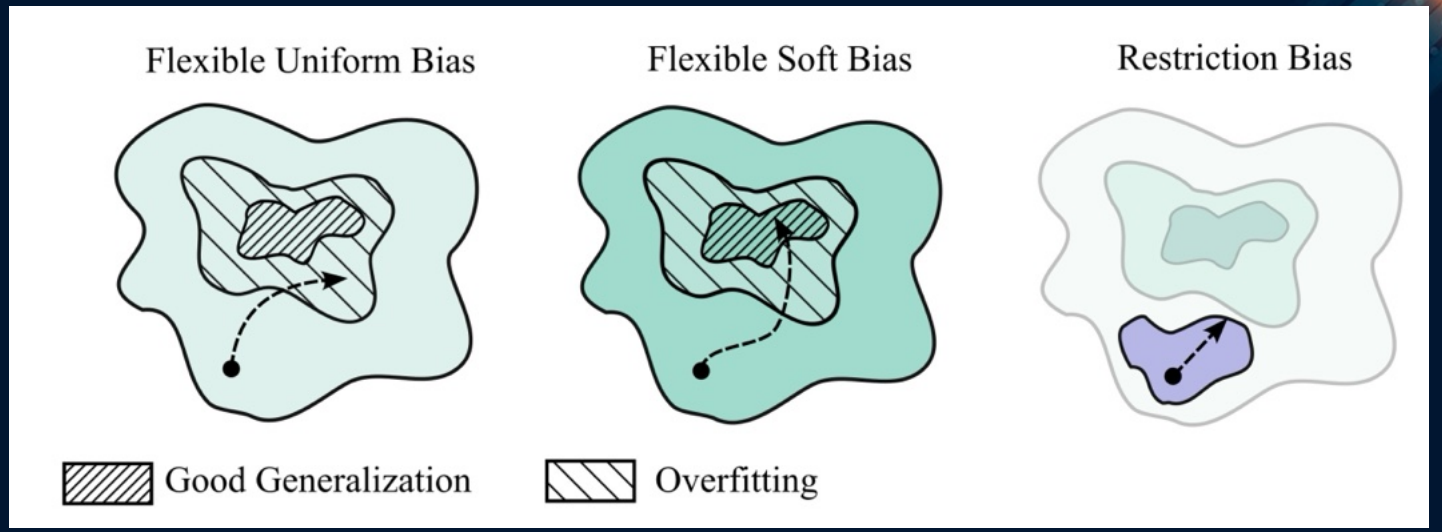
Data will Solve Robotics & Automation

1. Too much structure hurts!
(sad... but true)

Optimal solution not in the hypothesis space

Or

Optimal solution is representable but not findable!



A. G. Wilson, Deep Learning is Not So Mysterious or Different 2025

Data will Solve Robotics & Automation

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Data

From
”Scaling Data”

To
“Science of Scaling”

How to Scale?

“WHAT”

Multimodal Foundation Model
Does High-level Reasoning

“Reasoning” + “Common Sense”

Grounding what needs to “Happen”
Create an abstract plan
Generate reference for expected change

Replanning with “Prospection”

“HOW”

Generic Observation-to-control
Low-level Reasoning

“Self-Aware Motor-Control”

Control to ”effect” the change
Closed-Loop Reference Following
Affordance aware solutions

Reactive (Sys 1) or Deliberative (Sys 2)

How to Scale?

"WHAT"

Multimodal Foundation Model
Does High-level Reasoning

"HOW"

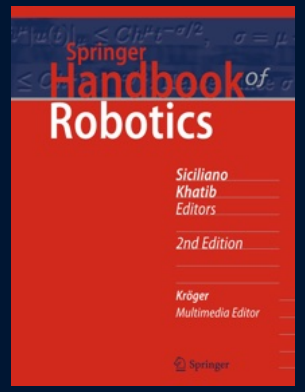
Generic Observation-to-control
Low-level Reasoning

2. Data helps with Ambiguity & Robustness

Data Unlocks Complex Problem-Solving beyond Manually Engineered Solutions

From Specific tasks to versatile recipes and ideally Generalizable Foundation Models.

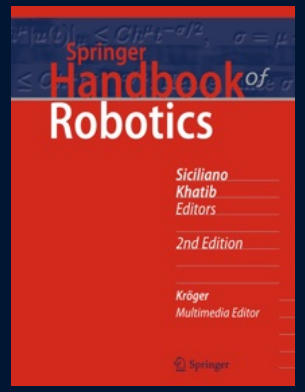
Flywheel Effect: Data Fuels Continuous Improvement



Is the Handbook of Robotics Obsolete?

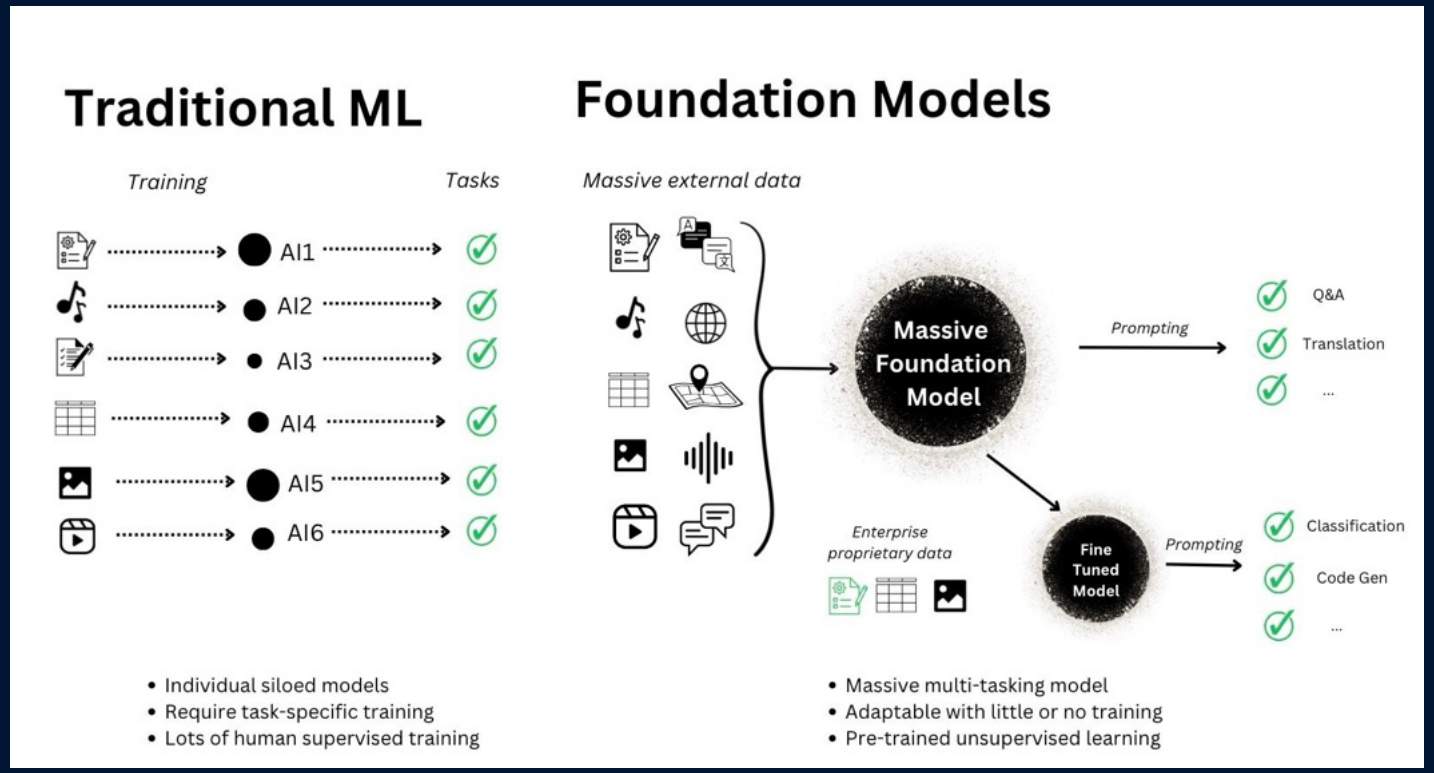
Robotics has been a community of communities.

80+ Chapters on Robotics Foundations, Design. Sensing & Perception, Manipulation, Navigation, Applications, HRI!



Is the Handbook of Robotics Obsolete? Build foundations before specializing!

3. Data leads to a Unifying Perspective!



humanloop.com/blog/foundation-models

The Computing Stack

Digital AI

App

General-Purpose Applications

Ease of Use

OS

Platform-Agnostic OS

Modular Utilities

Driver

Hardware-Specific Drivers

Optimize Performance

The Computing Stack

Digital AI

App
General-Purpose Applications
Ease of Use

OS
Platform-Agnostic OS
Modular Utilities

Driver
Hardware-Specific Drivers
Optimize Performance

Physical AI

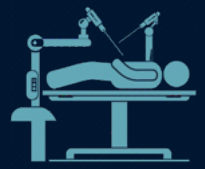
Natural Interaction Interface
Ease of Use
App

Platform-Agnostic Planning
Modular Tool-Use
OS

Hardware-Specific Skills
Optimize for Morphology
Driver

The Computing Stack

Physical AI



Natural Interaction Interface
Ease of Use

App

Platform-Agnostic Planning
Modular Tool-Use

OS

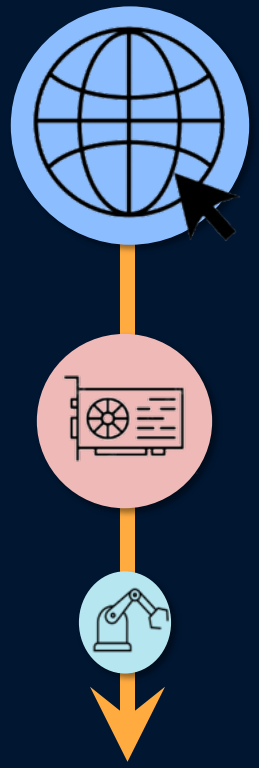
Hardware-Specific Skills
Optimize for Morphology

Driver

4. Data-First ⇏ Lack of Modularity

But Supervision is not _____

Scaling, generalizing, robust …



Internet Data
Language, Image, Video
$, Very Diverse

Synthetic Data
Simulation
$$, Engineered Designs

Real World Data
Teleoperation
$$$$, Limited Diversity

The revolution will not be supervised

– Alyosha Efros (circa 2018)

Data will solve Robotics?

Yes, data will take us very far!

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