

Robotics

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1 Robotic Generalization to New Tasks

One of the grand challenges in robotics is enabling robots to handle novel tasks and environments in out-of-distribution contexts. In previous years, robots have typically struggled outside of narrow, pre-defined scenarios. From 2023 to 2025, significant research has gone into making robots more general-purpose and adaptable.

A notable trend is training generalist robots that can learn many skills at once and leverage that knowledge for new tasks.

- In 2023 Google DeepMind introduced RoboCat, a single AI agent that learned to operate different types of robot arms and solve a variety of manipulation tasks.
- Google’s RT-2 (Robotics Transformer 2) in 2023 combined vision, language, and action; it was trained on both robot data and vast web images/text so that it could interpret instructions and attempt actions it hadn’t explicitly been trained on.

Vision-Language-Action models (VLAs) have also become more popular:

- PaLM-E, a large AI model that connects vision and language, enabling a robot to respond to spoken or written commands with appropriate movements by “understanding” the task context. These language-conditioned policies have shown impressive flexibility, e.g. a robot can be instructed in plain English to fetch an object from another room, and it can interpret the request and attempt it even if that exact request was never in training.

Researchers are also leveraging imitation learning from video:

- In 2022, BC-Z (Beta Cascade) showed that feeding a robot a large number of human demonstration videos (for 100 different tasks) plus a description of the goal allows it to perform tasks it never saw during training.

Another method is introducing synthetic obstacles or new and diverse environments (domain randomization) to improve generalization.

- “The Colosseum” was introduced to systematically evaluate a robot policy’s generalization across 20 different manipulation tasks and 14 axes of variation.

2 Data Scarcity in Robotics

3 Policy and Ethics around Robotics

References