

Robot intuition

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October 2019

While computers outperform humans in mathematical tasks and in playing games such as chess, Jeopardy, or Atari computer games, robots are still far away from solving the mundane everyday tasks faced by humans. These tasks include for example cooking, tidying up and cleaning, doing the laundry, or grocery shopping.

In the collaborative research center EASE (Everyday Activity Science and Engineering), we are enabling robots to perform these everyday tasks. One of the core concepts in EASE is to teach robots how to perform such tasks using human examples. We let humans perform household tasks, for example setting a breakfast table, and record, among other things, eye tracking data, EEG data, think aloud protocols, task results, and motion trajectories. The data, which we call *narrative enabled episodic memories* (NEEMs), can also be recorded from humans performing similar household tasks in virtual reality, or from actual robots performing these tasks. We can analyze the NEEMs and extract the generalizations of certain tasks, which we call *pragmatic everyday activity manifolds* (PEAMs).

With PEAMs, robots are able to perform various everyday tasks without additional prior training. However, usually task descriptions are incomplete and can be ambiguous. And sometimes, no PEAM will fit the task at hand. In such cases, we use semantic parsing to resolve ambiguities and find missing parameters. We test possible values for these parameters in physics simulations. To speed up this expensive search and test procedure, we train a generative artificial neural network which learns to predict the outcomes of the simulation. Thus, robots develop an intuition about the physical world around them and their actions in it. This intuition allows for a fast verification of possible parameter values to avoid getting stuck in unknown or underspecified situations.