Sony researchers create 'curious' Aibos

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Sony Corp. has succeeded in giving selected Aibo pet robots curiosity, researchers at Sony Computer Science Laboratory (SCSL) in Paris said last week. Their research won't lead to conscious robots soon, if ever, but it could help other fields such as child developmental psychology, they said during an open day in Tokyo.

More than 50 years ago Alan Turing, considered by many to be the father of computer science, speculated about the possibility of creating synthetic consciousness. Progress has been made with AI (artificial intelligence) systems, which have typically used task-defined learning algorithms that enable programs to define what is good or bad about particular sets of information in relation to achieving preset goals, according to SCSL researcher Frederic Kaplan.

Increases in computing power are leading to systems, for example robots, that appear to have the ability to react appropriately within a given set of parameters to ever more complex stimuli -- so that such systems may start to appear intelligent, Kaplan said.

But such approaches contain defined tasks and limitations so that while systems may become efficient in coping with sets of goals, they remain, essentially, programmed. And once the program's parameters are fulfilled, the learning stops, he said.

But what if a robot could be made inherently "curious?" And what if its curiosity was backed by awareness of the value of its learning?

Such qualities are precisely what Kaplan and his fellow SCSL researcher Pierre-Yves Oudeyer believe they have achieved with Aibo ERS-7 robot dogs in experiments over the last three years, Kaplan said.

They repeated the experiments hundreds of times with about a dozen Aibos, putting them in playpens with balls. In four or five hours, the mechanical dogs typically progressed from swivelling their legs and heads to wiggling, to being able to crawl. Then, each in their own way, they began to crawl and hit and follow the ball that had been placed in front of them, the researchers said.

Since the Aibos were not programmed to do any of these activities, such results suggest the Aibos have developed open-ended learning ability, Kaplan said.

To achieve this, the researchers equipped the Aibos with what they call an adaptive curiosity system or a "metabrain," an algorithm that is able to assess the robots' more conventional learning algorithms, they said.

In the experiments, the metabrain algorithm continually forced the learning algorithm to look for new and more challenging tasks and to give up on tasks that didn't seem to lead anywhere. The metabrains, in effect, gave the Aibos a sense of boredom as well as curiosity, helping them make choices to keep on learning, they said.

"What we have done is give Aibo an ability to have its learning defined by the quality of learning. It can learn the consequence of one thing, but if this seems to lead nowhere, it becomes bored and looks for something else to learn. So it's learning to classify its sensory space and progressively structure that space. It doesn't like the thing that's easy so much as wants to learn the thing that's hard. The metabrain is the key," Oudeyer said.

The idea behind this approach to AI was to recreate the world of a human infant; in other words, an entity with a sense of being, with a notion for exploring its environment, and the ability to wiggle its body, arms and legs, Kaplan said.

When children are born, they already have some learning in the form of experiencing touch and sound in the womb, Kaplan said.

The Aibos were given a basic sense of embodiment in that they were made aware of stimuli coming from sensors in their legs, and they were preprogrammed to fix on the ball in front of them when the experiments began, as a reference point for motion and balance, the researchers said.

So, as with human toddlers, the Aibos didn't quite start out at zero. But beyond bestowing the Aibos with the machine equivalent of a sense of being, there was no other programming, they said.

The idea of child's play is crucial to Sony's approach to AI with Aibo, because it returns to Turing's original ideas about creating machine intelligence, they said.

"Alan Turing said that if intelligent machines were to become a reality, they would have to learn and grow ... like children. For 50 years people have been trying to make 'adult' systems. But we think it's a ... brutal shortcut, to try to make ... robots to speak intelligently. First we need to reproduce cognitive intelligence and only when we can do that can we think about something as hard as language," Oudeyer said.

So the research is not going to lead to curious Qrios, the company's biped robots, which just execute programs.

For one thing, SCSL research is open-ended and not expected to lead to products soon, if at all. For another, even moving Aibo to a cognitive intelligence comparable to that of a two month-old infant human may be difficult, and moving beyond that may be impossible, because of the complexity of the intelligence involved, they said.

Next steps will be to add more stimuli and let the Aibos "evolve" over several days, and then several weeks, to see how and how far they develop. Such work could help developmental psychologists, for example, understand why toddlers and children learn skills at different paces, Kaplan said.

"What we are not trying to do is to build AI. But we feel our systems are useful to understand how children learn," he said.

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