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The Key to Better Robotics? AIoT

DR. AYANNA HOWARD'S *first encounter with the power of intelligent devices was a robotic arm that was set up in the office of one of her professors.*

“I had to figure out how to slowly move the hand,” recalls Howard, then an undergrad and now professor and chair of the School of Interactive Computing at Georgia Tech1. “It’s like feeling around in the dark when you don’t have your glasses on.”

When Howard succeeded at maneuvering the arm toward an object, it was a thrill – though, she says, the technology and the programming skills she needed were nothing like today’s robotics. “Now a middle-school student could easily program something like that,” she says. Nevertheless, the exercise fueled Howard’s fascination with robots – especially when paired with artificial intelligence.

“When you blend algorithms with hardware, it’s like you’re giving the math life in the real world,” Howard says.

In terms of robotics, “life” can mean many things, and Howard has explored a variety of these definitions across her 20-plus years of researching human-robot interaction. She’s created robotic spacecraft2 that could analyze terrain and decide where and when to land; she has also explored the value of assistive robots that can help humans around the home. Her current research focuses on developing robots with emotional recognition skills that could be helpful in supporting childhood development.

Outside of Howard’s research areas, the more widespread application of robotics remains uncertain. While the industry is expected3 to grow significantly in the next decade, only 15 percent4 of companies report they are currently making investments in robotics. But from Howard’s vantage point, the technology is well on its way to having a variety of effective, efficient applications across industries. The key factors for most of those applications are data and artificial

intelligence, a combination increasingly5 referred to as the artificial intelligence of things, or AIoT.

Data Is Essential for Robot Intelligence

Howard believes that robots and humans can form special bonds, and that robots can be helpful partners in our daily lives. But for robots to successfully connect with people (and for us to trust them), they need the capability to make better decisions, where "decisions" are not simply defined as fulfilling a series of tasks, but doing each step in a way that's expected and welcome. To do that, they need AI and data—lots and lots of data.

Given that AI is essentially the science of training systems to emulate human tasks through learning and automation, the learning part of that is firmly rooted in data, whereas the autonomous decision-making part of AI is the result of automating the algorithms—which use the data to fuel the processes involved. So AI is built on data as much as the Internet of Things (IoT) is.

"Robots need sensing to do anything interesting," Howard says. Even a robot with the most advanced AI programming can't make much use of its capabilities without the data to learn from. Whether it comes from IoT devices, other sensors or the cloud, data will enable robots to continually capture and analyze information—and then use those insights to take action. An intelligent "robot exercise coach," for example, could not only learn from the collected data from hundreds of thousands of fitness-device wearers, but also automatically recommend a specific stretching and exercise regimen tailored to each user.

So what's standing in the way of creating robots that have this data at their, well, fingertips? Some of the key challenges are legal and ethical, not engineering, Howard explains. "The folks that collect data have to ensure that it's shareable," she says. In her own research with therapeutic robots for children, Howard is restricted to the data from her small group of test subjects, which limits what robots can learn and therefore, potentially constrains their functionality.

“Sharing data is very important—it means I can provide my data to another researcher and I can access their data, and we’re all better off for it,” Howard says. The idea of shared data, however, opens the potential risk of running afoul of recent data privacy regulations in Europe6, California7 and elsewhere.

With AIoT, Robots Become Decision-Makers

With this critical combination of data and intelligence, robots can meet a host of critical applications not only in the industrial sector—where they’re already8 driving efficiency and lowering costs—but also in health care, education and other fields.

Howard herself is currently experimenting with robotics in early childhood development. Her robots—which are more toylike than the metallic, vaguely threatening droids typically imagined in movies and TV shows—can recognize changes in her subjects’ facial expressions and voice to provide situationally appropriate responses. For example, a robot can detect subtle cues of a child’s anxiety, such as furrowed eyebrows or a turned-down mouth, and then respond with comforting gestures of its own, such as a gently nodding head to indicate support and empathy.

In addition to this supportive role, AIoT technologies allow the robots to “coach” the children through exercises designed to improve motor skills. Robots are good at processing repetition, which meshes well with behavior patterns at certain age groups, Howard notes: They can use sensors to process walking movements, for example, and their AI will compare the child’s progress to data about other children. From there, the robots will take action to help the child improve his or her motor skills. In fact, in one study9 centered on helping children with autism, Howard’s robots helped increase their engagement.

Howard says we can already see the impact of AIoT, even as we envision what’s possible decades from now. The good news, she adds, is that as robots gain intelligence, humans seem more willing to interact with them.

“Parents seem hopeful about the potential benefits—I’ve not had them express

any apprehension, especially since the robots are engaging and socially interactive," Howard says of the families involved in her own research.

Humans' friendly feelings toward lifelike robots can become stronger, Howard believes, if robots continue to collect data and improve how they act on what they learn. "We're still taking baby steps here," she says, "But the more data we can use, the sooner this can happen."

Learn more about the AIoT

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Sources:

1. Georgia Tech
2. Robotic spacecraft
3. Expected to grow significantly
4. 15 percent
5. A combination increasingly
6. In Europe
7. California
8. already
9. study