

Machines are Catching Up with Human Intelligence

The State.com
Tue, Oct. 25, 2005
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Knight Ridder Newspapers

WASHINGTON — The machines are gaining on us. Their electronic brains are getting quicker and more capable and are displaying more signs of humanlike “intelligence.”

A race earlier this month by five driverless vehicles across 132 miles of twisting desert road without a living soul aboard is evidence of the remarkable progress being made in the arcane field of artificial intelligence — AI for short.

Artificial intelligence is what happens when a computer or machine does something that would be considered intelligent if a human did it, such as drive a car, play soccer, reserve a hotel room or pilot a plane.

Also known as machine intelligence, AI is wired into almost every corner of modern society. AI programs design jet engines, spot bank fraud, evaluate mortgage applications, vacuum floors, organize supply systems for Wal-Mart and the Air Force, search buildings for hidden bombs or terrorists.

The wildly popular information-search system Google is, at bottom, an AI application.

“If all the AI systems in the world suddenly stopped functioning, our economic infrastructure would grind to a halt,” Ray Kurzweil wrote in his new book, “The Singularity Is Near” (Viking, 2005). “Your bank would cease doing business. Most transportation would be crippled. World communications would fail.”

Business and industry rely on thousands of hidden AI applications that were just research projects 10 to 15 years ago, according to Kurzweil, who’s invented several successful AI systems, such as speech and handwriting recognition.

“Every major drug developer is using AI programs in the development of new drug therapies,” Kurzweil said.

An AI technology based on evolutionary principles — known as genetic algorithms — helped NASA design three small satellites that will be launched in February to study magnetic fields in Earth’s atmosphere.

“The AI software examined millions of potential antenna designs before settling on a final one,” said Jason Lohn, the lead scientist on the project at NASA’s Ames Research Center in Mountain View, Calif. “Through a process patterned after Darwin’s survival of the fittest, the strongest designs survive and the less capable do not.”

"We have seen great growth in our ability to represent knowledge and to reason about it," said Eric Horvitz, a group manager at Microsoft Research Corp. in Redmond, Wash.

Some AI systems are famous, such as Deep Blue, the computer that beat the world chess champion Garry Kasparov, or Predators, the unmanned spy planes hovering over Afghanistan.

But the machine intelligence that underlies most such systems is largely invisible, so people take their cleverness for granted. AI experts grouse that once one of their projects succeeds, people no longer consider it to be AI.

According to Rodney Brooks, the director of the Computer Science and Artificial Intelligence Laboratory at the Massachusetts Institute of Technology, "AI is everywhere around you every second of the day. People just don't notice it."

AI was born amid great enthusiasm in the 1960s, but it soon ran into computer software and hardware problems that were too tough for the much slower, far less sophisticated technology of the day. Disillusionment set in, and the 1980s and early 1990s became known as the "AI Winter."

"There was a lot of optimism about artificial intelligence in the early days. But then we hit a brick wall," said Alan Mackworth, a computer scientist at the University of British Columbia in Canada, and the president of the American Association for Artificial Intelligence.

"People were embarrassed to call themselves AI researchers," Mackworth said. "Now it's coming back. We've gotten a lot better at doing the science."

"The AI Winter is long since over," Kurzweil said.

The new wave of enthusiasm can lead to seemingly farfetched optimism.

In his book, for example, Kurzweil contends that 20 years from now, a computer program will be able to fool people into thinking that it's human. By 2045, he predicts, machine intelligence may equal or surpass the collective intelligence of all human beings on Earth, a scenario that could be more frightening than pleasing to contemplate.

"I don't see any reason why we can't achieve that," Mackworth said. "Ray (Kurzweil) has a helluva good track record. I don't take him lightly."

Microsoft's Horvitz said Kurzweil might be "somewhat or way too optimistic." But he added, "Over the long term ... we may learn enough to understand how to create intelligences that capture some or many aspects of our own intelligence."

Doubts remain, of course. As anyone who's used an automated answering system to make a reservation knows, computers still don't understand human language very well.

"We don't have truly intelligent machines yet," Marvin Minsky, a senior computer science professor at MIT, told the annual meeting of the American Association for Artificial Intelligence last summer in

Pittsburgh. “Although there have been terrific achievements, such as Deep Blue beating the chess champion, there is no program that shows the resourcefulness of a 2-year-old.”

Stanley, the robotic Volkswagen that won the Defense Advanced Research Project Agency’s race across the California desert on Oct. 9, was designed by the Artificial Intelligence Lab at Stanford University in Palo Alto, Calif.

Every 30 seconds, Stanley had to integrate signals from a global positioning system, a camera “eye,” lasers to detect obstacles and its accelerator, brakes and wheels to navigate the rugged course.

“Stanley has a model of how gas, brake and steering inputs affect his motion,” said Mike Montemerlo, one of the Stanford team leaders. “Stanley estimates his position very accurately.”

Earlier this year, the National Science Foundation, a taxpayer-supported research agency, asked AI researchers to develop “robust intelligence” systems that can assess their environments, develop plans to achieve goals, learn from experience and communicate their knowledge to others.

Seems pretty much like what a human boss would ask his human employees to do.