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Behind a Computer's Surprise Victory, Hints of Global Economic Upheaval

By Paul Basken | MARCH 14, 2016

Yao Qilin, Xinhua News Agency/Getty Images

The unexpected struggle of Lee Sedol, a world champion of the ancient and immensely complicated board game Go, against a Google-owned computer program suggests that artificial intelligence may have the capacity to reshape human life much faster than many experts have anticipated.

After his surprise losses over the past week to a Google-owned computer system, Lee Sedol, a champion of one of the world's most complex board games, can take a couple of major points of consolation: He still has both his career and his sense of personal accomplishment.

For most everyone else in the world, however, the looming implications might not be quite as clear.

Millions of jobs and ways of life are going to change in the next big wave of automation. And as Mr. Lee has found out in a five-game challenge match, underway in Seoul, South Korea, it may all be coming much sooner than both experts and laymen have been expecting, before most are ready.

"There's absolutely no question about it — it's a dramatic sign of progress," Christof Koch, president and chief scientific officer at the Allen Institute for Brain Science, said of Mr. Lee's defeats in the centuries-old brain game known as Go.

The Google-owned computer program that beat Mr. Lee, AlphaGo, is a cutting-edge example of programs that mirror humanlike brain structures, and its success against Mr. Lee in Seoul is now indisputable. The computer won the first three games in the match before Mr. Lee finally captured one, on Sunday. The fifth and final game will be played on Tuesday.

The game of Go, in which Mr. Lee is an 18-time world champion, dates back more than 2,500 years to China, where it was considered an essential spiritual art. It involves alternating placements of black and white stones on a square grid, aimed at capturing territory. The full-sized version of the game has 19 lines on each side, meaning hourslong contests with hundreds of possible moves each turn.

Even for a computer, that's too much complexity for a "brute force" calculation of the outcomes of all possible moves over several player turns. Human experts such as Mr. Lee typically describe their play as involving large amounts of intuition.

AlphaGo works largely by combining versions of two established computer processing techniques. One is known as an artificial neural network, which is a vast array of data-processing points that make individual contributions toward the goal of identifying a complex overall pattern. The other is known as Monte-Carlo tree search, which involves logical chains of what action leads to another, driven by feedback on outcomes and the quick elimination of nonviable pathways.

'A Big Deal'

Like past instances of computers that beat top human competitors — such as Deep Blue against the chess grandmaster Garry Kasparov in 1997, and Watson against the *Jeopardy!* champ Ken Jennings in 2011 — AlphaGo was specifically trained for its game.

But experts credit AlphaGo with much higher expectations for wider applicability, given the need in Go to make decisions from an array of choices far more numerous than it can actually calculate. "This is much closer to the way animals do it, including us," said Mr. Koch, a former professor at the California Institute of Technology. "It's a big deal."

Others are somewhat less certain. The software that beat Mr. Lee is impressive, said Miles Brundage, a doctoral student at Arizona State University who has been studying AlphaGo. But Google also "threw a lot of hardware at it," Mr. Brundage said.

That suspicion is shared by Mark O. Riedl, an associate professor of interactive computing at the Georgia Institute of Technology. The AlphaGo victory may reflect improvements in computer processing speeds as much as software innovation, Mr. Riedl said, and once-rapid advances in the operating speed of computer chips have slowed over the past decade.

And while a Go playing board presents a forbidding number of choices, it's still a constrained world, not a full replication of the number of options faced in many real-world environments, said Bart Selman, a professor of computer science at Cornell University.

But even with all of those uncertainties about the importance of AlphaGo, the current rapid progress in artificial intelligence "is absolutely genuine," said Edward M. Geist, a research fellow at the Center for International Security and Cooperation at Stanford University.

AlphaGo's ability to cull decisions out of more information than it can directly process has direct implications for machine vision, which is needed for self-driving cars and text-to-speech interfaces, Mr. Geist said. Some companies are already starting to offer self-driving technologies. But the science behind them is proprietary and outside experts have had trouble assessing how close they really are to widespread commercial application.

Jobs at Stake

When that application fully arrives, that will mean huge changes in employment. Some 10 percent of all American jobs involve driving vehicles, and most all of them will be lost, said Moshe Y. Vardi, a professor of computational engineering at Rice University. "What are we going to do with these 3.5 million people?" asked Mr. Koch. "Are they all going to turn into Java programmers? I'm not sure."

Other sectors seen as likely to experience widespread job losses from future forms of humanlike automation include customer service and agriculture. And while the general population may be slow to recognize the implications, experts in artificial intelligence are warning that politicians and even academics aren't doing much better.

"This is a real issue of our time, and none of our politicians right now is even mentioning it," Mr. Koch said. "I'm not sure anybody even knows about this, which is rather depressing."

There is attention to the issue among university researchers, said Wendell A. Wallach, chair of the Technology and Ethics study group at Yale University's Interdisciplinary Center for Bioethics. But much of it appears to be disjointed talk rather than concerted action, he said.

Mr. Wallach is pulling together an interdisciplinary project with the Hastings Center, a bioethics-research institute, to assess the societal effects of artificial intelligence. He found himself surprised by the lack of awareness of the implications in fields such as sociology and economics. "These people are almost oblivious to what each other is doing," he said.

Part of the problem with focusing on the real economic and social threats, Mr. Vardi said, is excessive attention on far less realistic fears, such as robots taking over society. Elon Musk, the founder of Tesla Motors, is a leading voice behind those worries, calling artificial intelligence humanity's biggest threat and spending millions of dollars to deal with it.

Those kinds of fears may eventually prove valid, Mr. Vardi said. But it's so far beyond current computer capabilities, he said, that it would be like worrying about genetic engineering in 1953 right after James D. Watson and Francis Crick discovered the structure of the DNA molecule.

The far more urgent need, Mr. Brundage said, is a real and comprehensive examination of how society and its economy will function once artificial intelligence begins wiping out millions of jobs. Academics are paying attention, Mr. Brundage said, but largely in theoretical settings. It's a case of being "more talked about than actual research on it," he said.

Correction (03/14/2016, 11:10 a.m.): This article originally referred to Lee Sedol, on subsequent references, as Mr. Sedol. The references should be to Mr. Lee. The article has been changed to reflect this correction.

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