

Get smart: Tech companies pour resources into artificial intelligence

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Credit: Piotr Siedlecki/Public Domain

The latest Silicon Valley arms race is a contest to build the best artificial brains. Facebook Inc., Google Inc. and other leading tech companies are jockeying to hire top scientists in the field of artificial intelligence, while spending heavily on a quest to make computers think more like people.

They're not building humanoid robots - not yet, anyway. But a number of

tech giants and startups are trying to build computer systems that understand what you want, perhaps before you knew you wanted it.

"It's important to position yourself in this market for the next decade," said Yann LeCun, a leading New York University researcher hired to run Facebook's new A.I. division in December. "A lot is riding on [artificial intelligence](#) and content analysis, and on being smarter about how people and computers interact."

Artificial intelligence programs can already recognize images and translate human speech. Tech researchers want to build systems that can match the [human brain](#)'s ability to handle more complex challenges - to intuitively predict traffic conditions while steering automated cars or drones, for example, or to grasp the intent of written texts and spoken messages, so they can better anticipate what kind of information, including ads, their users want to see.

Facebook has recruited several well-regarded A.I. scientists, including one from Google, in recent months. Google has been working on artificial intelligence for several years, enlisting prominent researchers such as Stanford's Andrew Ng and the University of Toronto's Geoffrey Hinton to help build computer systems known as "neural networks," which are capable of teaching themselves.

But in a sign it wants to do more, Google paid a reported \$400 million in January to buy DeepMind, a British startup said to be working on artificial intelligence for image recognition, e-commerce recommendations and video games. DeepMind had also drawn interest from Facebook. In March, Facebook CEO Mark Zuckerberg invested personally in Vicarious, a Silicon Valley startup working on software that can recognize - and draw - images of animals or other things.

"In the last 18 months, every venture capital firm I know has made at

least one investment" in artificial intelligence, robotics or related sectors, said Raj Singh, CEO of Tempo AI, which makes a "smart calendar" mobile app that acts like a personal assistant. Tempo uses technology from SRI, the Menlo Park, Calif., think tank that developed key elements of Apple's Siri and has spun off several artificial intelligence startups.

Competition among digital personal assistants is especially heated: While each works differently, Tempo is vying with Siri, Google Now and Microsoft's new Cortana. Through a series of upgrades, each has tried to outdo the others in providing reminders and anticipating questions by analyzing relevant data from users' calendars, contact lists and email.

The ultimate goal is something closer to "Samantha," the personable operating system voiced by actress Scarlett Johansson in the film "Her," though it undoubtedly will be more businesslike.

Right now, even Siri fans have voiced frustration with its limitations, including balky silences and nonresponsive answers. But there are signs Apple is working feverishly to improve it.

"Apple is hiring some of the most intelligent guys in this field," said Abdel-Rahman Mohamed, a University of Toronto researcher who has used a form of artificial intelligence known as "deep learning" to improve speech recognition by computers. Based on Apple's recent hiring, Mohamed predicted Siri will improve dramatically.

Facebook, meanwhile, wants to better understand its users' posts and preferences so it can show them more relevant messages, LeCun said. It's working on improved facial recognition algorithms for photo-tagging. Zuckerberg has also hinted he wants to compete with Google in providing answers to users' questions, drawing on recommendations and observations by the social network's 1.2 billion members.

"The goal here is to use new approaches in A.I. to help make sense of all the content that people share, so we can generate new insights about the world to answer people's questions," Zuckerberg told analysts recently. "This has the potential to be really powerful."

Google has similar goals. So do Microsoft, Yahoo, China's Baidu and other companies. IBM poured more than \$1 billion into its Watson computer system, which uses artificial intelligence and competed on "Jeopardy."

Already, Google has used artificial intelligence to improve its voice-enabled search and Google Now, as well as its mapping and self-driving car projects. Google wouldn't discuss the details of its projects, but CEO Larry Page showed his enthusiasm at a TED technology conference in March.

"I think we're seeing a lot of exciting work going on, that crosses computer science and neuroscience, in terms of really understanding what it takes to make something smart," Page said. He showed videos from Google and DeepMind projects in which computer systems learned to recognize cats and play games - without detailed programming instructions.

Google and Facebook both hope to do more with "deep learning," in which computer networks teach themselves to recognize patterns by analyzing vast amounts of data, rather than rely on programmers to tell them what each pattern represents. The networks tackle problems by breaking them into a series of steps, the way layers of neurons work in a human brain.

The approach was pioneered in the 1980s by a handful of scientists including Hinton, Ng and LeCun. But researchers say its potential has exploded in recent years because they now have access to more powerful

computing systems and bigger sets of data.

That technology could help companies build systems that go beyond recognizing words or phrases, to understand the intended meaning of written texts and conversational speech - so instead of typing the keywords "weather forecast San Jose," users can simply ask: "Do I need an umbrella today?"

It may also help companies like Google and Facebook analyze individuals' posts and preferences to tailor the ads they see, though neither company tends to highlight such uses.

A powerful artificial brain that knows your preferences and habits can be a scary notion, acknowledged Mohamed, who said companies must consider ethics and privacy as they develop new services.

But experts say it's clear that artificial intelligence will be used more widely. Someday soon, intelligent "assistants" will be built into a variety of gadgets and online services, predicted Singh.

"Everything is going to be more anticipatory, and more personal," he said. "If it's done right, you may not even notice it. But once you start experiencing it, you'll realize: 'Wow! How did you live without it?'"

ARTIFICIAL INTELLIGENCE

Artificial intelligence is a broad term that covers a number of goals and technical methods. Here are some problems that tech companies are working on:

- Speech recognition, or the ability to translate spoken words into computer commands.

-Image recognition, or the ability to recognize objects from visual representations.

-Natural language processing, or the ability to discern the meaning and intent of written texts and conversational speech, and recognize their relevance even if they don't contain specific search terms.

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