| ARTIFICIAL INTELLIGENCE

FACEBOOK AI CHIEF PUSHES THE TECHNOLOGY'S LIMITS

Yann LeCun is one of a handful of scientists at companies and universities world-wide training artificial intelligence to better learn by itself

Facebook's chief artificial intelligence scientist, Yann LeCun, photographed outside his home in New Jersey, is working on training AI to better learn by itself.

PHOTO: MAMADI DOUMBOUYA FOR THE WALL STREET JOURNAL

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As babies drop spoons and cups from their high-chairs, they come to understand the concept of gravity. To a parent, it might seem like the process takes forever, but babies typically grasp the idea in a few months.

Algorithms require much more data and time to learn much narrower lessons. A handful of scientists are pushing the furthest limits of artificial intelligence by training it to better learn by itself, more like a baby.

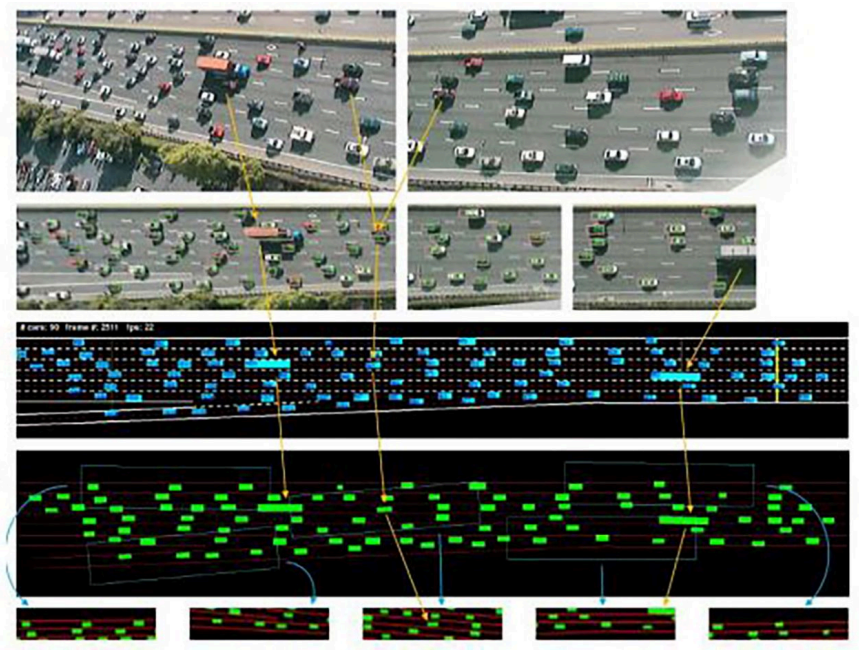
"This is the single most important problem to solve in AI today," says Yann LeCun, chief artificial intelligence scientist at Facebook Inc.

It is a Manhattan Project-like effort that will go on for years, if not decades. At Facebook, Alphabet Inc.'s Google and other companies and universities around the world, scientists are working to create better AI that learns through self-supervision, teaching itself about the world the way people do. The immediate goal is broader AI that can perform multiple tasks, but that could one day lead to artificial general intelligence, or machines with humanlike thinking.

Scientists have had some early success with self-supervised learning, especially in areas such as natural-language processing used in mobile phones, smart speakers and customer-service bots.

While there is no assurance of success, ongoing innovations could help unlock applications from the creation of fully autonomous vehicles to virtual tutors for school children, more effective medical-imaging analysis and the real-time identification of hate speech on Facebook, according to Dr. LeCun.

Today, training AI is time-consuming and expensive, Dr. LeCun says, and for all that effort it can't comprehend concepts such as gravity. You might be able to teach today's AI about the dangers of driving a car too close to a cliff, he says, "but you would have to crash thousands of times."



Using imaging from an overhead camera, AI models are trained in a self-supervised way to predict how every car moves relative to a central car.

PHOTO: YANN LECUN

In self-supervised learning, AI can train itself without the need for external labels attached to the data. It doesn't need to be told "this is a cat" to identify other images of cats, or to distinguish between images of "cats" and "chairs."

Dr. LeCun is now focused on applying self-supervised learning to a more complex problem, computer vision, in which computers interpret images such as a person's face.

The next phase, possible over the next decade or two, is to try to create a machine that can "learn how the world works by watching video, listening to audio and reading text," he says.

Dr. LeCun, who shared the 2018 A.M. Turing Award for his work on deep learning, joined Facebook in 2013.

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"Yann's a visionary," says Kyunghyun Cho, a professor of computer science and data science at New York University's Courant Institute of Mathematical Sciences, where Dr. LeCun also is affiliated.

The push for self-supervised learning is a high priority at Facebook, which is under pressure from lawmakers, outside groups and its own users to crack down harder on misinformation and hate speech.

An audit commissioned by Facebook, made public in July, found the company had not done enough to police hate speech and other problematic content on its platform, despite investments in AI-based censors and teams of human analysts trained to track down and remove harmful content.

Self-supervised learning, which can strengthen AI-based filters, is "very important" to detect hate speech in hundreds of languages, Dr. LeCun says. "You can't wait for users to flag hate speech. You have to take it down before anyone sees it," he says.

Not all research is focused on self-supervised learning. Another important approach is called neuro-symbolic, which combines two techniques, deep learning and symbolic AI. Using this neuro-symbolic approach, International Business Machines Corp. is at work on a technology that extends AI's strength in interpreting human language to machine language.

An AI bot works alongside human engineers, reading computer logs to spot a system failure, understand why the system crashed, and offer a remedy. It also can be used to help people write software code, suggesting ideas much as a spell-checker might.

Broader AI could, in time, increase the pace of scientific discovery, given its potential to spot patterns not otherwise evident, says Dario Gil, director of IBM Research. "It would help us address huge problems, such as climate change and developing vaccines."

Until now, the best-performing self-supervised learning has relied on "contrastive learning," or using examples of what a thing is not to train the system to recognize the thing itself, according to Michal Valko, a machine learning scientist at DeepMind, a U.K.-based Google division focused on AI. A few images of a dog might be included in a data set of cat images to better illustrate what a cat is. The so-called negative examples were thought to improve the performance of the system but could introduce errors, Dr. Valko says.

A promising idea in self-supervised learning emerged in June, when Dr. Valko and others at DeepMind published a paper outlining a new approach. The DeepMind research showed that these negative examples could be eliminated.

"By doing so we improve the performance, make the method more robust, and possibly increase the applicability of the method," he says.

For AI to model and navigate the surrounding world, it will also be important for AI to go beyond predicting the next item in a sequence, one at a time. Right now, natural-language processing, for example, predicts the next word in a sequence by probability. Ultimately, AI that learns in a self-supervised way would be able to predict a sequence of events in an arbitrary order and skip unimportant steps—much like humans learn to go to the store without having to perform each step of the process in the same order every time, says NYU's Dr. Cho.

The ability to make such nonlinear language predictions is closely related to making longer-term predictions in the physical world, he says. "We know how to develop a car that can drive by itself and stay in the lane," he says. But there are unsolved higher-level problems associated with autonomous vehicles where self-learning AI can play a role.

"Instead of saying, how do I change the steering wheel moment to moment, I can just say, 'I need to go to the store,'" Dr. Cho says.

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