AI Joins Hunt for ET: Study Finds 8 Potential Alien Signals

A University of Toronto undergrad among an international team of researchers unleashing deep learning in the search for extraterrestrial civilizations.

Author: Brian Caulfield

Artificial intelligence is now a part of the quest to find extraterrestrial life.

Researchers have developed an AI system that outperforms traditional methods in the search for alien signals. And early results were intriguing enough to send scientists back to their radio telescopes for a second look.

The study, published last week in Nature Astronomy , highlights the crucial role that AI techniques will play in the ongoing search for extraterrestrial intelligence.

The team behind the paper trained an AI to recognize signals that natural astrophysical processes couldn't produce. They then fed it a massive dataset of over 150 terabytes of data collected by the Green Bank Telescope , one of the world's largest radio telescopes, located in West Virginia.

The AI flagged more than 20,000 signals of interest, with eight showing the tell-tale characteristics of what scientists call "technosignatures," such as a radio signal that could tip scientists off to the existence of another civilization.

In the face of a growing deluge of data from radio telescopes, it's critical to have a fast and effective means of sorting through it all.

That's where the AI system shines.

The system was created by Peter Ma, an undergraduate student at the University of Toronto and the lead author of the paper co-authored by a constellation of experts affiliated with the University of Toronto, UC Berkeley and Breakthrough Listen , an international effort launched in 2015 to search for signs of alien civilizations.

Ma, who taught himself how to code, first became interested in computer science in high school. He started working on a project where he aimed to use open-source data and tackle big data problems with unanswered questions, particularly in the area of machine learning.

"I wanted a big science problem with open source data and big, unanswered questions," Ma says. "And finding aliens is big."

Despite initially facing some confusion and disbelief from his teachers, Ma continued to work on his project throughout high school and into his first year of college, where he reached out to others and found support from researchers at the University of Toronto, UC Berkeley and Breakthrough Listen to identify signals from extraterrestrial civilizations.

The paper describes a two-step AI method to classify signals as either radio interference or a potential technosignature.

The first step uses an autoencoder to identify salient features in the data. This system, built using the TensorFlow API , was accelerated by four NVIDIA TITAN X GPUs at UC Berkeley.

The second step feeds those features to a random forest classifier , which decides whether a signal is noteworthy or just interference.

The AI system is particularly adept at identifying narrowband signals with a non-zero drift rate. These signals are much more focused and specific than natural phenomena and suggest that they may be coming from a distant source.

Additionally, the signals only appear in observations of some regions of the sky, further evidence of a celestial origin.

To train the AI system, Ma inserted simulated signals into actual data, allowing the autoencoder to learn what to look for. Then the researchers fed the AI more than 150 terabytes of data from 480 observing hours at the Green Bank Telescope.

The AI identified 20,515 signals of interest, which the researchers had to inspect manually. Of those, eight had the characteristics of technosignatures and couldn't be attributed to radio interference.

The researchers then returned to the telescope to look at systems from which all eight signals originated but couldn't re-detect them.

"Eight signals looked very suspicious, but after we took another look at the targets with our telescopes, we didn't see them again," Ma says. "It's been almost five to six years since we took the data, but we still haven't seen the signal again. Make of that what you will."

To be sure, because they don't have real signals from an extraterrestrial civilization, the researchers had to rely on simulated signals to train their models. The researchers note that this could lead to the AI system learning artifacts that aren't there.

Still, Cherry Ng, one of the paper's co-authors, points out the team has a good idea of what to look for.

"A classic example of human-generated technology from space that we have detected is the Voyager," said Ng, who studies fast radio bursts and pulsars, and is currently affiliated with the French National Centre for Scientific Research, known as CNRS.

"Peter's machine learning algorithm is able to generate these signals that the aliens may or may not have sent," she said.

And while aliens haven't been found — yet, the study shows the potential of AI in SETI research and the importance of analyzing vast quantities of data.

"We're hoping to extend this search capacity and algorithm to other kinds of telescope setups," Ma said, connecting the efforts to advancements made in a broad array of fields thanks to AI.

There will be plenty of opportunities to see what AI can do.

Despite efforts dating back to the '60s, only a tiny fraction of stars in the Milky Way have been monitored, Ng says. However, with advances in technology, astronomers are now able to conduct more observations in parallel and maximize their scientific output.

Even the data that has been collected, such as the Green Bank data, has yet to be fully searched, Ng explains.

And with the next-generation radio telescopes, including MeerKAT, the Very Large Array (VLA), Square Kilometre Array, and the next-generation VLA (ngVLA) gathering vast amounts of data in the search for extraterrestrial intelligence, implementing AI will become increasingly important to overcome the challenges posed by the sheer volume of data.

So will we find anything?

"I'm skeptical about the idea that we are alone in the universe," Ma said, pointing to breakthroughs over the past decade showing our planet is not as unique as we once thought it was. "Whether we will find anything is up to science and luck to verify, but I believe it is very naive to believe we are alone."

Image Credit: NASA, JPL-Caltech, Susan Stolovy (SSC/Caltech) et al.

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