SETI: Alien hunters get a boost as AI helps identify promising signals from space

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Credit: AI-generated image (disclaimer)

An international team of researchers looking for signs of intelligent life in space have used artificial intelligence (AI) to reveal eight promising radio signals in data collected at a U.S. observatory.

The results of their research, published in *Nature Astronomy* are remarkable. The team hasn't yet carried out an exhaustive analysis, but the paper suggests the signals have many of the characteristics we would expect if they were artificially generated. In other words, they are the kinds of signals we might pick up from an extraterrestrial civilisation broadcasting into space.

A cursory review of the new paper suggest these are indeed promising signals. They're much more compelling than what is perhaps the most famous SETI candidate, the "Wow!" signal, radio emission bearing the hallmarks of an extraterrestrial origin that was collected by an Ohio telescope in 1977.

Realistically, it's most likely that these eight new signals were generated by human technology. But the real story here is the effectiveness of AI and the techniques used by the team to dig out rare and interesting signals previously buried in the noise of human-generated radio frequency interference, such as mobile phones and GPS.

Astronomers working in the field of SETI (the search for extraterrestrial intelligence) must filter out interference produced by radio communications here on Earth.

In this case, Peter Ma from the University of Toronto and his colleagues unleashed a set of algorithms on a mountain of data collected by the Green Bank Telescope in West Virginia, US. The data was gathered through a SETI initiative called Breakthrough Listen, established in 2015 by the investor Yuri Milner and his wife Julia.

Here are the characteristics astronomers look for in signals that could be artificially-generated: firstly they are narrow-band, which means that where the radio transmission is confined to only a few frequency channels. They also disappear as the telescope is moved to another direction in the sky, and they exhibit "Doppler drifting," where the frequency of the signal changes in a predictable way with time. We would expect Doppler drifting because both the transmitter—on a distant planet, for example—and the receiver, on Earth, are moving.

Buried in the noise

The Breakthrough Listen project's first candidate signal, called BLC1, was first announced in 2020. But it was later traced to transmissions associated with cheap electronic devices on this planet. The application of AI techniques to the Breakthrough Listen observing program, however, is a potential game changer for the field. Even seasoned SETI researchers are beginning to think that we might be on the cusp of a momentous scientific breakthrough.

This may explain renewed interest by groups around the world that are planning for SETI success. For example, a SETI post-detection hub has been set up at the University of St Andrews in Scotland. This will study how humans should react if we discover we are not alone in the Universe.

The International Academy of Astronautics (IAA) SETI permanent committee oversees the SETI post-detection protocols, which outline what steps scientists should take in the event of detecting a genuine signal. The IAA has opted to update the text of the protocols sometime later this year.

But the new study highlights a problem with previous signals of interest. When the team took another look at the stars associated with the eight narrow-band transmissions, they could no longer detect the signals.

It would not be surprising if many, and perhaps the vast majority of bona-fide SETI signals, were isolated events. After all, what are the chances that we point our telescopes in exactly the right direction, at the right time and with the right frequency on multiple occasions?

Missing ingredients

As I argued here a few years ago, SETI surveys would greatly benefit from employing multiple radio telescopes, operating in a manner that's known as a classical interferometer network.

These telescope arrays (groups of several antennas observing together) generate huge amounts of data. With AI onboard, the challenge is perhaps more manageable than previously thought.

Breakthrough Listen is already using telescope arrays such as MeerKAT in South Africa for SETI searches. In Europe, researchers have been experimenting with arrays that span the globe.

This European approach would help us isolate signals from human-made interference, give us multiple independent detections of individual events, and permit us to localize signals to individual stars and possibly orbiting planets.

Among the future projects is the Square Kilometer Array, an international project to build the two largest telescope arrays in the world, which will be based in Australia and South Africa. Another upcoming project is the next generation VLA (ngVLA), a series of linked telescope facilities that will be spread across the United States. These radio telescope arrays will be even more sensitive than current instruments.

It's my belief—and indeed hope—that somewhere out there intelligent beings are waiting to be discovered. The AI revolution might be the missing ingredient that previous endeavors have lacked. In particular, AI algorithms will eventually evolve into powerful tools that no longer suffer from human biases.

Lord Martin Rees, chairman of the Breakthrough Listen advisory board and the astronomer royal, has proposed that if we do find aliens they are likely to be intelligent machines operating in the depths of space, unconstrained by the biological limitations placed on humans.

If we ever do find a bona-fide signal, it could just be that it's mediated by machines on Earth and in space.

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