to the Finnish company Vaisala, headquartered in Vantaa, which runs a lightning-detection network. And a July 2014 storm over the Canadian Arctic caused more than 15,000 lightning strokes north of the Arctic Circle[4].

Lightning in the Arctic is normally rare, accounting for around 0.5% of all global strokes detected by the WWLLN.

But Holzworth and his colleagues found that the number of annual summertime lightning strokes above a latitude of 65° N rose from around 35,000 in 2010 to nearly 250,000 this year. The scientists studied the months of June, July and August, when nearly all Arctic lightning occurs. Many of the lightning strokes they observed happened around northern Siberia.

Tracking trends in lightning can be difficult because detection networks grow more efficient over time, as advanced sensors are added. So Holzworth and his colleagues ran several analyses to confirm that there was more Arctic lightning happening, not just more being detected. "There's no question about it," he says.

Verifying a trend

Vaisala's network has not recorded the same trend. Its data go back only to 2012, rather than to 2010. But "we don't see an unambiguous trend toward more lightning at more extreme latitudes", says Ryan Said, a meteorologist and lightning analyst in Vaisala's office in Louisville, Colorado.

In places that see relatively little lightning, such as the Arctic, just a couple of intense thunderstorms can cause a proportionally huge rise in the total number of lightning strokes detected in a given year, Said notes. With so much year-to-year variability, it can be hard to isolate long-term trends.

One way to verify Holzworth's work would be to survey Indigenous and other communities living at high latitudes, says Jessica McCarty, a geographer at Miami University in Oxford, Ohio, who studies Arctic wildfire.

Another way is to follow up with further lightning-detection studies. Holzworth's work shows "an interesting correlation" with changes in global temperature, says Antti Mäkelä, a lightning specialist at the Finnish Meteorological Institute in Helsinki. By next year, Mäkelä and his colleagues will have 20 years of data from a lightning-detection system that spans Norway, Sweden, Finland and Estonia[5] — and they plan to analyse the data set to see whether there has been an increase in lightning in northern Scandinavia.

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PRESTIGIOUS AI MEETING TAKES STEPS TO IMPROVE ETHICS OF RESEARCH

For the first time, the organizers of NeurIPS required speakers to consider the societal impact of their work.

By Davide Castelvecchi

After a year of heavy scrutiny and seemingly endless controversy around artificial-intelligence (AI) technologies, the field's most prestigious conference has tried to set a good example. For the first time, the Neural Information Processing Systems (NeurIPS) meeting, which took place completely online in December, required presenters to submit a statement on the broader impact that their research could have on society, including negative effects.

The organizers also appointed a panel of reviewers to scrutinize papers that raised ethical concerns — a process that could lead to their rejection.

"I think there's a lot of value even in getting people to think about these things," says Jack Poulson, founder of the industry watchdog Tech Inquiry in Toronto, Canada. He adds that the policy could help to shift the field's culture.

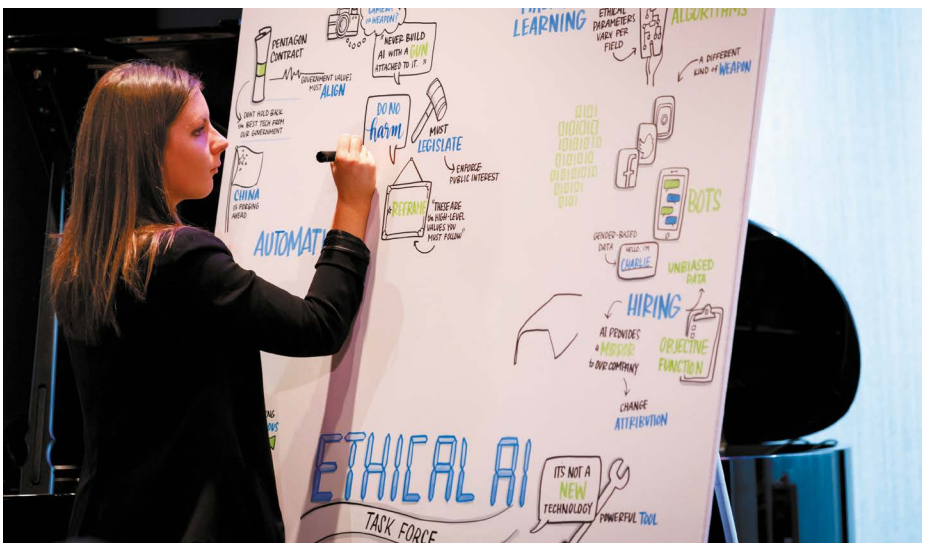
Researchers who work on machine learning are increasingly aware of the challenges posed by harmful uses of the technology, from the creation of falsified videos, or 'deepfakes', to mistakes by police who rely on facial-recognition algorithms when deciding who to arrest.

"There was previously a period of techno optimism," says Iason Gabriel, an ethicist at the AI powerhouse DeepMind, a sister company of Google based in London. "Clearly, that has changed in recent years."

Unintended uses

The idea of conference participants writing an impact statement was inspired by the Future of Computing Academy, a group led by Brent Hecht, a specialist in the human impacts of technology at Microsoft and at Northwestern University in Evanston, Illinois. In 2018, Hecht and his collaborators proposed that authors of computer-science publications should be required to state the potential side effects and unintended uses of their research. Unlike in other scientific disciplines, most peer review in computer science happens when manuscripts are submitted to conferences, rather than to journals. As the field's largest conference, NeurIPS was a natural choice to test this proposal.

The 2020 meeting attracted 9,467 submissions. The reviewers assessed papers mainly on their scientific value, but those with the potential to be accepted could be flagged for a full review by a separate ethics committee led by Gabriel. Of the 290 papers that were flagged, 4 were ultimately rejected by the programme chairs because of ethical considerations, says Marc'Aurelio Ranzato, a computer scientist at Facebook AI Research in New York



MICHAEL COHEN/GETTY

Artificial-intelligence research is coming under increasing ethical scrutiny.

City who was one of the programme chairs.

"In general, I would say the ethics process has done well," says Katherine Heller, a computer scientist at Google in Mountain View, California, who was the conference's co-chair of diversity and inclusion.

Gabriel says that most problematic issues should have been caught, because any of the three anonymous peer reviewers could flag a paper, as could the subject-area chair. "A signal from any one of them would be enough to engage the review process," he says. Still, he admits that the process was not infallible. For example, if all the reviewers happened to be men — not unusual in a male-dominated field — they might not be able to adequately assess whether an algorithm could affect women negatively. "I can't rule out the possibility that there would be blind spots of this kind," Gabriel says.

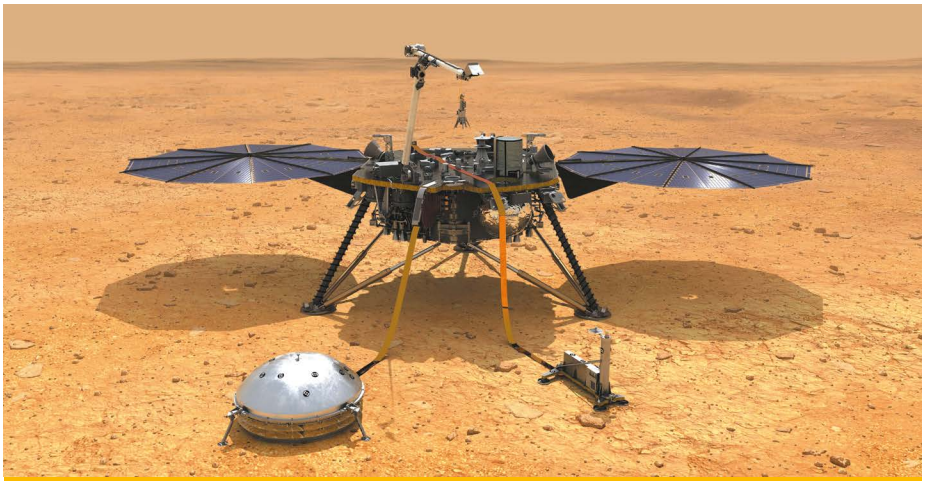
In addition, reviewers were not given specific guidance on what constitutes harm to society. For example, says Ranzato, some reviewers flagged papers that made use of databases containing personal information or photographs that were collected without explicit consent. The use of such databases has come under heavy criticism, but the conference organizers did not single out this issue to reviewers or provide a list of problematic databases. Still, Ranzato adds that the review policy is a step in the right direction. "Nothing is perfect, but it's better than before."

Policing AI

The last day of the conference featured a special session focused on the broader impact of AI on society. Hecht, Gabriel and other panellists discussed ways to address the industry's problems. Hanna Wallach, a researcher at Microsoft in New York City, called for researchers to assess and mitigate any potential harm to society from the early stages of research, without assuming that their colleagues who develop and market end products will do that ethical work. Ethical thinking should be built into the machine-learning field rather than simply being outsourced to ethics specialists, she said, otherwise, "other disciplines could become the police".

Wallach and others, such as Donald Martin, a technical programme manager at Google in San Francisco, California, are redesigning the product-development process at their companies so that it incorporates awareness of social context. AI ethics, Martin says, "is not a crisis in the public understanding of science, but a crisis in science's understanding of the public".

The revamped review process and the ethics-focused discussions are the latest in a series of efforts by NeurIPS organizers to improve practices in machine learning and AI. In 2018, the conference dropped an acronym that many people found offensive, and began a crackdown on sexist behaviour by participants. And last year's meeting featured robust discussions of AI ethics and inclusivity.



NASA/JPL-CALTECH

The Mars InSight lander is measuring 'marsquakes' with its domed seismometer (left).

FIRST PEEK INSIDE MARS REVEALS A CRUST WITH CAKE-LIKE LAYERS

NASA's InSight mission yields the first data on the internal structure of a planet other than Earth.

By Alexandra Witze

NASA's InSight mission has finally peered inside Mars — and discovered that the planet's crust might be made of three layers. This is the first time scientists have directly probed the inside of a planet other than Earth, and will help researchers to unravel how Mars formed and evolved over time.

Before this mission, researchers had measured the interior structures of only Earth and the Moon. "This information was missing, until now, from Mars," said Brigitte Knapmeyer-Endrun, a seismologist at the University of Cologne in Germany, in a recorded talk played at the virtual American Geophysical Union meeting on 15 December. She declined an interview with *Nature*, saying that the work is under consideration for publication in a peer-reviewed journal.

It is a major finding for InSight, which landed on Mars in November 2018. One of its goals is to work out the planet's internal structure[1]. The InSight lander squats near the Martian equator, on a smooth plain known as Elysium Planitia, and uses an exquisitely sensitive seismometer to listen to geological energy thrumming through the planet[2]. So far, the mission has detected more than 480 'marsquakes', says Bruce Banerdt, the mission's principal investigator and a scientist at the Jet Propulsion Laboratory in Pasadena, California.

Just as they do with earthquakes on Earth, seismologists are using marsquakes to map the red planet's interior structure. Seismic energy travels through the ground in two types of wave; by measuring the differences in how those waves move, researchers can calculate where the planet's core, mantle and crust begin and end, and the general make-up of each one. Those geological layers reveal how the planet cooled and formed billions of years ago at the fiery birth of the Solar System. Now, "we have enough data to start answering some of these big questions", says Banerdt.

Earth's continental crust is generally divided into sublayers of different types of rock. Researchers had suspected, but didn't know for sure, that the Martian crust was also layered, says Justin Filiberto, a planetary geologist at the Lunar and Planetary Institute in Houston, Texas. Now, InSight's data show that it is made up of either two or three layers.

A three-layered crust would fit best with geochemical models[3] and studies of Martian meteorites, says Julia Semprich, a planetary scientist at the Open University in Milton Keynes, UK.

Next up, InSight scientists plan to report measurements taken even deeper in Mars, says Banerdt — ultimately revealing information about the planet's core and mantle.

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