

Asking the Earth

A search engine is being built that indexes every sizeable object on Earth. Is that a good idea? **Aisling Irwin** investigates

IT HAS been 18 years since Google Earth was launched and we have become used to seeing beautiful satellite photographs. Although these images may be sharp, they are generally past their sell-by date. Google Earth imagery of any given place could be three or four years old.

Now a series of space firms is springing up with the aim of providing images of the planet that are updated in real time. Foremost among them is Planet, which held a conference a few weeks ago to explore what its technology can do.

The firm's ambitions go further than pictures. It plans to create an interface through which users can ask questions about the entire planet. They call it "queryable Earth". Think of it like a search engine not for the internet, but for the surface of our world.

There are good reasons that such a thing might be useful. Imagine you are a stock trader and want to know how a retail business is doing. You could read the newspapers or dig into financial reports. But it turns out that you could get a useful insight if you ask how many vehicles are in the business's car parks.

This idea has been around for a while. Connecticut-based firm RS Metrics was founded in 2011 and began by using click counters to tot up the number of cars in parking lots on satellite pictures. This information is sold to investors, to provide an up-to-the-minute hint at how well the company is trading.

The approach seems to work. A recent analysis by Panos Pataoukas at the University of California, Berkeley, and his colleagues looked at 4.7 million RS Metrics observations of about 67,000 shops across the US between 2011 and 2017. The team



350 of its own satellites. Only about 140 are still in orbit, because they eventually burn up in the atmosphere. This includes a fleet that images the entire surface of Earth every day at a maximum resolution of about 3 metres.

The firm is now coupling these images with artificial intelligence (AI) algorithms. Its AI can recognise and count all the ships in a port each day, for example. It also conducts a daily census of roads, buildings and aeroplanes across the globe.

Eventually, the firm says its customers won't need to see images at all. At the conference, Planet showcased its upcoming "automated change detection" feeds, which will tell subscribers about major changes to things like shipping traffic or the sudden appearance of roads in forests. "It gives us an ability to learn things about how the Earth is changing, as fast as it's changing. That's never been done before," says Brian Hernacki, who leads Planet's software team.

The goal is to create a real-time, indexed database of all the sizeable objects on Earth. This will mean users can effectively ask the planet what is happening, says Planet's co-founder Will Marshall.

The firm has certainly disrupted the status quo, says Josef Strobl at the University of Salzburg in Austria. It has done this, he says, principally by sacrificing fine resolution, which requires large, expensive satellites, in favour of a profusion of cheap, low-resolution imagers. "While you can get higher resolution with targeted imagery, you don't have any other platform with the daily full global picture."

Planet has the largest constellation of satellites, but it is far from the only player in this game. Orbital Analytics, in Palo Alto, California, for example, gives



found that the number of cars parked next to a company's stores accurately predicted the short-term performance of its shares in the weeks leading up to quarterly earnings reports.

The team also looked at how a trader would have fared if they had bought stocks in retailers when parking figures spiked abnormally and sold them when the figures went down. They found the return would have been 4.7 per cent higher than a benchmark trading strategy – a huge margin.

RS Metrics buys images to analyse from other firms, but Planet has launched about

Satellites show us the world in glorious detail, from the Himalayas (top) to Woody Island in the South China Sea (above left). Counting vehicles in car parks like this one in Arizona (above right) can also yield economic insights

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Number of satellites launched so far by a firm called Planet

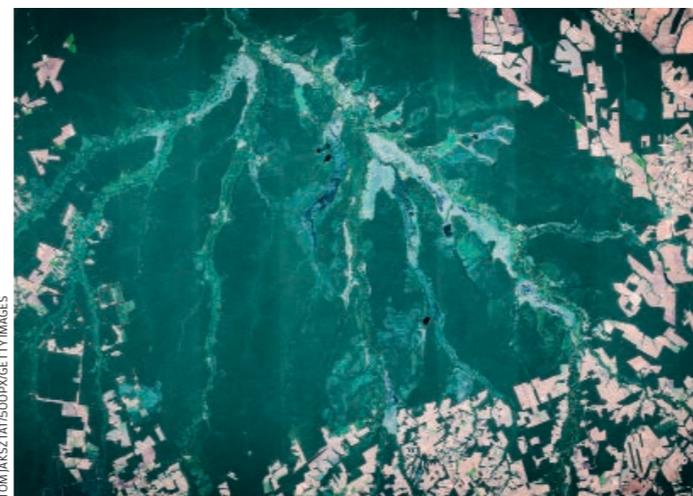
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a hint of what we might see more of in future, by pairing object detection with information such as location data from cellphones and sharper imagery from higher resolution satellites and drones.

One of its services is to estimate the levels of oil in storage around the world by looking at shadows. The firm has trained an AI to recognise oil storage tanks, which have a characteristic shape and a lid that floats up and down on the oil depending on how full the tank is. When the team set the AI to work, it found about 25,000 of these tanks around the world.

Then the AI looks at the shadow cast by the whole tank to work out its total size, and at the shadow related to the lid to work out how full the tank is. Combined with information about where the sun and the satellite were at the time of the photo, the company can calculate how much oil is stored in each tank across the planet. Such information is valuable to oil traders, especially at moments of market volatility.

Real-time images could help track Amazon deforestation



Up-to-date images can also be a boon for scientists. Planet has provided the imagery that allowed researchers to use AI to identify and map patches of the world's coral and produce the Allen Coral Atlas.

With the atlas in place, automated feeds from regular satellite imaging alert people to changes in coral reefs. These might indicate bleaching, illegal

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fishing or "survivor" patches of coral that could provide genetic material for reseeded.

David Gehl at the non-profit Environmental Investigation Agency in Washington DC says alerts like this could provide "a huge range of possibilities for conservation".

The strategy could be used to automatically pinpoint new roads built in protected forests, or to keep tabs on the logging supply chain. Micah Farfour at Amnesty International says it would make her job easier. "Theoretically, we

would be able to look over, say, the entire Rakhine state in Myanmar where the Rohingya people were burned out of their villages," she says. It could be possible to find those villages quickly.

Information could also be misused. People who want to identify and stop illegal logging could use the data, but so could people who want to identify the best places to carry out illegal logging, says Gehl.

The service could conceivably be used by malign forces during fast-moving conflicts to find refugee settlements to target. "There are very important questions raised with the technology," says Maria De-Arteaga at Carnegie Mellon University in Pennsylvania. "You may just be making communities that are already vulnerable even more vulnerable."

Planet's low-resolution imagery couldn't be used to find individual people or identify cars. Still, that doesn't negate worries over privacy. The firm's daily feeds could provide the unifying thread that ties together other technologies that are already making inroads into privacy, like drones, cellphone counts and internet-of-things devices.

In response to such concerns, Planet, Orbital Insight and similar firms say they have processes for making sure their services aren't abused. These firms also aren't the first to use satellite images.

"We actually believe that Planet is creating greater democratised access to remote-sensing information," says Hernacki. "Today, you have a very small number of governmental and commercial entities who have access to rich geospatial information," he says. "We want more people, specifically those people who didn't have access, to have access." ■

Working hypothesis

Sorting the week's supernovae from the absolute zeros



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