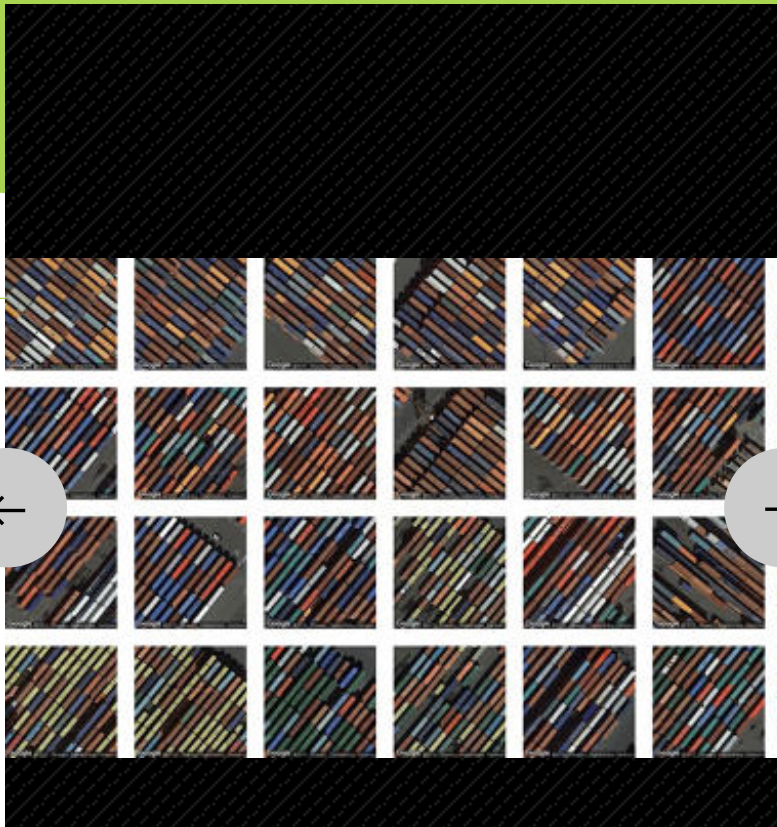




3 MINUTE READ

# This Neural Network Reveals Your City's Secret Patterns

Terrapattern is a new search engine for satellite imagery that could open the door to a real-time Google Earth.





01 / 07



JOHN BROWNLEE | 06.01.16 | 7:00 AM

### What if you could search the

topography of the real world as easily as you search the Internet, all in real time?

Terrapattern is a new search engine that does just that. Created by a team led by data researcher [Golan Levin](#),

Terrapattern combines satellite data and machine learning to let you search four major American cities for interesting patterns and points of interest, whether that's all the [Christmas tree farms in San Francisco](#) or the [fracking wells of Pittsburgh](#).

While it's a great time waster for anyone, Terrapattern could have a big impact on the workflows of journalists, government agencies, urban designers, and more, within the next few years.

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Like the neural network that powers Google's [Deep Dream AI](#), [Terrapattern](#) uses a deep convolutional neural network to group patterns in satellite map data by type. For example, it can tell just by looking at a satellite map that two tennis courts, or sports stadiums, are of the same type. All neural networks like this need to be "trained" to identify content using a library of data. In the case of Terrapattern, this training library was provided by [OpenStreetMap](#), a collaborative map of the world (complete with a satellite component) that volunteers have been building out since 2004. Using OpenStreetMap's data, Levin was able to train his neural network to "look" at a tile of satellite imagery, and "see" what it shows.

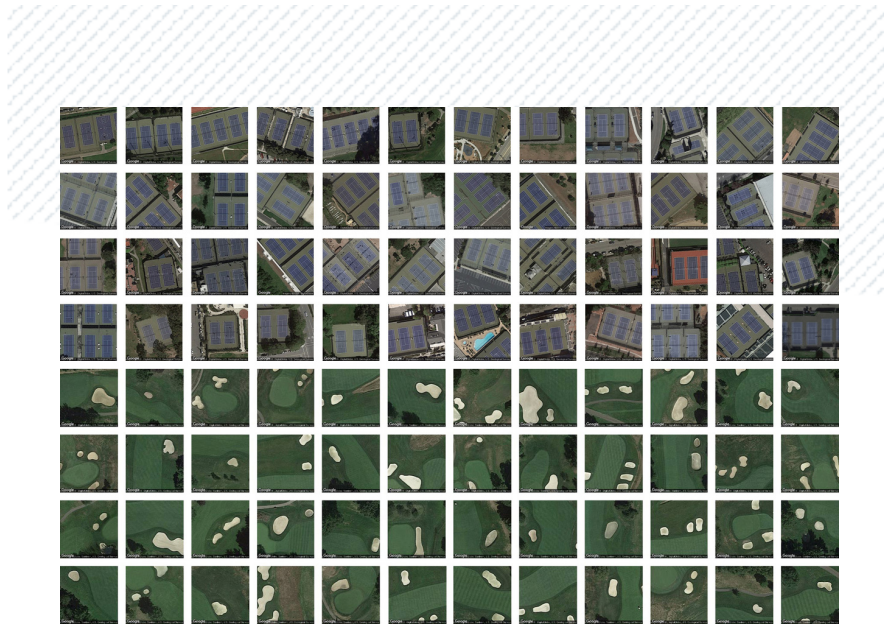
**You can use it to search for all the churches in Detroit, or all the topiary gardens in New York City.**

Unlike Google Photos, you can't just search Terrapattern for all examples of, say, swimming pools or skate parks. You need to know where one example of what you're looking for is located first—so you have to browse by city, dragging your way through a satellite map and clicking on features that interest you. Once

you do so, Terrapattern suddenly shows off its power: You can use it to search for all the churches in Detroit, or all the topiary gardens in New York City, and so on.

Terrapattern has a couple limitations right now. One, it only works in four areas: Pittsburgh, New York, San Francisco, and Detroit, cities chosen by the team because they either lived there, or had friends there. In theory, there's no reason Terrapattern couldn't be expanded to encompass the whole world, but the bottleneck is computer power. Powering a single city's search in Terrapattern requires 10 GB of active RAM; Levin estimates they would require

2,000 times more to store and serve a searchable model of the whole United States.



The second limitation has to do with the size of a search area. Terrapattern isn't great about searching for features smaller than 10 meters (around 33 feet), or larger than 100 meters (328 feet), but that isn't a hard limit. Future versions of Terrapattern past the alpha prototype stage could well enable larger or smaller scale searches.

According to Terrapattern's creators, there is every reason to believe that within the next few years, access to whole-earth satellite imagery that is updated on a daily basis will be widely available online. Compare that to today,



where the satellite imagery of your area in Google Maps might be weeks or months out of date. Once daily satellite imagery is widely available, Levin and his team believe that there will be a lot of interest in tools that can help make sense of it.

**Levin hopes it will serve as a useful baseline for the planet-sized search engines to come.**

Humanitarian organizations could use satellite data to identify mass migrations of refugees as they happen, and predict where they're going before they get there. Journalists could also use this data to identify patterns for stories, proving (for instance) there's been a 30% increase in solar panel installations in the

last six months, a 20% decrease in forest fires from a year ago, or where armies were building up their forces. Skaters could find new zones to conquer by watching what swimming pools in their area have been allowed to go empty over the summer.

Terrapattern is an attempt to prototype the sort of tool that will be needed when

satellite imagery is updated regularly. It's a thought experiment that anticipates what we'll want from a real-time Google Earth when the time comes, and while it's not there yet—Terrapattern can't compare satellite imagery over time, nor can you use natural language to search, like you can in Google Photos—Levin hopes it will at least prove useful as a baseline for the planet-sized search engines to come.

[You can try it for yourself here.](#)

*All Images: via [Terrapattern](#)*

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