

## **Annapolis, Attica**

*James Bridle*

“Do you ever feel like you’re living, not in the wrong place, but in the wrong time? Like something occurred, or is going to occur, right here, just down this street, but you’ve missed it or you’re going to miss it and there’s no going back or forwards? Do you get FOMO for the future?”

Anna was studying at the Technical University, a visiting scholar. She specialised in remote sensing and urbanism. Something about uncovering the patterns of the city using satellites and infrared cameras. She didn’t like talking about it except when she got drunk, and then it was all she could talk about.

“FOMO?”

“Fear of missing out. But, like, not for right now, but for the future.”

I looked up at her. She hadn’t been herself for a while, it felt like. When I met her, back in the summer, she’d been drunk most of the time. So had I. The bars, the beach, the islands. It was a good summer. But when term started again I’d seen less and less of her, snatching the odd coffee here and there in the cafeteria, sometimes wandering up to the square for beers. She’d texted me for a drink the month before, and insisted on asking me loads of questions about machine learning - something she’d been working on with a partner from another department, closer to mine. I’d explained some of the principles, the lay of the land.

“People have been trying to do this for a few decades, but it’s only in the last five they’ve got really good. Massive neural networks, using all the data on the web, and all the processing power on the network. That’s why Facebook and Google are really good at this. They’ve got all of the information and all of the power. Facebook knows what two billion faces look like, and owns six datacentres. Google has three times that number. They’re using neural nets for tagging photos, translating languages, even making music. They’re like electronic brains.”

“So you feed in all this information, and the system, like, reads it, and builds a model of what it sees? And then it can make inferences from

that model? So if you show it lots of pictures of cats, and lots of pictures of dogs, it can recognise the difference between cats and dogs?”

“Yeah, that’s one thing you can do with it. But you can put in any kind of data, not just images. Statistics, designs, formulae, functions - anything you can express in maths, in ones and zeroes. It doesn’t really discriminate.”

“But it’s predictive, right?” she asked.

“Well, sort of. It can come up with new outputs, but they’re always some variant of what you’ve put in. It can’t just make stuff up, out of nothing.”

I got the impression she understood, but she didn’t seem very satisfied.

That evening she’d come to Πωλείται with a sheaf of print-outs, big ones, A3 and A2, folded and scored with markings. She’d put them down between us and started drinking. She looked tired and very, very excited at the same time.

“So,” she said. “So. We finally got the network running, the big one I told you about.” I didn’t know what she was talking about, and it showed. “You know. The landscape reader.” I blanked, and she grimaced. “Jesus, you must have been drunk. OK.”

She started drawing on the empty side of one of the papers. Lines of nodes, circles with letters in them, connected by lines. Arrows going in one side, arrows out the other side. A neural network. Plus little cartoons of satellites and houses.

“We’re working with archeology and maths,” she said. “Maths is the collaborator; archeology is the client. We’ve been looking at aerial maps from before the war, when the air force did a bunch of surveys of the city and the countryside, and then there’s more aerial surveys from the 60s and 70s, and from the 80s onwards you’ve got LandSat, GeoEye, a bunch more satellites coming in. Loads and loads more data. Archeology are looking for new dig sites, I was looking at the road planning - but I’ve got most of this historical stuff on file. Archeology figured that if we looked at enough of that imagery the right way, we could find new sites. Places that had been overlooked, places only visible from the air.”

She saw me frown. “They’ve been doing this for ages. Have you heard of shadow sites?” I shook my head.

“Shadow sites are places that are only visible from the air because they’re so low to the ground. Walls that have weathered down for millennia, maybe all that’s left is a few inches high. Imagine you’re walking through the desert, and it’s just miles and miles of rock and sand. The sun’s bouncing every which way and you can’t see a thing. Now imagine you’re a thousand - or five hundred thousand - feet up. At dawn and dusk the low sun catches the tops of those walls and boom - suddenly these straight lines appear. You can see the outlines of everything.”

“And we can do way more than that,” she said. “We can use interference, thermal infrared, microwave - we can see what the ground is made of, and what’s underneath it. So if the ground has been disturbed, or something’s been buried, it pops right out. In Egypt, they’ve been finding all these new tombs using synthetic aperture radar. In Belize, they found a whole city they didn’t know about, right under the trees, with LiDAR.”

“Jungles, deserts,” I said. “What has this got to do with the city?” I waved a beer bottle around. “Everything here’s been turned over a million times. There’s nothing just lying about on the surface just waiting for you to come pick it up.”

“That’s what this is for,” she said, jabbing at the diagram. “We’ve been using a neural network to explore the images. To find hidden patterns over time. Things that you can’t see, that nobody can see, unless you see how a machine sees: through time, through all kinds of different data.”

“But,” I said, squinting. “That network is massive. You’ve got, what, three hidden layers? And what’s the dimensionality?”

“Four,” she said. I looked blank again. “Yeah, I know. We had to ask the university in Geneva to use one of their supercomputers. Some kind of deal for them coming over here next summer. But this is the point. Nobody has built one this big for this stuff before. I don’t know anyone

who's even tried to do urban data plus historical data plus climate, hydrological, social, political..."

"Climate? Social and political?"

"These things are input agnostic, right. You said you can give it anything in numbers. We started with just the aerial photos, the city over the last few decades. Then we added the satellite data: interferometry, elevation, buried watercourses from SAR. And then we put in the meteorological data: rainfall, pressure, temperature fluctuations. And the social history: timelines of the various political parties, voting records, immigration patterns... basic shit. But look, that's not what I came to tell you. I wanted to show you what came out."

She turned over one of the sheets of paper and unfolded it. It was a map of Athens, with the sea at the bottom, and the city sprawling up to the edges of the mountains. At long oblique angles, the city was scored with black lines, rectangles stretching from the southwest to the northeast, thickening out to the northeast and blurring into the next set of lines.

"We overlaid the true colour outputs onto a contemporary map, but this is the equivalent of one of those shadow sites I told you about. These things are man-made: they're structures."

"Structures? These are buildings? But they're huge. Nobody ever built anything like this. And when?"

She pulled another one out. This was in false colour - all bright greens and reds - and apart from the yellowish circle of mountains, the city seemed to have disappeared. Between the rectangles was just flat, dark grey, while the structures themselves were olive-brown and peach. Around them, to the north and east, ran a new line, a thin curve of bright pink, broken in a few places with notches and what looked like gates.

"Look," she said, "This is thermal and shortwave infrared, together with some natural green. We've got plants here - all over the structures - but everything else is water, pretty much. That ridge doesn't show up in the shadows because it's just under the waterline."

"I don't understand," I said. "You're saying the city used to be flooded?"

“Well, that’s what it looks like, but these water levels are all wrong. The water was never this high, not since the last ice age, and there weren’t settlements here then. Hell, there weren’t settlements anywhere then, not like this. These look like canals. But the height differentials are crazy, you’ve got blocks and blocks here, like skyscraper-size blocks, or container ships. Like a port, but they’re not shaped like ships. These are towers. And that ridge, it’s too sharp to be mountains, it’s some kind of wall. We’re looking at a city, right? But it’s been inundated. It must have taken years, decades. That’s a sea wall: with locks and gates to keep the water back. But it wasn’t enough in the end. The water came over. And the buildings - they must have figured out how to grow them, like plants.”

She put down the map, and rolled another cigarette, lit it, and blew the smoke out.

“We asked for an extrapolation from the data, but we didn’t specify the direction. We thought we would get a map of the past, but this... this is a map of the future.”