Policing

The aftershocks of crime

An idea borrowed from seismology may help to predict criminal activity

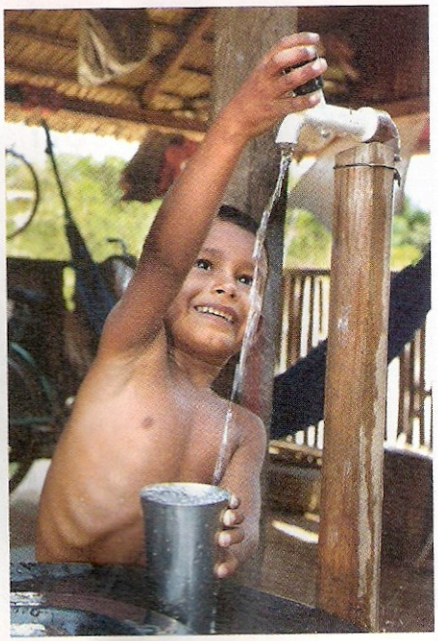
LOS ANGELES is one of the most under-policed cities in America. With a mere 26 officers for every 10,000 residents (Chicago, by comparison, has 46), the Los Angeles Police Department (LAPD) needs all the help it can get.

That help may be at hand, with a modification of technology used to predict another type of threat that the city is prone to: the aftershocks from earthquakes. Big earthquakes are unpredictable. Once they have happened, however, they are usually followed by further tremors, and the pattern of these is tractable.

George Mohler, a mathematician at Santa Clara University, in California, thinks something similar is true of crimes. There is often a pattern of "aftercrimes" in the wake of an initial one. The similarity with earthquakes intrigued him and he wondered if the mathematical formulas that seismologists employ to predict aftershocks were applicable to aftercrimes, too.

To test this idea, he and a team of researchers from the University of California, Los Angeles, adapted a computer program used by seismologists to calculate the likelihood of aftershocks. They then seeded it with actual LAPD data on 2,803 residential burglaries that occurred in an 18km-by-18km region of the San Fernando valley, one of the city's largest districts, during 2004. Using the seismological algorithms, the computer calculated which city blocks were likely to experience the highest number of burglaries the next day, and thus which 5% of homes within the area were at particular risk of being broken into. In one test the program accurately identified a high-risk portion of the city in which, had it been adequately patrolled, police could have prevented a quarter of the burglaries that took place in the whole area that day.

In addition to modelling burglary, Dr Mohler examined three gang rivalries in Los Angeles, using data from 1999 to 2002, and discovered that similar patterns emerge from gang violence as retaliations typically occur within days—and metres—of an initial attack. That, too, should help police deploy their limited resources more effectively. RoboCop move over, then. ComputerCop is coming.



Clean water

Silver threads of life

A water filter that kills bacteria, rather than just removing them

MORE than a billion people lack clean water—and in most cases the lack is just of cleanliness, rather than of the water itself. The result is disease, particularly diarrhoea. This kills millions of children a year and stunts the growth of millions more. Better water filters, then, could save many lives and improve many others, and Yi Cui of Stanford University thinks he has come up with one.

Traditional filters work by forcing water through pores to weed out bacteria. That needs power, as well as frequent changes of the filter element as the pores fill up with bugs. Dr Cui's filter, though, does not screen the bacteria out. It kills them.

The filter element he and his team have designed is a mesh of tiny carbon cylinders, known as nanotubes, and silver wires laid on top of a thin strip of cotton cloth. Silver is well known to kill bacteria, so Dr Cui conjectured that forcing bugs to pass close to the metal without actually trapping them might lead to their destruction. He also suspected that running an electric current through the silver might help the process, because electrical fields have the ability to break down the membranes that surround bacterial cells. Though silver is a good conductor, carbon is cheaper, and the nanotubes provide the extra electrical conductivity needed.

To make their new filter, the team first dipped strips of woven cotton into "ink"

sion research, consists of some 10,000 standardised images of 101 types of just such complex shapes, including faces, cars and watches. When a ConvNet with unsupervised pre-training is shown the images from this database it can learn to recognise the categories more than 70% of the time. This is just below what top-scoring hand-engineered systems are capable of—and those tend to be much slower.

This approach (which Geoffrey Hinton of the University of Toronto, a doyen of the field, has dubbed "deep learning") need not be confined to computer-vision. In theory, it ought to work for any hierarchical system: language processing, for example. In that case individual sounds would be low-level features akin to edges, whereas the meanings of conversations would correspond to elaborate scenes.

For now, though, ConvNet has proved its mettle in the visual domain. Google has been using it to blot out faces and licence plates in its Streetview application. It has also come to the attention of DARPA, the research arm of America's Defence Department. This agency provided Dr LeCun and his team with a small roving robot which, equipped with their system, learned to detect large obstacles from afar and correct its path accordingly—a problem that lesser machines often, as it were, trip over. The scooter-sized robot was also rather good at not running into the researchers. In a selfless act of scientific bravery, they strode confidently in front of it as it rode towards them at a brisk walking pace, only to see it stop in its tracks and reverse. Such machines may not quite yet be ready to walk the streets alongside people, but the day they can is surely not far off. ■

Correction: In "SpaceShipTwo" (October 16th) we said that the latest NASA authorisation bill paved the way for an unmanned mission to an asteroid. That should, of course, have been "a manned mission". Several asteroids have already been visited by robot spaceships, and NASA's *Dawn* craft is currently on its way to two others, Ceres and Vesta, which are the largest of them all.