

# Futures



We explore the trends and technologies that are set to shape the future

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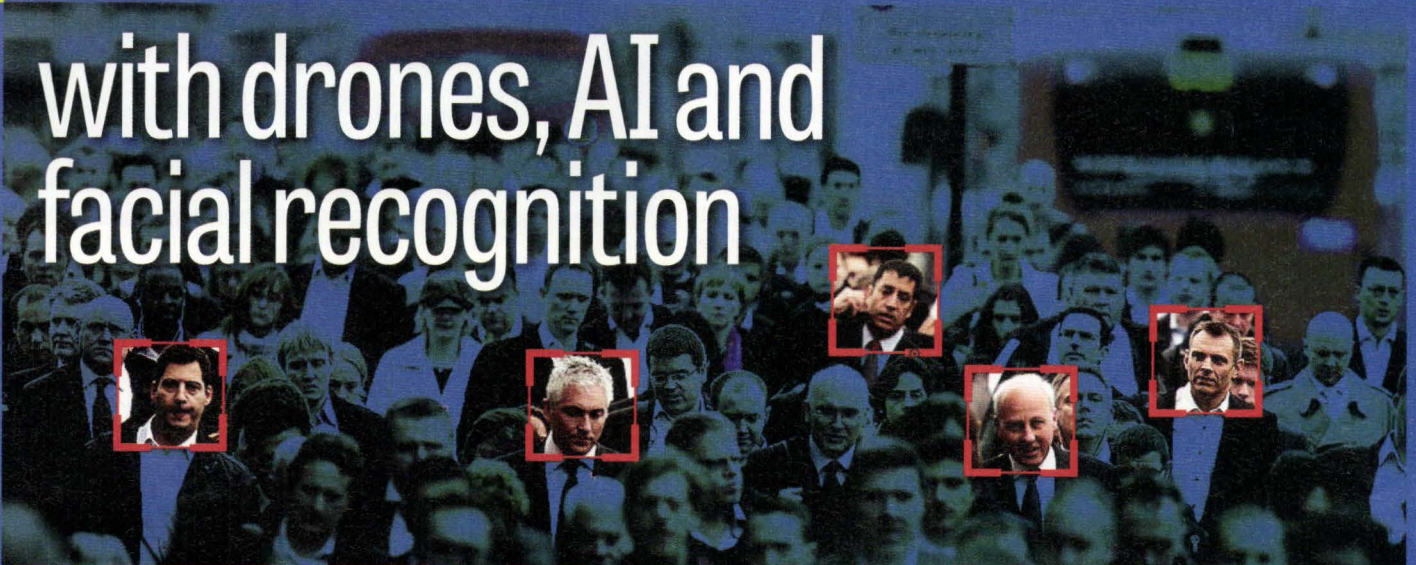
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### POLICE TECH SPECIAL

# POLICING THE FUTURE

## with drones, AI and facial recognition



Police are trialling facial-recognition cameras, human-hunting drones and artificial intelligence. Nicole Kobie reveals the tech on test

The police van looks like any other, but on its roof sits a pair of large cameras. Along the side, above the blue and yellow reflective paint, is the explanation: “*Adnabod Wynebau Wedi Ei Gosod*”. Or, in English: “facial recognition fitted”.

This innocuous statement may well be the future of British policing – and the South Wales Police force’s facial recognition tech has already paid off with its first arrest. A man wanted for an unspecified crime was spotted by the cameras at the UEFA Champions League final in Cardiff in June.

It’s not the only trial of future tech by British police. AI is helping decide

who to bail and who to keep in jail, drones are hunting for missing people, and body-worn cameras are soon to be the norm. The future is coming faster to forces elsewhere, with Dubai boasting its own “RoboCop” and a driverless car that chases down criminals (see p126).

Alongside reducing danger to the public and officers, police are eyeing the same benefits from technology as any other organisation – saving cash, time and effort – but the downsides are potentially much larger (see p127), with concerns over privacy invasion and algorithmic bias. Rollouts must therefore be carefully trialled and

considered, with British police forces frequently working with academics for robust research into what works and what knock-on effects there may be to any new technology.

For example, body-worn cameras are growing in popularity – the Metropolitan Police force is rolling out cameras made by Taser-maker Axon to 22,000 frontline staff – so the University of Cambridge studied 2,000

officers sporting the wearable recorders. Its findings? Their use cut complaints from the public by 93%.

“Cooling down potentially volatile police-public interactions to the point where official grievances against the police have virtually vanished may well lead to the conclusion that the use of body-worn cameras represents a turning point in policing,” said

**“Police are eyeing the same benefits from technology as any other organisation, but the potential downsides are much larger”**

Cambridge criminologist and study author Dr Barak Ariel, at the time of publication.

### ■ AI-boosted decisions

Another such project is a joint effort between police in Durham and the University of Cambridge, who are trialling the use of artificial intelligence to help decide which people accused of crimes should be kept behind bars or sent home on bail. Working with Cambridge, Durham Constabulary has created the Harm Assessment Risk Tool, which uses data known about a suspect to decide if they're likely to pose a risk of violent crime if released from police custody.

The system gives a rating of low, medium or high risk, although a final decision is made by a custody sergeant. The system has been tested for two years before being allowed to influence decisions; during that time, the researchers who developed it say it was accurate more than nine times out of ten.

However, the rise of AI and intelligent cameras in police work has more to do with boosting officers' abilities rather than replacing them, notes Dr Anne Adams, senior lecturer in innovation at the Open University. "The interesting and intriguing way forward with technology is not so much in the technology itself, but how the technology merges with the intelligence of us," she told *PC Pro*.

### ■ Crime prediction

It's nigh on impossible to mention police technology without referencing *Minority Report*, the 2002 film based on Philip K Dick's

short story about crime prediction. Police already throw AI at datasets for predictive policing, but not in the way that story suggests.

Instead, data is analysed and mapped to predict where crime might flare up. This not only means police can be deployed to that area but also helps us understand and address the reasons behind such crime hotspots.

That idea is being trialled by Imperial College London and the Metropolitan Police, alongside a host of other universities and police forces around the country, with mathematicians and police teaming up to develop algorithms to spot potential problem areas.

"These models are based on crime data and seem to work well, but we can make improvements to provide greater levels of statistical validity of model-based predictions," Professor Mark Girolami of Imperial College London said at the project's launch earlier this year. "With more powerful models we can start to predict not just where, but when, and what type of crime is likely to occur."

He warned that there are ethical issues to consider, particularly when such models are extended from predicting which neighbourhoods could become crime hotspots to spotting potential serial offenders. "For example, some police forces would like to be able to predict who might become a serial offender, and make an intervention at an early stage to change the path followed," he noted. "The ethical issues are really huge there - should we even be thinking about such interventions?"

## EYE IN THE SKY



ABOVE Sussex and Surrey police have a squad of 40 officers trained to fly Aeryon SkyRangers, costing £64,000 apiece

Sussex and Surrey police have teamed up on a drone squad since last year, training 40 officers to fly five Aeryon SkyRangers. The quadcopters cost £64,000 apiece - and were purchased via external grants from the Home Office's Police Innovation Fund, the forces stress, rather than coming out of operating budgets - and travel at 30mph, carrying thermal or HD cameras.

Devon and Cornwall police ran a drone trial in 2015 using smaller devices costing about £5,000 apiece. The trial was successful enough that the drone team has its own Facebook page to share the intriguing eye-in-the-sky photos, plus this March recruited a drone manager - a job title that certainly looks good on a business card.

The aim is to search for missing people, help with major incidents or investigations, assist with event planning and management, and "provide situational awareness" to officers, with Surrey and Sussex both noting that drones will help police access areas they normally couldn't see to catch criminals and scout for evidence, without risking the safety of officers.

LEFT For non-Welsh speakers, this van says "facial recognition fitted" on its side





For that reason, he said the project will include not only mathematicians “working on theorems and proofs” but will also include psychologists and social scientists.

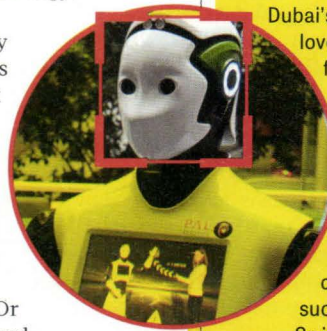
### ■ Where humans are better

Such tools may help support police, but Dr Adams notes they can’t outright replace officers. As one example, she points to a subset of police workers known as “super-recognisers” – people who can spot a face in the crowd and identify it as one of hundreds or thousands of wanted criminals.

While those super-recognisers can be helped in their work via databases of images being better connected, so criminals roaming the country can be more easily noted, there’s simply no computer system that’s as good at recognising faces as these people – including the Welsh

facial-recognition van. “They can literally see somebody for two seconds and recognise them far better than technology,” Adams explained.

That’s especially true as police forces face challenges not only in crime, but in managing other areas of social services, such as mental health issues. “They have to deal with everything,” Dr Adams said. “It’s hard enough for a police officer to understand issues around health care... it’s not so simple that a computer can deal with it.” Drones, facial recognition and AI may make officers’ jobs easier, but policing still needs a human touch.



## RISE OF THE ROBOTS?

Dubai’s public services love their toys: firefighters have been trialling jetpacks for sky-high tower rescues, and local police are famous for their collection of sporty cars such as Ferraris.

So it’s no surprise that it’s the first police force in the world to have a robot officer. But while robots have long been used by police for bomb disposal and could have a role in active shooter or hostage situations, Dubai Police’s RoboCop is more about public relations.

The humanoid robot cop is based on PAL Robotics’ REEM model, which the company pitches as a service machine. “She can be a receptionist, entertain and compliment your guests, provide dynamic information and even make presentations and speeches in many languages,” PAL’s website promises. Not quite the role of most police, in Dubai or anywhere else.

Indeed, the receptionist robot is tasked with rolling around Dubai’s malls and tourist attractions, to offer information via its touchscreen and let people report crimes or pay fines, as well as to collect data about transport and traffic. Its only crime intervention skills are to broadcast what it can see back to human police in a command centre.

That’s similar to security robots made by Californian firm Knightscope, which are already rolling around malls, offices and an Uber parking lot,

using 360-degree infrared cameras and a microphone to spot suspicious activity. However, an early version failed to spot a child in a mall, and ran over the curious tot – the firm has since improved its robots to avoid such incidents.

Will British beat cops be replaced by a machine? Not anytime soon. Dubai Police have said they hope such rolling RoboCops make up 25% of their force by 2030, but they’ll be additions to the force, not replacing an officer. And no wonder: so far, they’re little more than a helpful CCTV camera on wheels. While having eyes on the ground can help, robots are best deployed for a specific task – a Roomba is excellent at vacuuming the floor, as long as you expect nothing more from it.

Dubai’s next policing robot shows more promise. The O-R3, from Singaporean startup OTSAW Digital, is a hip-high, four-wheel robot that looks like a toy car. Like the Knightscope K5, it has 360-degree cameras, but the automated patrol car adds the ability to look for wanted people using facial recognition. It can even deploy a mini drone for an eye in the sky.

What it does when it catches them remains to be seen, but a requirement for human officers to be on scene to make a final arrest shouldn’t be seen as a fault. Policing isn’t a black and white issue and subtleties of human interaction will remain beyond AI for a long time to come, if not forever.

## VIRTUAL REHABILITATION

Virtual reality headsets have been used to treat PTSD and other mental health issues, as well as for training. Virtual Rehab has brought both VR and augmented reality to prisons, to cut re-offending rates.

“We develop programmes comprised of real-life scenarios and curriculum that prepare offenders along with drug/alcohol addicts to

experiences real-life scenarios that challenge them with typical decisions that they need to make upon their release,” Dr Wahidy said. “The offenders are measured against their actions and reactions to these scenarios.” The aim is to build self-awareness, as well as social, professional and behavioural skills, with the results then analysed by their therapist.

The idea is backed up by academic research stretching back to the mid-1990s, starting with Kaiser Permanente’s work on treating acrophobia, with similar technologies used to treat mental illness and PTSD. And, Dr Wahidy notes,

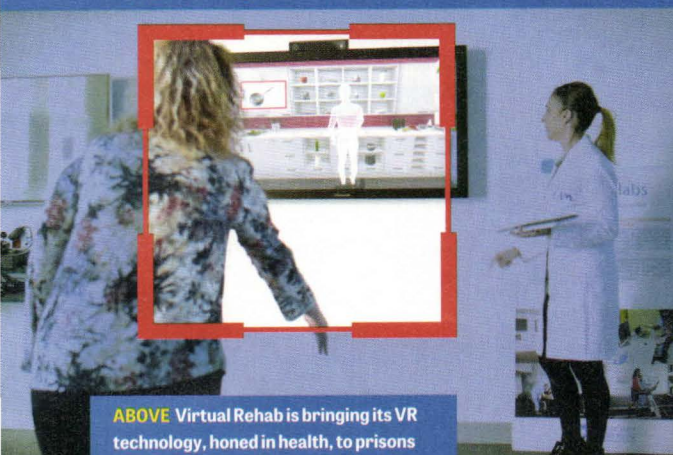
it’s been proven that people grasp education better when they have a chance to practise. Virtual Rehab is already being used in the US, but is yet to roll out in Europe or the UK.

“Ideally, we would like for Virtual Rehab to be used as a tool which helps offenders to re-integrate back into society,” Dr Wahidy explained. “The last thing we want is for an offender to spend years in prison and come out not knowing how to behave or what to do, and as a result, re-offend all over again.”

**ABOVE** Virtual Rehab is bringing its VR technology, honed in health, to prisons

re-integrate back into society upon their release from prison and rehab centres,” founder Dr Raji Wahidy told *PC Pro*. “Our programmes include formal education, vocational job training, psychological rehabilitation, and correctional services rehabilitation.”

The programmes pair a widely accepted psychological treatment called cognitive behaviour therapy (CBT) with exposure therapy. “The offender is immersed into a virtual environment where he or she



**RIGHT** Dubai’s second “RoboCop” can cruise the streets on the look-out for criminals using facial recognition

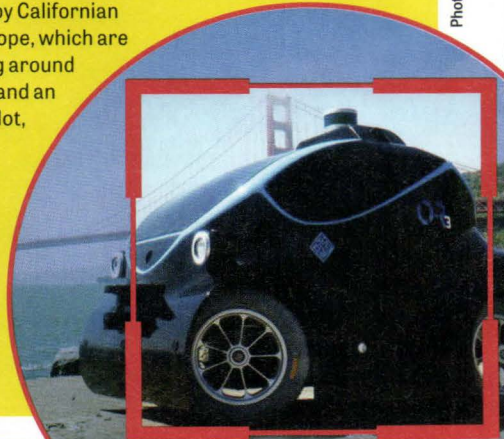


Photo: Virtual Rehab

Photo: OTSAW

Photo: Metropolitan Police



# WHY TECH AND POLICING DON'T ALWAYS MIX

## If police want futuristic technologies, they need to get better at following data protection laws

There's a reason futuristic policing films such as *Blade Runner* and *RoboCop* are set in apocalyptic versions of our world – there's a lot that can go wrong when technology and police combine.

While there's potential for improved transparency, faster response times and cheaper but better results, there are also concerns around privacy invasion, excessive surveillance and abuse of power.

"While technological advances may bring benefits for policing, this must always be balanced with the risks they pose to our privacy and security," said Pam Cowburn, communications director at the Open Rights Group. "The police have a duty to uphold human rights law and that includes ensuring that their techniques do not violate our fundamental rights."

That's not always easy, she noted, as tech develops more quickly than the law. "For example, drones armed with Tasers or driverless police cars could easily become a policing reality in the UK (they are already being adopted in other countries)," she said. "We need to ensure that we have the laws to regulate developments such as this."

### Legal wobbles

Existing laws aren't always as robust as rights campaigners would like. The Investigatory Powers Act of 2017 – the so-called Snoopers' Charter – gives police the power to hack devices, for example.

But there are protections. Last December, the Court of Justice of the EU ruled that police must get independent authorisation to view communications data. "Despite this, the police continue to get internal sign-off for such requests," said Cowburn. "We know that there have been abuses of such powers:

for example, the accessing of journalists' data. If the police want to maintain the public's trust, they need to ensure that there is rigorous oversight and regulation of their powers."

Even when we do have laws in place to protect us, police forces can bend or push the rules. "There have been a number of occasions when the UK police have refused to delete data because it can be useful in the future," Cowburn said. "This goes against the core principle of data protection."

For example, in March the independent Biometrics Commissioner criticised British police forces for storing the images of millions of people who have not been charged with any crimes, and holding that data on searchable databases. In response to the commissioner's report, the Home Office noted that people could request to have their images deleted... if they happen to know the police have their photo. The Home Office also noted that not all forces use the Police National Database, so it's difficult to say how many photos are held nationwide. The collection in question has 19 million photos, but it doesn't include the Metropolitan Police Service, the largest in the country.

Body-worn cameras, drones and intelligent CCTV will only increase the data

collected on us and stretch the applicability of existing law. "For example, the government's guidance on surveillance cameras says, 'people in public places should normally be made aware whenever they are being monitored by a surveillance camera system'" said Cowburn.

"It is difficult to see how this can be met if police are continuously filming via body wearables."

On the other hand, body-worn cameras don't only raise risks, but have clear rewards, Cowburn noted. "Wearables could also make the police more accountable and provide evidence if they are accused of abusing their powers," she said.



ABOVE As body-worn cameras become more common, the questions about police-owned data will only grow

And what of *Minority Report*-style policing? The use of algorithms to predict where crime will happen – and potentially who will commit it – as well as to support decisions on bail, punishment and so on could prove problematic. "Predictive policing is particularly worrying as it can reverse the presumption of innocence," Cowburn explained. "Algorithms can have inherent racial and social biases. This must be taken into account if they are being used, for example, to make decisions about bail or re-offending. There needs to be proper oversight to pick up on any bias."

That's a problem as we have a tendency to trust technology as neutral and fair over human decisions. "Officers may be more likely to trust a computer's decision as more neutral, but this may not be the case," she said. Sorry *RoboCop*, the future of policing may well be better off human.



# Q&A FACE-AGEING TECH HELPS HUNT FOR MISSING PEOPLE

How the University of Bradford professor Hassan Ugail is improving the accuracy of algorithms for ageing photos

**WHAT ARE YOU** going to look like in ten, 20 or 30 years? Professor Hassan Ugail knows. His team at the University of Bradford's Centre for Visual Computing has developed a machine-learning trained algorithm to age photos of missing people, considering not only their features, but background, culture, lifestyle and even how their family ages.

Making an accurate image of a person missing for years can help track them down, but previous models have mostly taken into account facial features, assuming all humans age in the same way. Professor Ugail first used machine learning to teach his system the different ways we age, improving accuracy.

As a test case, Ugail's team progressed photos of Ben Needham, who went missing from the Greek island of Kos in 1991, in the hopes that more accurate images might help track down the vanished toddler. We spoke to Professor Ugail to understand how the system works.

## ■ What's new about your technique?

We've used a database of 30,000 people with their ages, backgrounds and culture so the computer learns how humans age and how to individualise it. All humans age in a certain way, though there are differences. We were interested in modelling what those trends might be, mathematically and algorithmically.

Facial aging isn't a new topic, we're not the first people to look at this problem. There have been algorithms available for ageing for decades... the cutting edge before us was the assumption that all humans age in a very similar way, which is obviously wrong - there might be people who



**Hassan Ugail is professor of visual computing at the University of Bradford**

constantly drink or take drugs... they will age very fast. So there's lifestyle, culture, habit - things like that.

Our programme tries to take differences into account. That means we could take in a person's face, but also their siblings, parents and grandparents into the picture, to get a better result. We've developed a non-linear model that's individualised. It's not 100% accurate, computers can never be 100% accurate [with such predictions], but it's more accurate than previous algorithms.

## ■ How do you test the accuracy of an algorithm?

We would take a picture of you, and recreate what you would have looked like at about four or five [years of age], and then take an actual photo of you from the same age, and compare both. If there's minimal difference, for

example it passes through facial recognition as you, then we know that our algorithm is pretty accurate. That's how we can test it, by running the algorithm backwards.

## ■ Who will use this?

We're talking to various policing and charity organisations, and we've done some examples with Ben Needham. Interestingly, our results are much different than what police have produced so far, and we think ours are much more accurate. We're beginning to have discussions [on other cases], mainly for finding missing people, though there are other applications. We've done work with the BBC for entertainment purposes, looking at a photo of yourself when you're ten years older, but the main application lies in finding missing people.

## ■ Will you make an app so the rest of us can see our future?

We're computer scientists, so we tend not to develop software. If a company is interested in working with us to develop this, we'd be interested in it, but it's not really what we do. We're here to solve unsolved problems.

## ■ What's next?

We want to create an emotional analysis, to predict in real-time people's emotion. That uses simple things like a blink rate. Counting a blink rate through a computer tells a lot about what the state of a person is - the more blinks you make the more tired you are, for example. There's also looking at the face to identify what diseases or illness they might have. This sort of machine learning applied to the face is a very powerful way to predict many things. ●

