

e-book #3

# Tech Scan

Safety and security





## Innovating 10 years earlier

Technology lies at the root of many innovations. It got us from the combustion engine to adaptive cruise control, and from gunpowder to launching rockets to Mars. Nonetheless, the potential of a lot of new exciting technologies is still waiting to be unlocked, such as gait recognition and sensor data for suspicious behavior detection.

Our mission at Bit is to help companies innovate 10 years earlier. We do this by helping you find out which of these emerging technologies fit your challenge, creating a chance to seize the opportunity of early adoption.

For this, we created the Bit Maturity Wave. It's a framework that helps you to assess the maturity of technologies.



Bit maturity wave for

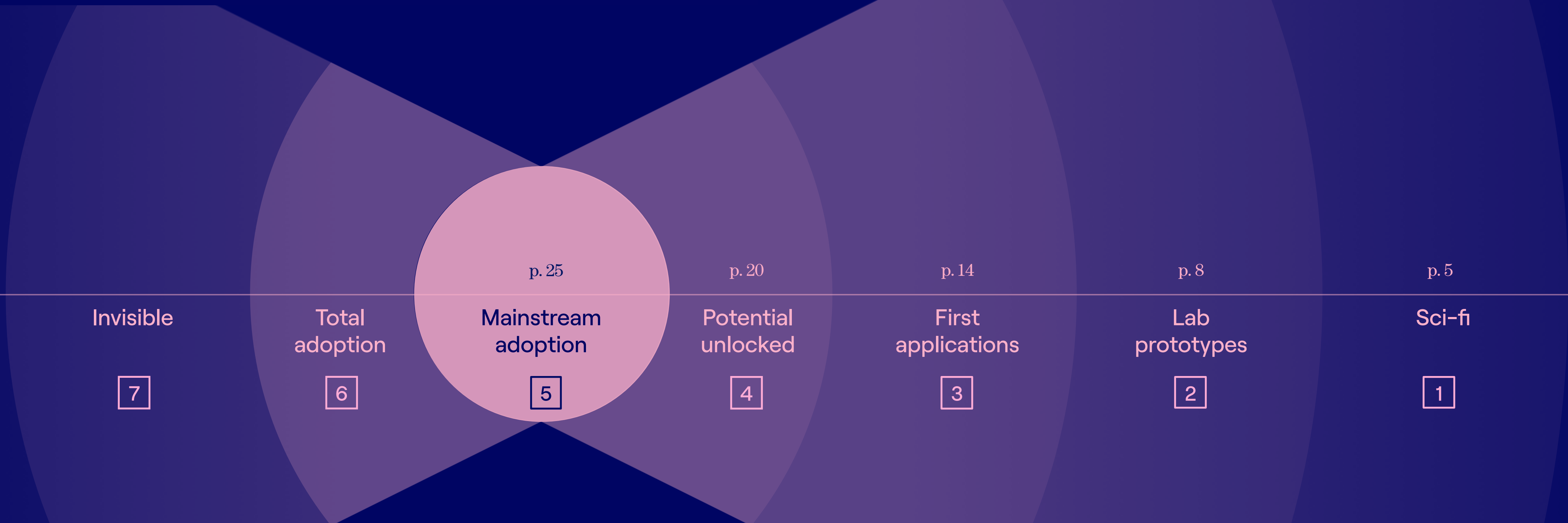
# Safety and security

The Bit Maturity Wave provides insights into promising technologies, and gives an indication of when we expect them to hit the mainstream.





# Bit maturity wave for Safety and security

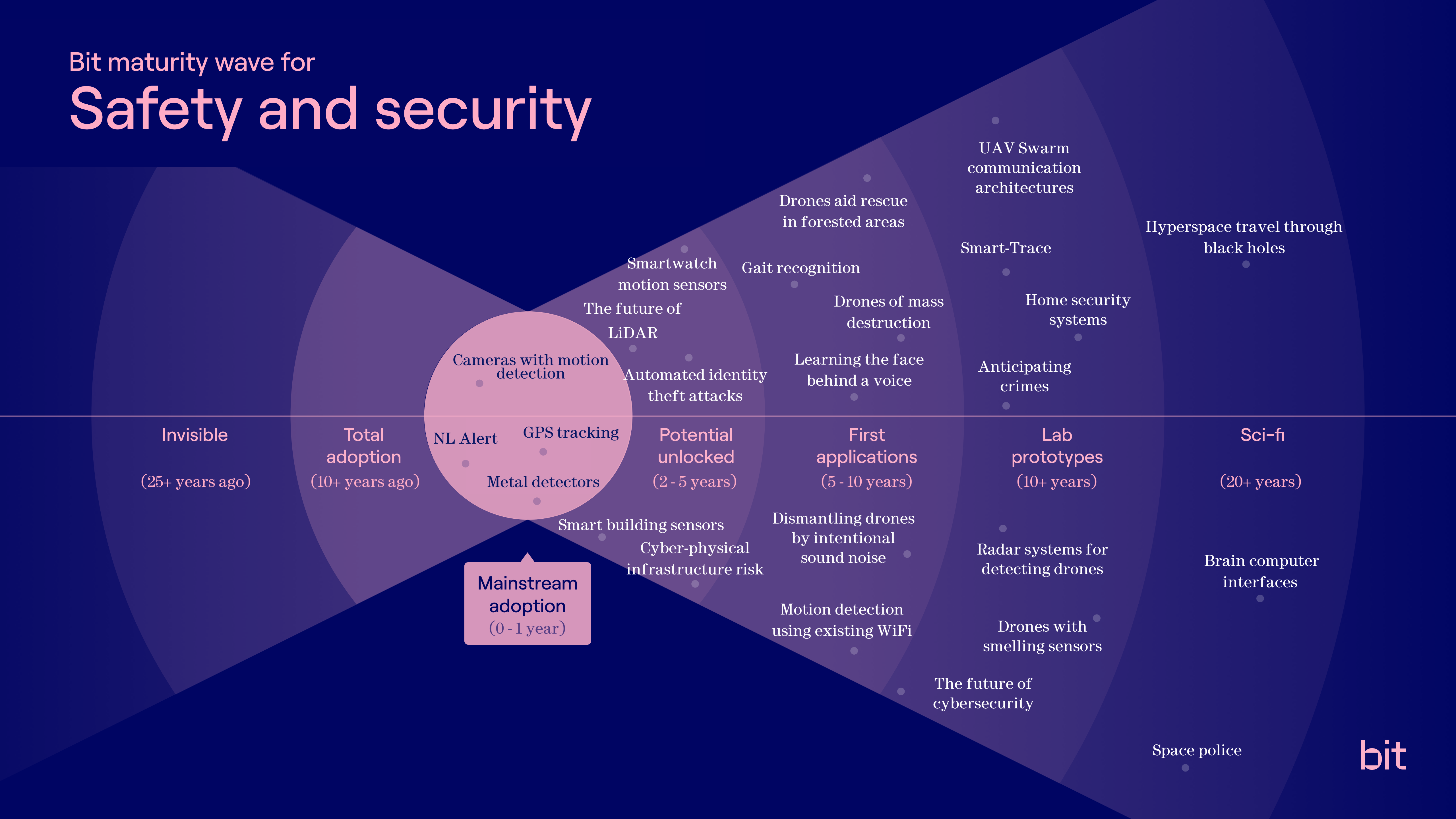


There are seven waves, each at a distinct position from mainstream adoption. In the following pages, we will explain what identifies each wave. Subsequently, we will show you which technologies currently fit this wave. Each technology contains a link to read more or see a demo.



Bit maturity wave for

# Safety and security





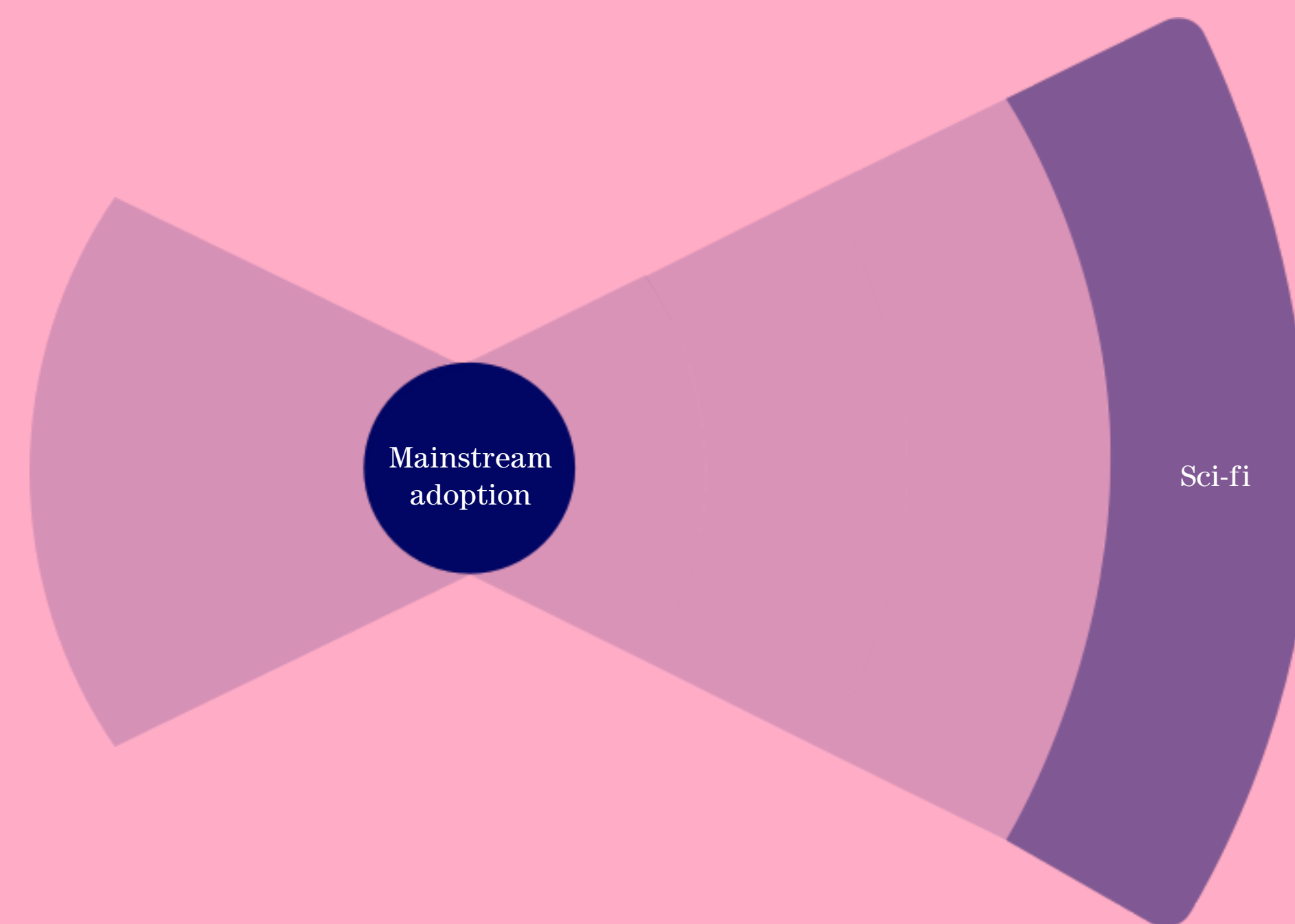
# 1 Sci-fi

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The first wave is the furthest away from becoming reality. It captures technologies that we can only envision. We have yet to figure out how we would build these technologies.

Think of tech you see in Star Wars or Jules Verne novels like teleporting or Quantum internet.

20+ years  
Time to mainstream





## Hyperspace travel through black holes

Black holes have always been considered as death traps for humans. However, physicists have recently discovered through computer simulations that certain types of black holes could actually represent the solution for hyperspace travel. One of the safest passageways might be the supermassive black hole at the center of our galaxy, called Sagittarius A. Will this portal end up being our gateway to a future safer life?

[Read more →](#)



Image: Curiosmos

## Neuralink and brain computer interface

Neuralink is a corporation founded by Elon Musk which focuses on the development of implantable brain-machine interfaces (BMIs). This piece of technology is a direct communication pathway between an enhanced brain and an external device. Although incredible developments have been achieved by the company, concerns are rising considering its implementation via invasive surgery of the interfaces together with the risks of attracting viruses through these interfaces.

[Read more →](#)

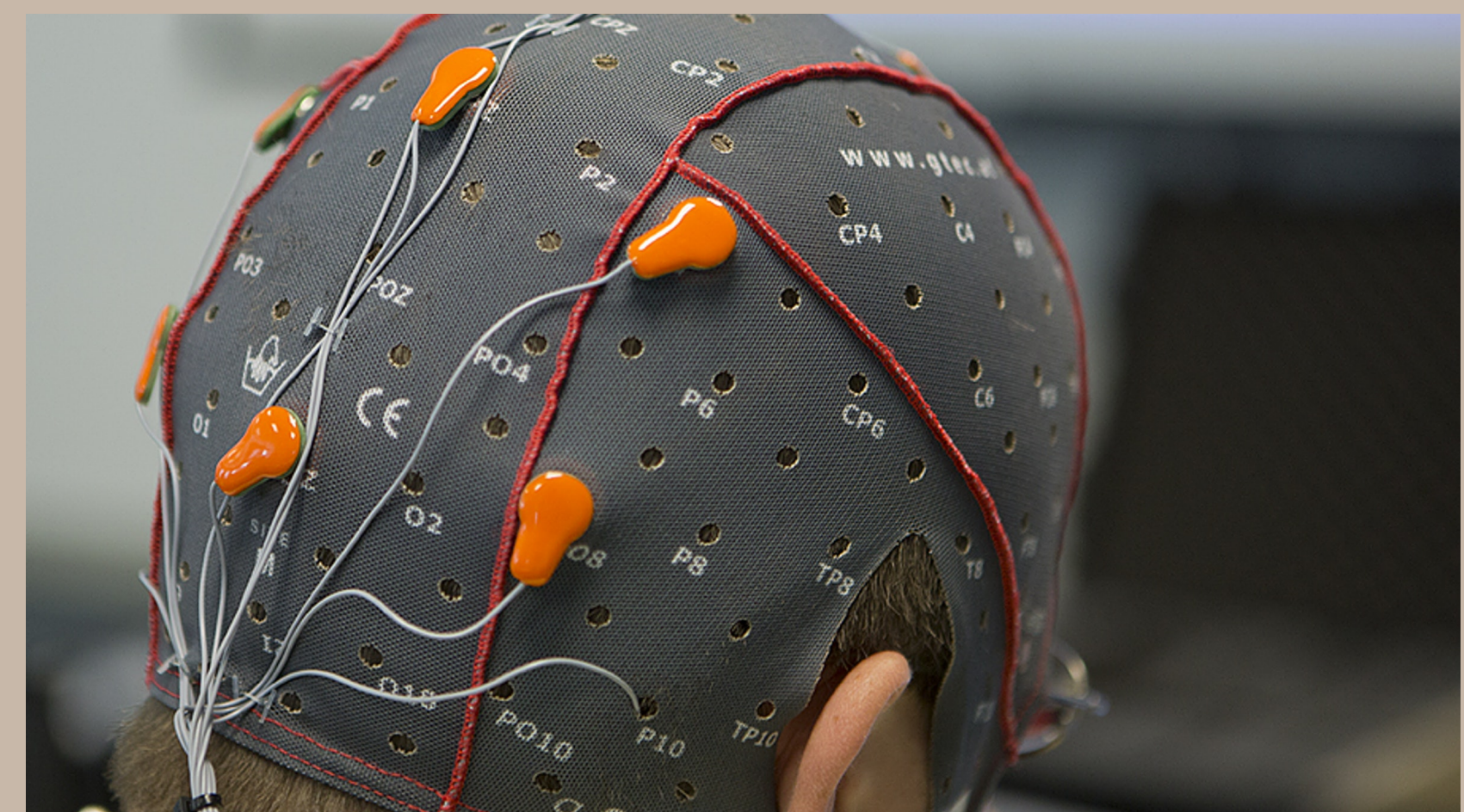


Image: massive science



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# Sci-fi

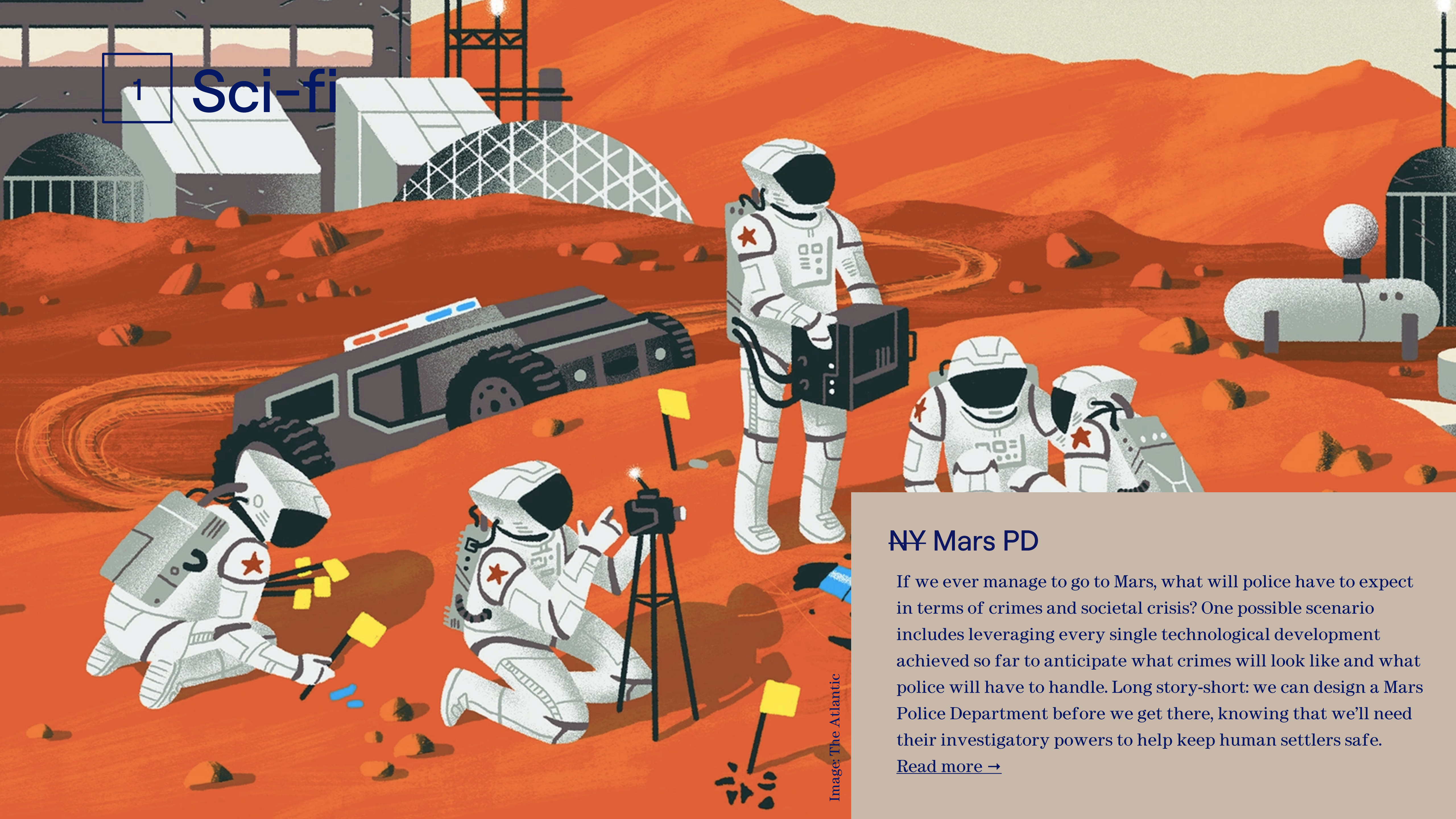


Image: The Atlantic

## NY Mars PD

If we ever manage to go to Mars, what will police have to expect in terms of crimes and societal crisis? One possible scenario includes leveraging every single technological development achieved so far to anticipate what crimes will look like and what police will have to handle. Long story-short: we can design a Mars Police Department before we get there, knowing that we'll need their investigatory powers to help keep human settlers safe.

[Read more →](#)



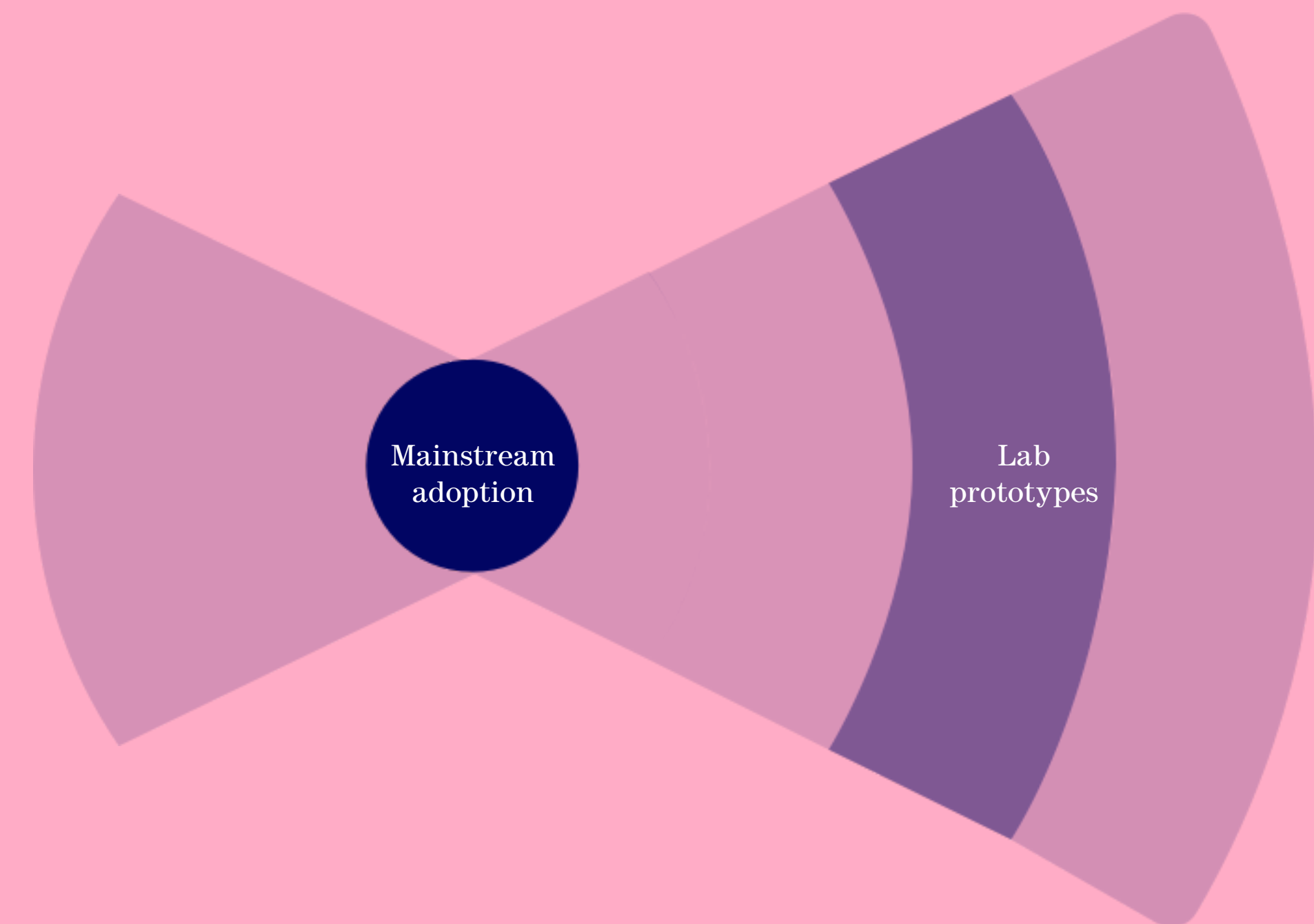
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# Lab prototypes

The second wave comprises the first manifestations of what used to be sci-fi. These prototypes emerge in research labs (MIT, Harvard) or R&D heavy companies (Google, IBM). The role of these prototypes is to show that these seemingly impossible technologies can actually be built in a controlled environment.

If the prototype works, we have proof that conceptually it can be built. However, these prototypes are not built for scale. It can take over 10 years for them to reach mainstream adoption.

10+ years  
Time to mainstream





2

# Lab prototypes

## UAV Swarm communication architectures

Unmanned aerial vehicles are becoming increasingly popular due to the ruling out of humans on board and thus humans safety, but also due to the wide range of possibilities. Besides safety reasons, several other commercial advantages are making the utility of unmanned aerial vehicles increasingly relevant. UAV swarm would have the potential to distribute tasks and coordinate operation of many drones with little to no operator intervention. [Read more →](#)



Image: MITRE Corporation

## Smart-Trace: a future security aid

Smell print is a technique to perform authentication, verification and validation of a person to apply in fields of human tracking and criminal investigation. Smart trace is a sensor technology harnessing smell print mechanisms (such as e-nose and cogno-detective mechanisms) that help locate human corpses during disasters through an artificial olfaction system that senses individual's body odor. Researches are beginning to implement this approach in areas of defence and national security screening. [Read more →](#)

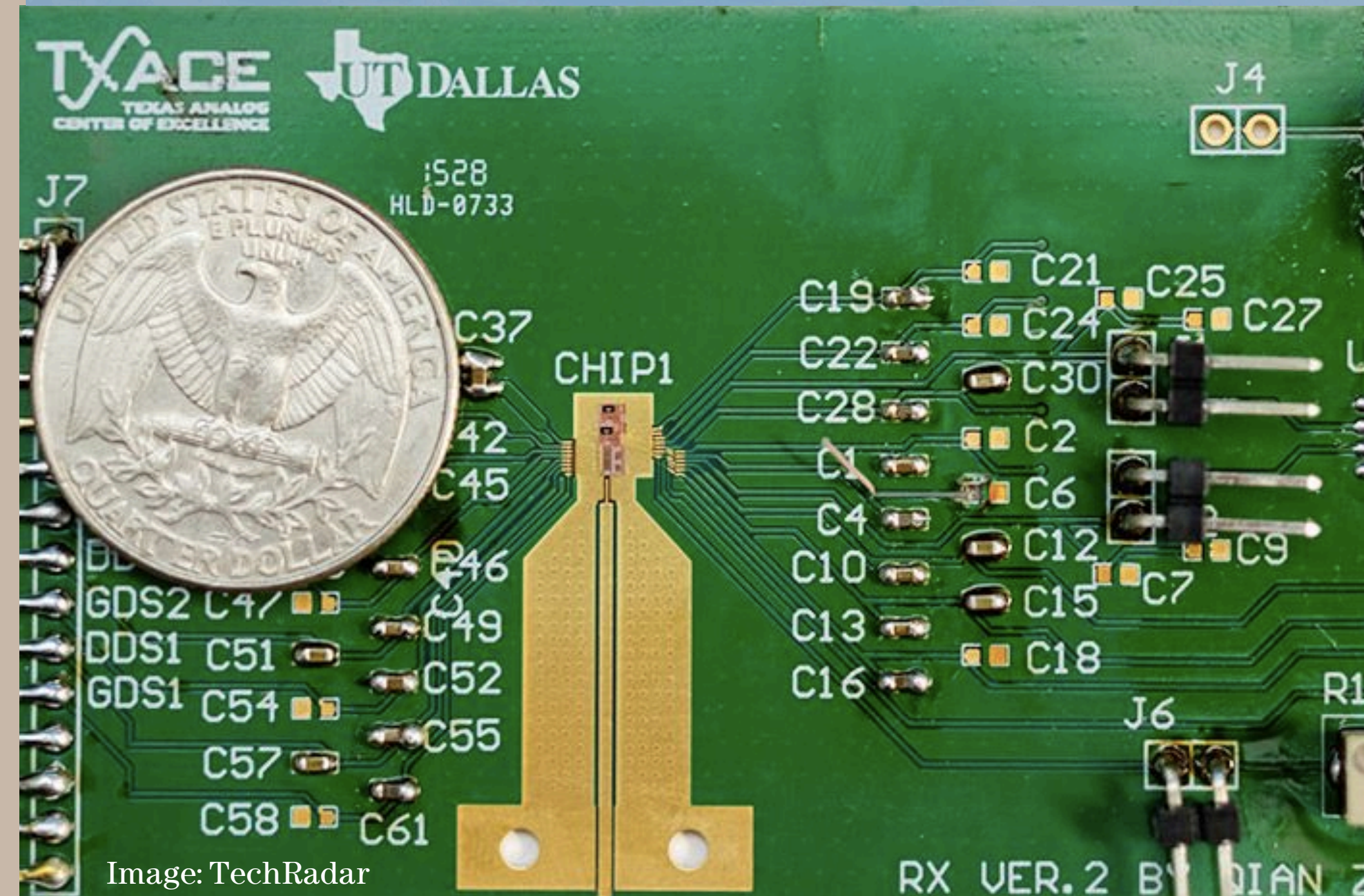


Image: TechRadar



2

# Lab prototypes

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## Anticipating crimes

Ever since the Philip K Dick novel *The Minority Report* was published in the 1950s, the concept of “pre-crime” has become increasingly explored. Now different companies and startups have managed to make predictive policing leap from science fiction to an ongoing prototype. PredPol, for instance, states that its data analytics algorithms can improve crime detection by 10-50% in some cities. [Read more →](#)



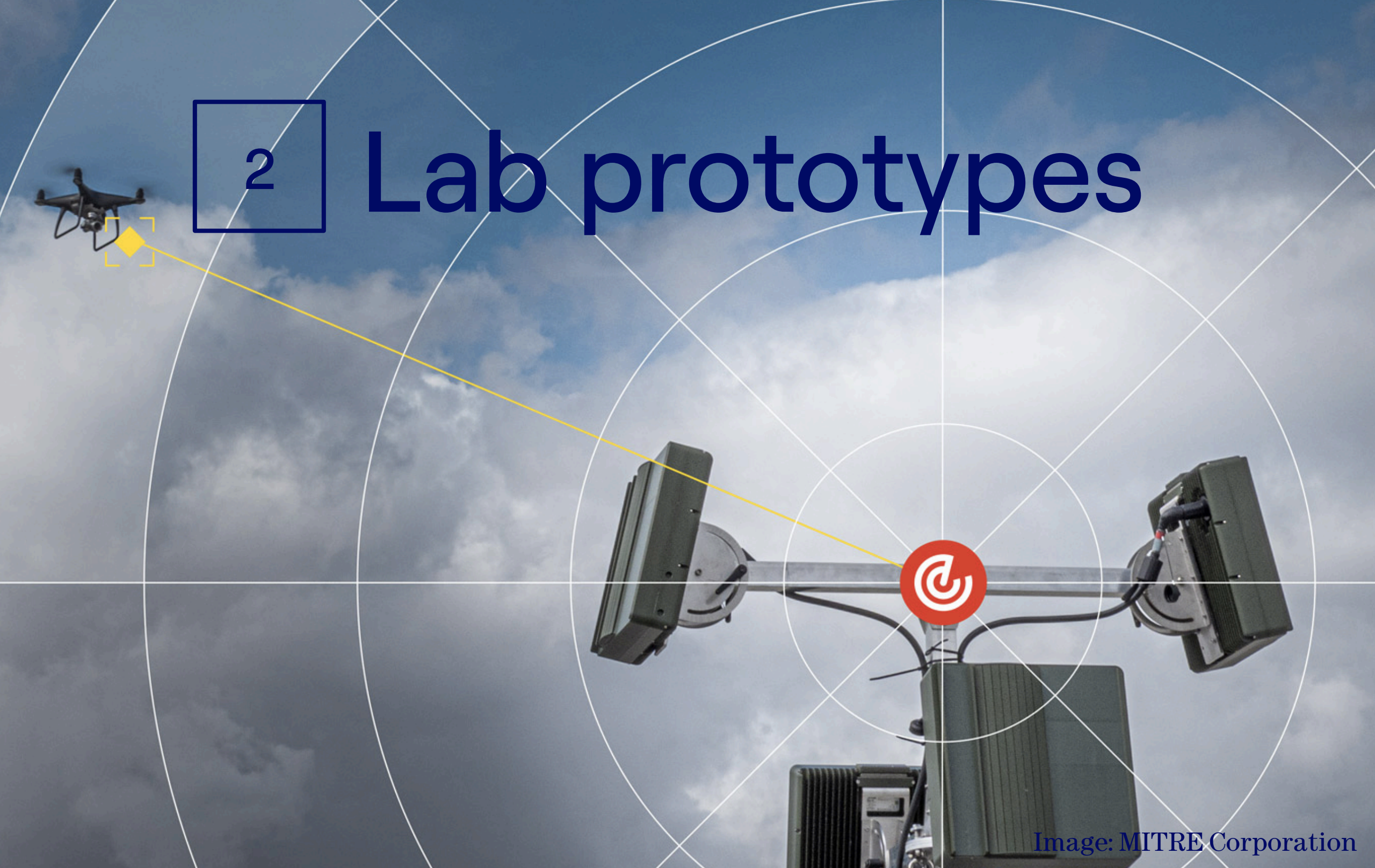


Image: MITRE Corporation



## Radar systems for detecting drone swarms

Drones can end up being lethal weapons due to the possibility of being controlled remotely. “Terrorists and other militants can operate small, inexpensive drones loaded with weapons to threaten U.S. and allied forces on the ground,” said Daniel Miller, chief engineer for High Energy Laser Integration at Lockheed Martin Skunk Works. As a consequence, radars have been developed for the detection of drones’ swarms. One example is a Q-53 radar that detected and tracked several unmanned aerial systems and provided that data to the command and control post. [Read more →](#)

## Drones with smelling sensors

Drones with e-nose sensors installed are being tested to verify their ability to detect gas in the air for security services. Initial results show that the pattern of sensor data clearly differs when in presence of volatile substances in the air. Therefore, the aim now is to make them functional for explosives’ detection and for farmers’ agricultural emissions. [Read more →](#)



2

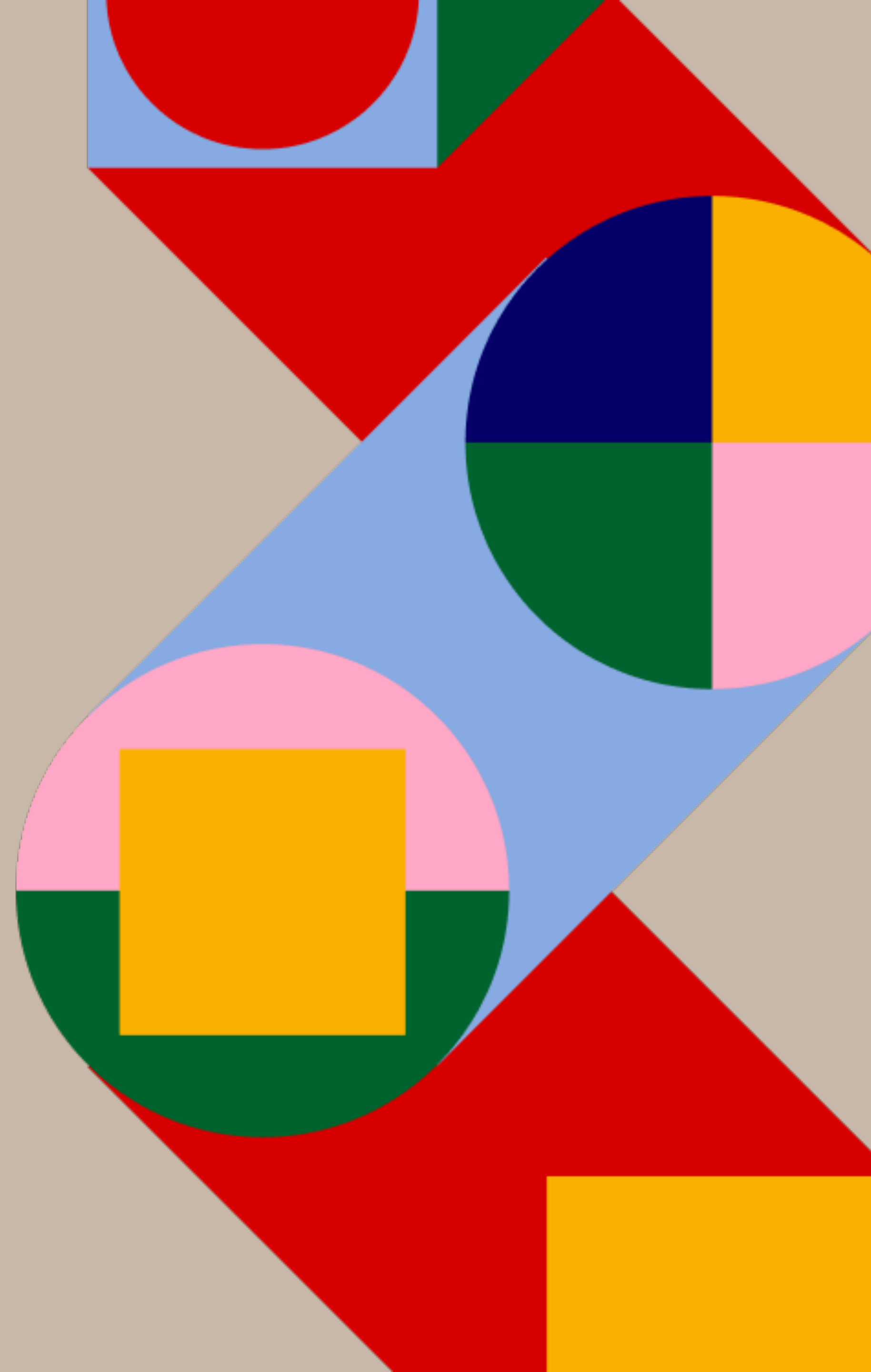
# Lab prototypes

## The future of cybersecurity

Automated cyberdefence is already a reality. However, the team at MIT does not settle for it and is attempting to push the boundaries and see what else can be achieved. The plan is to create competition within the data scientist community with the hope that this combat will yield fresh insights into how to harden machine learning systems against future attacks. Will they manage to mislead even the smarter algorithms? [Read more →](#)

## Home security system based on smartphone sensors

The smartphone is one of the pieces of technology that people tend to change most often. Therefore, why not exploiting the retired smartphones to build a home security system? Studies have already demonstrated that door-related events such as opening and closing have unique vibration signatures that can be captured by a smartphone when the phone is mounted on a wall near the door. This is what SecureHouse entails: a home security system based on smartphone sensors that detects door openings for home security using the on-board accelerometer and magnetometer of a smartphone. [Read more →](#)





2

## Lab prototypes

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### Camera-less sensing of human movements

Cameras are the most common tool when it comes to monitoring the privacy of places. Yet, they have a major problem: privacy violation. One possible solution to this, is the implementation of a simple low power consumption sensor. Researchers at Massey University in New Zealand have developed Protel: a phototransistor exposed to different degrees of lighting to test its motion detection. [Read more →](#)



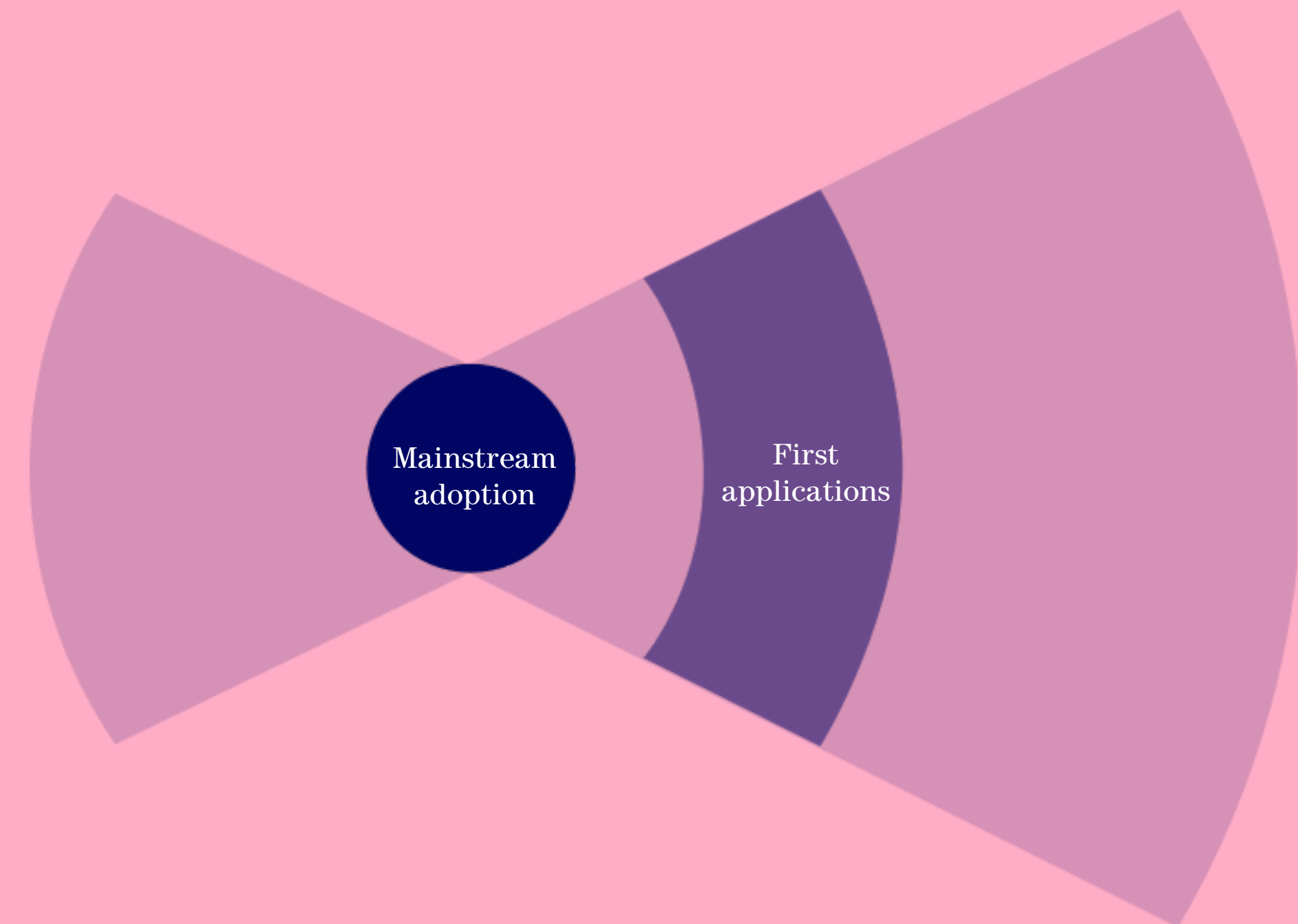


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# First applications

The third wave occurs once a technology leaves the lab. At this point, it's exposed to the real world. Startups, prototyping studios and new ventures try to find the right applications for the newly available technology. A lot of blockchain solutions are in this wave, as they are applied in many areas to see which are a good fit. Once this fit is found it will usually take 5 to 10 years to reach mainstream adoption.

5 - 10 years  
Time to mainstream





## Drones aid rescue in forested areas

Recent studies have discovered that autonomous drones can become a potential solution for the search of lost hikers in forests. As a matter of fact, autonomous drones have already been provided with the ability to bob and weave through trees, however, GPS's reliability issues are delaying this process to be more leveraged.

As a consequence, MIT researchers have presented an autonomous system for a fleet of drones using only onboard computation and wireless communication — no GPS required. [Read more →](#)

## AI to supercharge surveillance

Good news for public safety as artificial intelligence is drastically impacting surveillance cameras by providing them with digital brains to match their eyes. This significant improve, would enable them to autonomously analyze live videos without humans' interference.

Nevertheless, concerns around the future of privacy and social justice are arising inevitably. What would happen when a biased algorithm is running on the cameras in your local mall, pinging the cops because it doesn't like the look of a particular group of teens? [Read more →](#)





Image: The Mirror

## Drones of mass destruction

Drone swarms are multiple unmanned weapons deployed to accomplish a shared objective, with the weapons autonomously altering their behavior based on communication with one another. This technology could have a considerable positive impact on every area of military competition, thanks to the ability to successfully deliver a warhead to a target, and defense, their ability to prevent successful delivery and mitigate consequences. [Read more →](#)

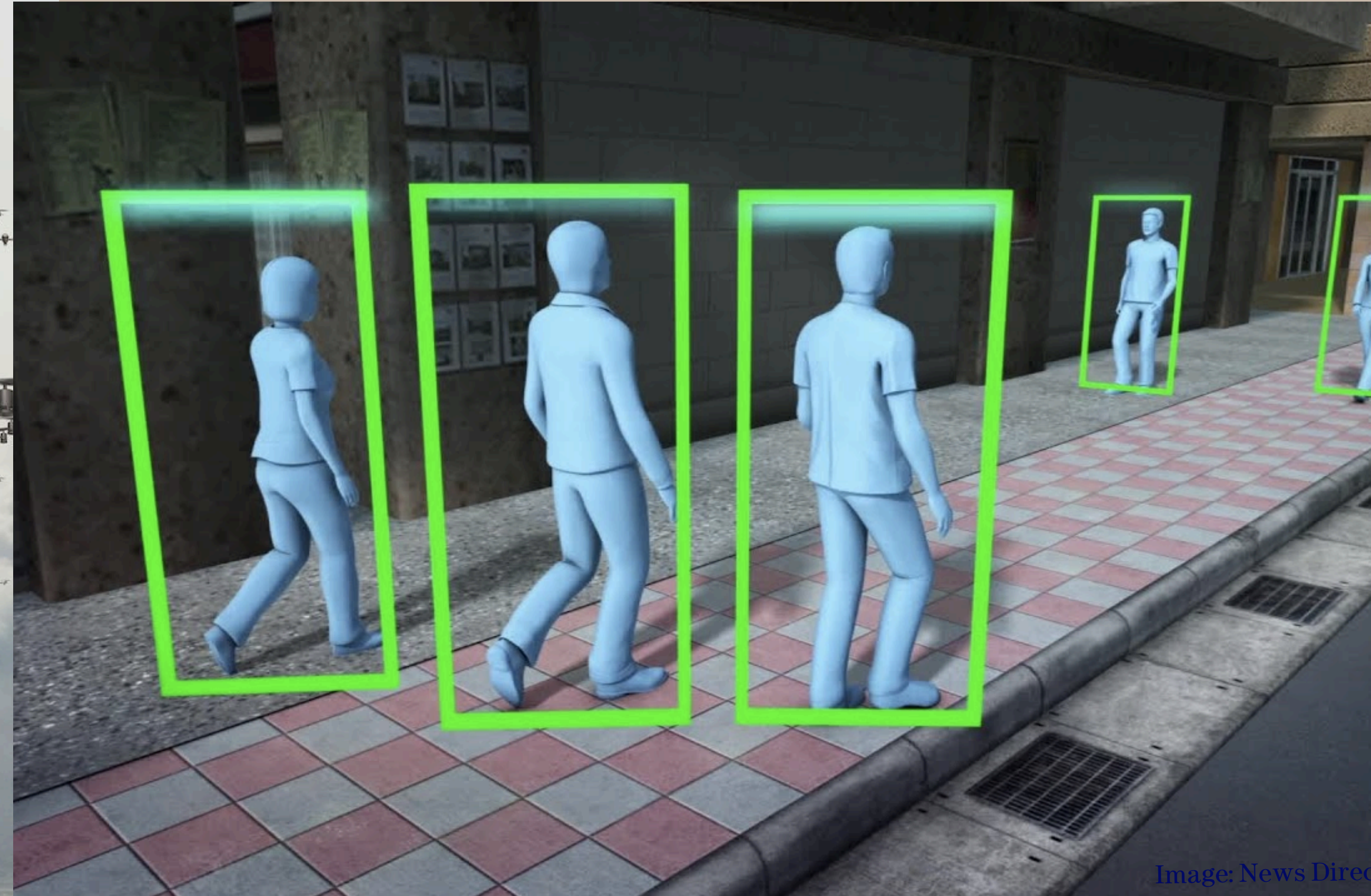


Image: News Direct

## Gait recognition

The gait refers to the way we walk: a unique characteristic as every single individual moves in a different way. Because of this, it is proved to be a useful device in the forensic toolbox due to its accuracy in identifying perpetrators. The identification of a person by their gait was first admitted as evidence in 2000 in London where a perpetrator wore two pairs of trousers, mask and gloves, but he could not disguise the way he walked. [Read more →](#)



A large number of small, black quadcopter drones are flying in a circular pattern against a light blue sky. The drones are arranged in a way that suggests a coordinated swarm, with some in the foreground and others further back, creating a sense of depth. The background is a solid light blue color.

3

# First applications

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## Drones to disrupt FBI hostage operations

“Criminals are increasingly using drones in illegal activity and as a way to counter surveil and disrupt the FBI and other law enforcement agents”, according to a report by Defense One. During recent FBI hostage rescues, swarms of small drones started to assail the FBI operation in a series of “high-speed low passes at the agents in the observation post to flush them.” These accidents show how organized crime groups are leveraging more and more on small consumer drones to support their activities. . [Read more →](#)



3

# First applications

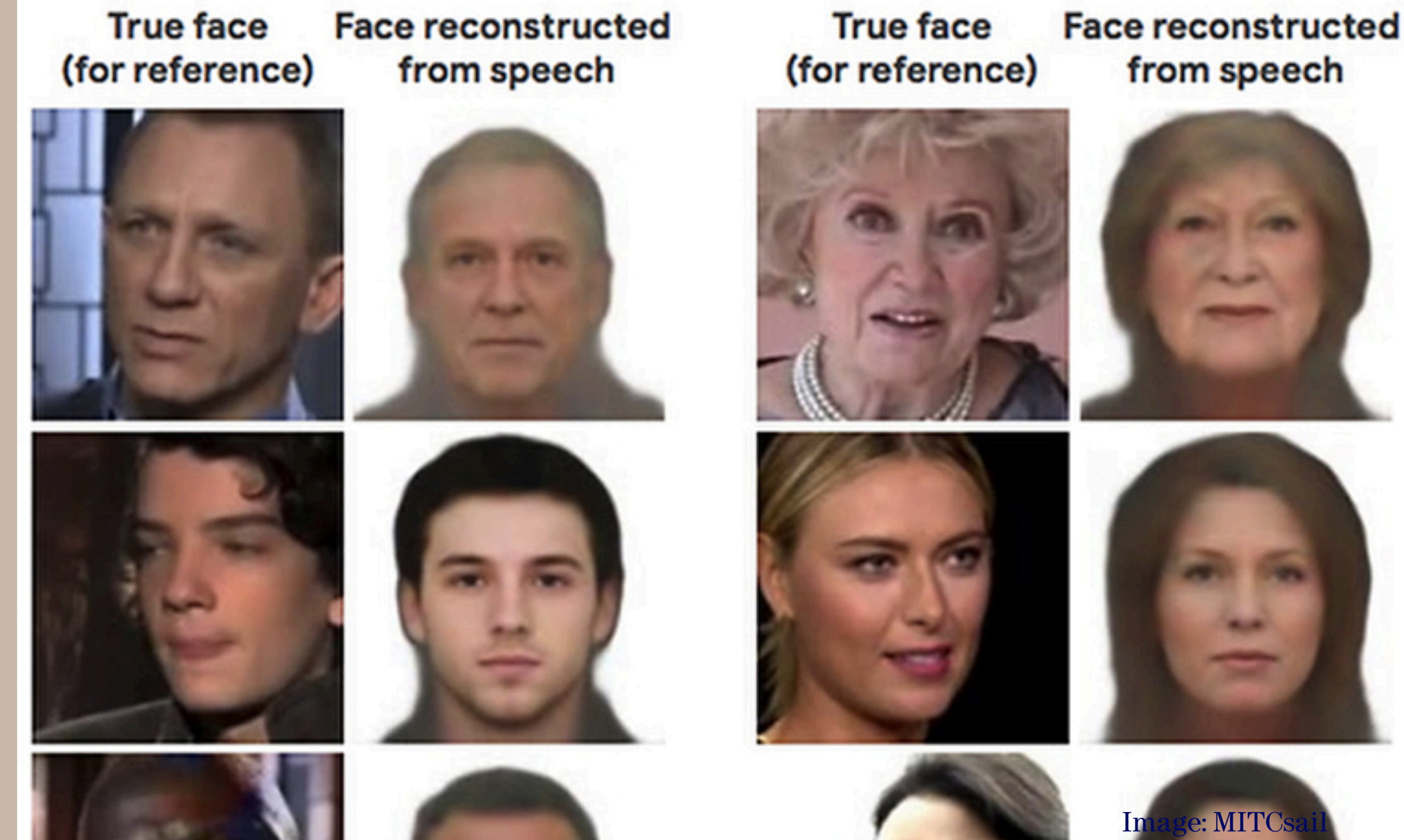
## Learning the face behind a voice

How much is it possible to find out about a person's looks from the way they speak? A deep neural network is being designed to perform this task using millions of natural videos of people speaking from the Internet. Initial results show that the model learns audiovisual, voice-face correlations that allow it to produce images that capture various physical attributes of the speakers such as age, gender and ethnicity.

[Read more →](#)

## Dismantling drones by intentional sound noise

Would enemies be able to dismantle drones equipped with Micro-Electro-Mechanical Systems gyroscopes using intentional sound noise? Sensing and actuation systems contain sensors to observe the environment and actuators to influence it. The first real world's experiments show that one of two target drones equipped with vulnerable gyroscopes lost control and crashed shortly after the attack had started. [Read more →](#)





3

# First applications

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## Motion detection using existing WiFi

WiFi Motion™ is an innovative software that detects motion by interpreting changes in WiFi signals. It transforms the existing wireless network into a highly accurate motion detection system. Indoor IoT devices become motion sensors, slowing down the network or impacting data usage. The more devices in the home, the better the coverage and accuracy. [Read more →](#)



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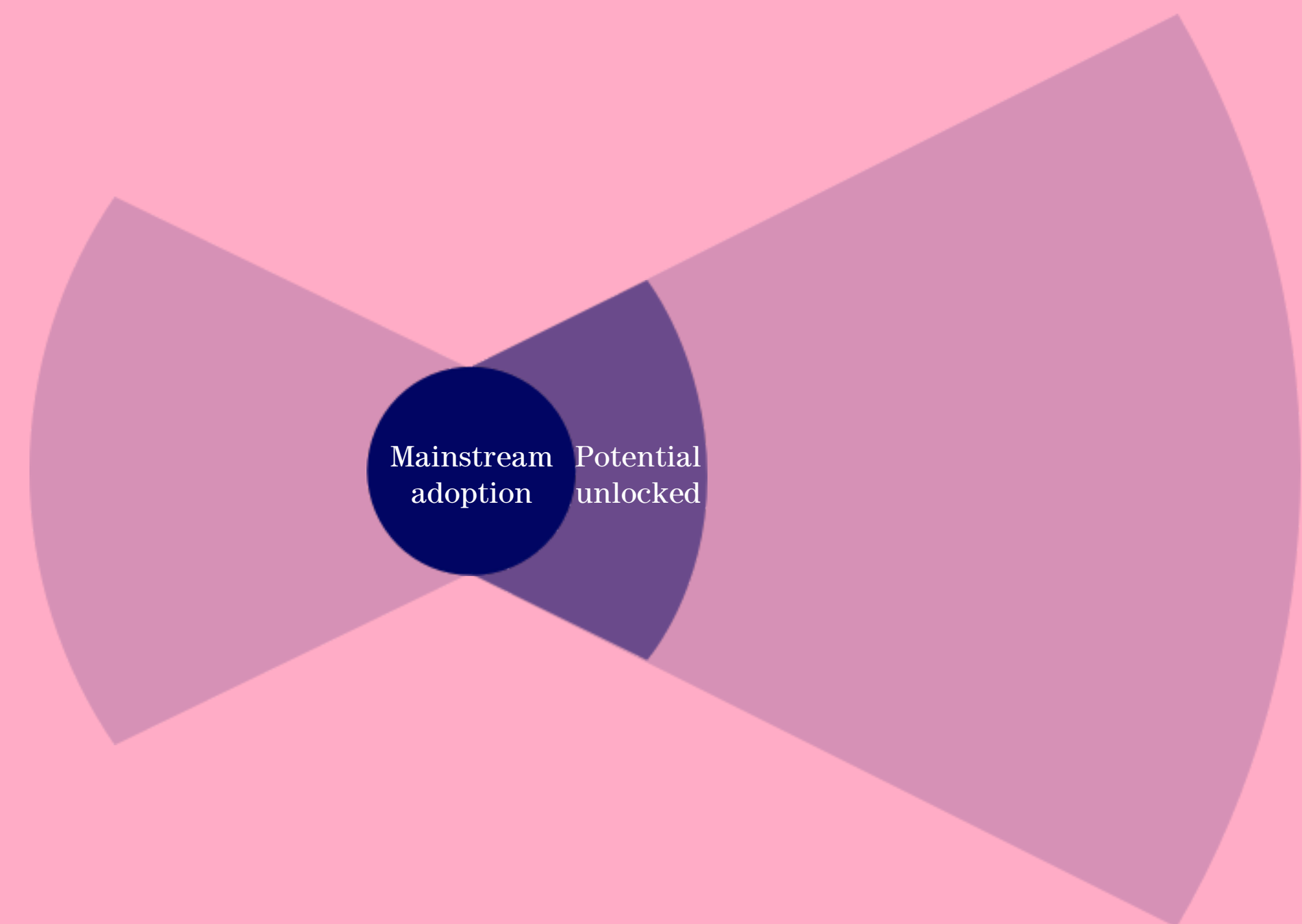
# Potential unlocked

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The fourth wave is crucial when spotting early successes. Once an applied technology has found its place in the real world and starts to provide value, its potential will truly be unlocked. Note that for adoption to ensue, the value it generates should at least be on par for the competing solutions. This is the reason why blockchain is stagnating, as in many cases it isn't superior to a centralized database. Within 2 to 5 years, a technology in this wave can become mainstream.

2 - 5 years

Time to mainstream





4

# Potential unlocked

## Realtime drone surveillance system

Drones are being deployed in innumerable ways to monitor hostiles, spy on foreign drug cartels, and conduct border control operations. One system that has been found out to be effective is a real-time drone surveillance system to identify violent individuals in public areas. The system would detect the violent individuals in real-time by processing the drone images in the cloud. [Read more →](#)

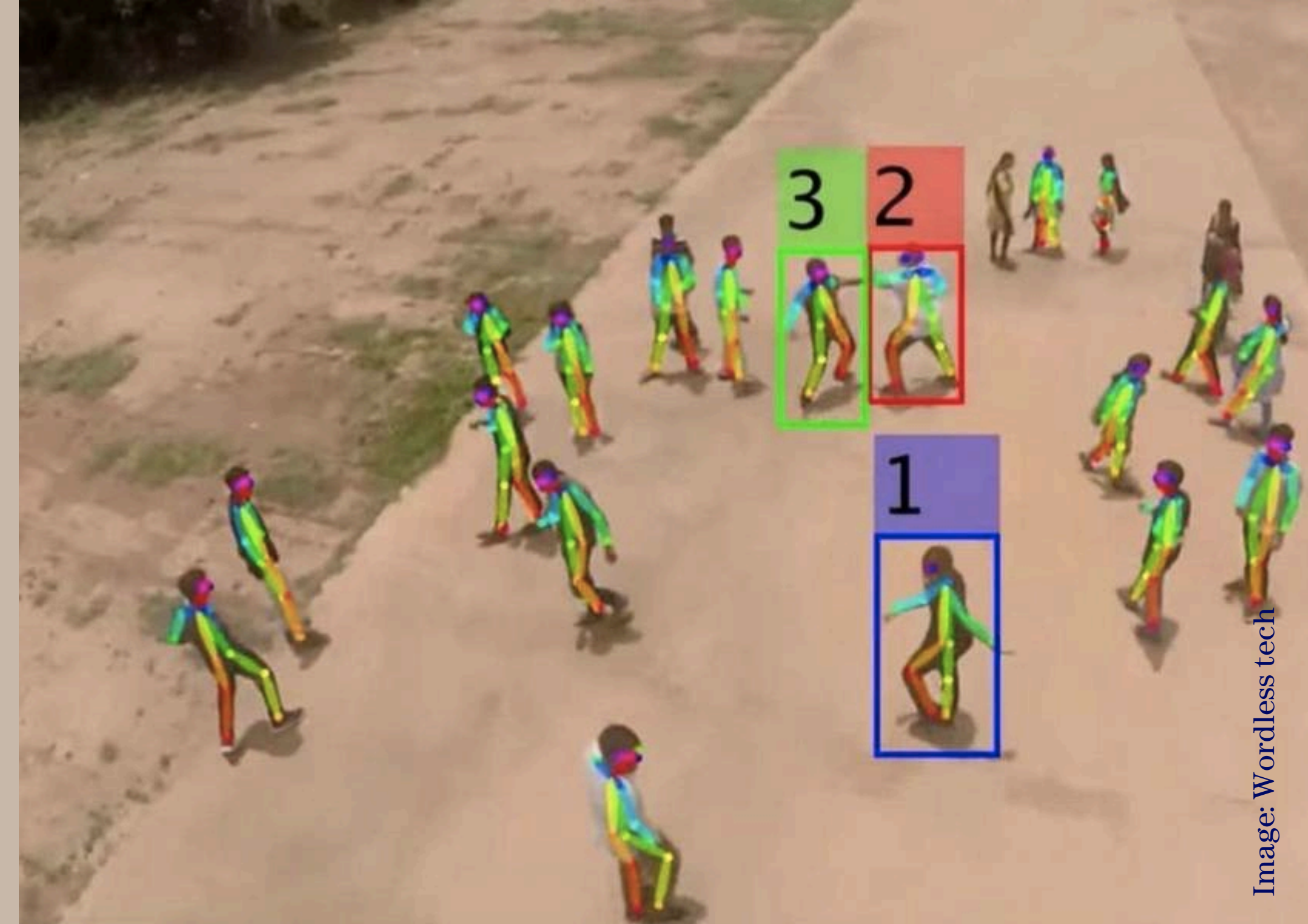


Image: Wordless tech

## Smartwatch motion sensors

The popularity of smartwatches with motion sensors is continuously increasing. However, the security risks linked with sensors on these devices have yet to be fully explored. Studies are currently trying to demonstrate a method for inferring smartphone PINs through the analysis of smartwatch motion sensors. Specifically, the focus is on showing how malware with access to smartwatch's sensors is able to recognize user activity and specific numeric keypad entries. [Read more →](#)



Image: The Conversation





## Potential unlocked



Image: CPO Magazine

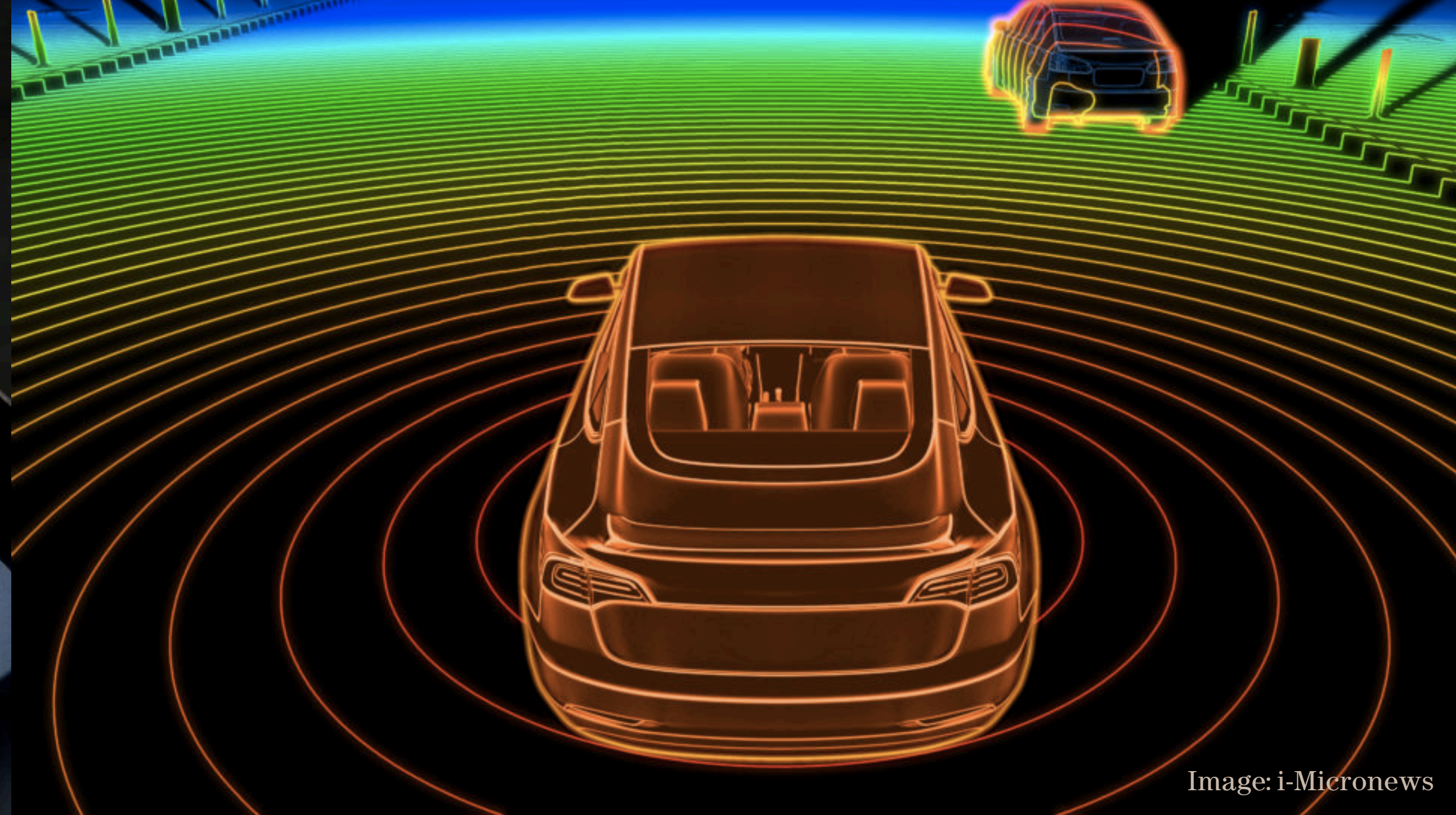


Image: i-Micronews

### Automated identity theft attacks on social networks

The constant growth of social media these days is no news. The fact that millions of people every day consciously choose to share private data on the Internet has become a daily routine. Therefore, how easy would it be for a potential hacker to launch identity theft attacks against a number of popular social networking sites in order to gain access to a large volume of personal user information? Initial results with real users prove that unfortunately automated attacks are effective and feasible. [Read more →](#)

### The future of LiDAR and security

LiDAR sensors are being harnessed more and more. They also have entered the world of smart cities being placed on robo-taxis, self-driving trucks, delivery drones, parking garages, mass transit, traffic lights and utility poles. LiDAR has the advantages of creating high-resolution 3D images that identify the size, direction and velocity of objects in the field of view. On top of everything, it is hard to hack or fool, which makes it an attractive proposition. [Read more →](#)



# Potential unlocked

## Cyber-physical infrastructure risk

Smart Cities are defined as urban centers that integrate cyber-physical technologies and infrastructure to create environmental and economic efficiency while improving the overall quality of life. The interconnectedness of cyber-physical technologies, that connects cyber systems to physical systems, is increasingly removing the barriers between the cyber and the physical world. Thus, this presents a host of opportunities for increased efficiencies and greater convenience, but the greater connectivity also expands the potential attack surface for malicious actors. [Read more →](#)

## Smart building sensors

Smart building solutions utilize IoT (Internet of Things) technology to connect building systems together through networked IoT devices. This allows them to send and receive data between buildings and enhance the way that the building works. The number options of smart building sensors is considerable. Whether you are trying to meet environmental targets as a facilities manager or a hotels' landlord, smart building sensors could end up being a suitable solution. [Read more →](#)



## AI facial recognition software

AI is becoming a powerful tool for police officers and is getting very close to the possibility of crime-fighting. China is currently using AI to predict and prevent murders or acts of terrorism. One example is when Chinese authorities were able to catch on to a murderer after he tried to scan his victim's face to apply for a loan. This was achieved thanks to Money Station which uses artificial intelligence to verify applicants identity. [Read more →](#)



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# Mainstream adoption

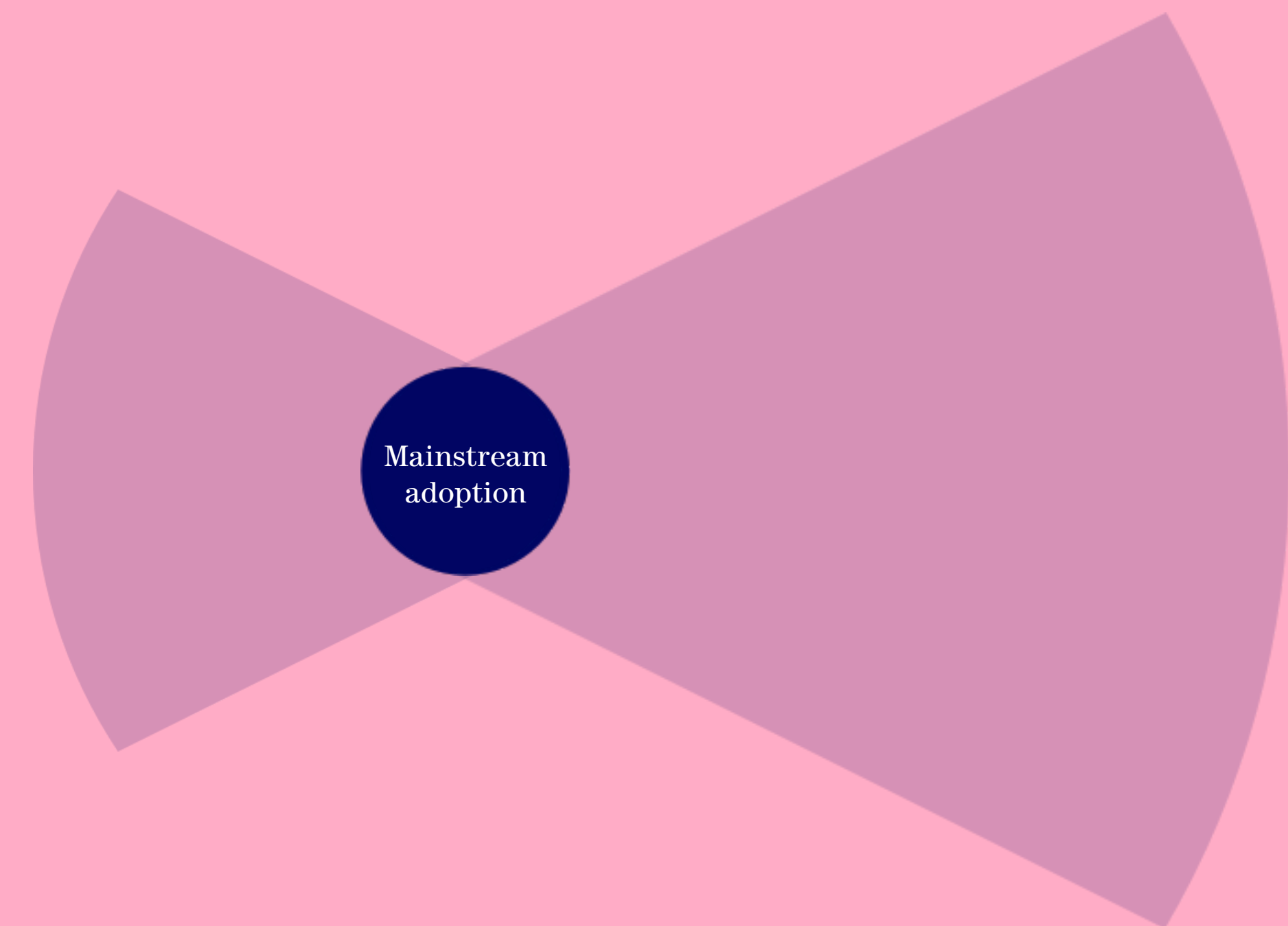
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When potential is unlocked, things start to develop really fast. Solutions become easier to implement as technology becomes available off-the-shelf. Think of how easy it is these days to integrate a chatbot on your website. 10 years ago, this would have required fast teams of developers to build it.

When the technology hits mainstream adoption, being a forerunner is hard, as there is a lot of competition. It means you have to get into it within a year, or you are out.

Think of having an app as a customer interface.

0 - 1 years  
Time to mainstream





# Mainstream adoption

## GPS tracking

The Global Positioning System (GPS) leverages satellites orbiting in space to help users on the ground to precisely determine their location almost anywhere in the world. Its incredible efficacy pushed researchers to develop the GPS tracking for security use. For instance, GPS Asset Trackers have been developed for the recovery of stolen merchandise and the apprehension of the criminals who stole it. [Read more →](#)

## Metal detectors in airports

Metal detectors are technologies that we give for granted nowadays. The security check at airports is a step that has become part of the travel routine that we do not question anymore. Their mainstream adoption has become crucial considering that civil aviation remains a prominent target for terrorism and other criminal activities. Yet, before 1970s, they were a piece of technology considered sci-fi. During that year, a Finnish company named Outokumpu astonished the world with the deployment of metal detection technologies to identify people carrying metallic weapons. [Read more →](#)

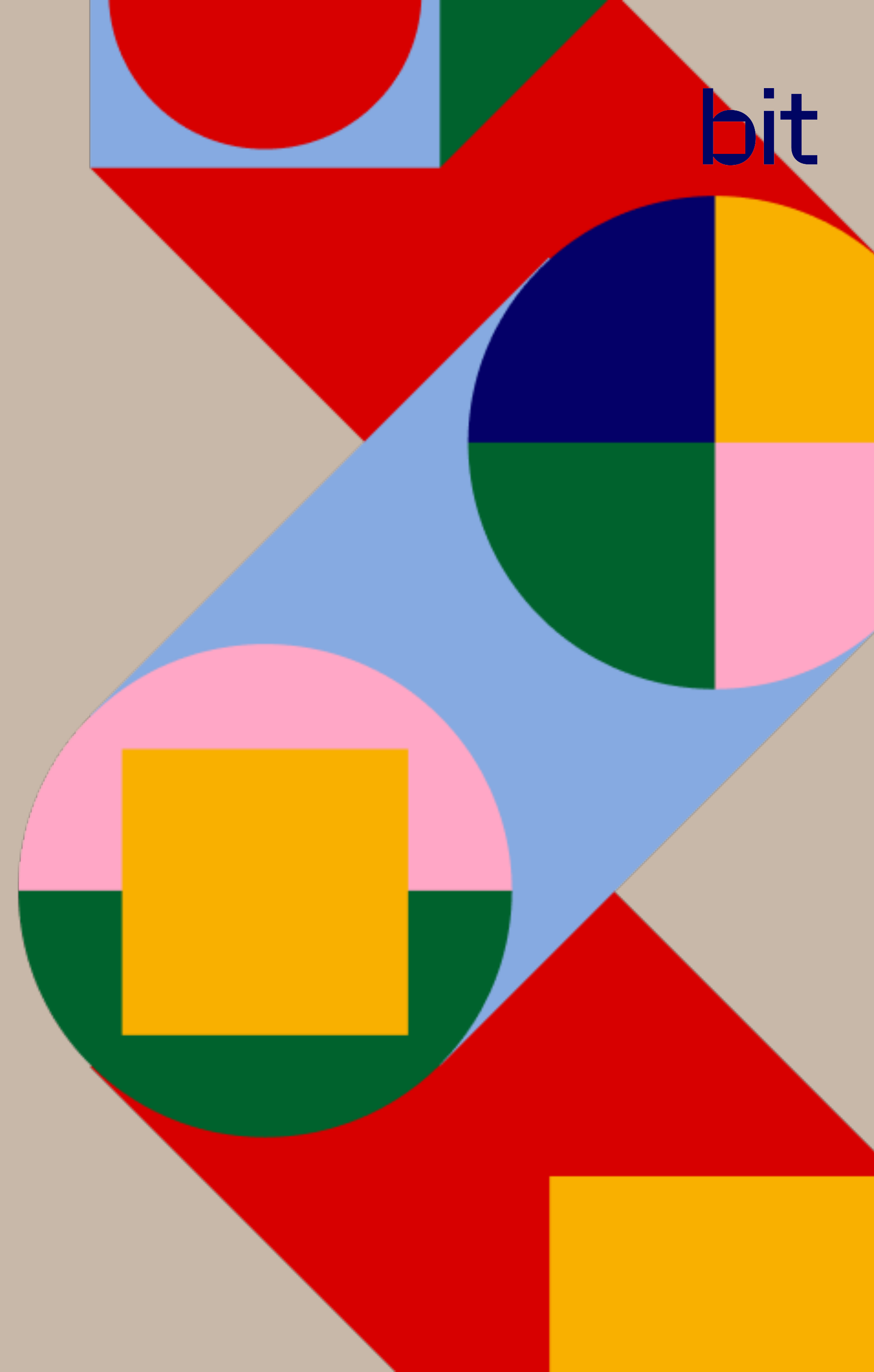






Image: Arrow Electronics

## Cameras with motion detection

Motion detection cameras are so embedded in our lives that leaving our house to go grocery shopping or to head to our workplace is not something that scares us anymore. After all, thanks to built-in sensors that vigilantly monitor their field of view for movement, we have the certainty that cameras would alert us in case of suspicious activities inside and outside our homes. Despite their widespread use, it is important to acknowledge their limitations, commonly manifested by an exaggerated number of false alarms. [Read more →](#)



Image: Vodafone UK

## IoT-enabled heat detection camera

Vodafone UK launched a Heat Detection Camera to help UK organizations get back to work safely during the coronavirus pandemic. Thermal imaging is used to screen the temperature of people as they enter buildings. The camera can scan up to 100 people every minute by exploiting IoT. IoT allows for real-time body temperature screening accurate to within +/- 0.3 degrees Celsius. [Read more →](#)



5

# Mainstream adoption

## NL-Alert

NL-Alert is a cell broadcast alarm system used by the Dutch government to quickly alert citizens of crisis situations. It is one of the first applications of the EU-Alert legislation which aims at increasingly deploying the cell broadcast technology to spread public warning messages. The alert can be received via 2G, 3G and 4G systems, therefore not requiring any specific registration or configuration. [Read more →](#)

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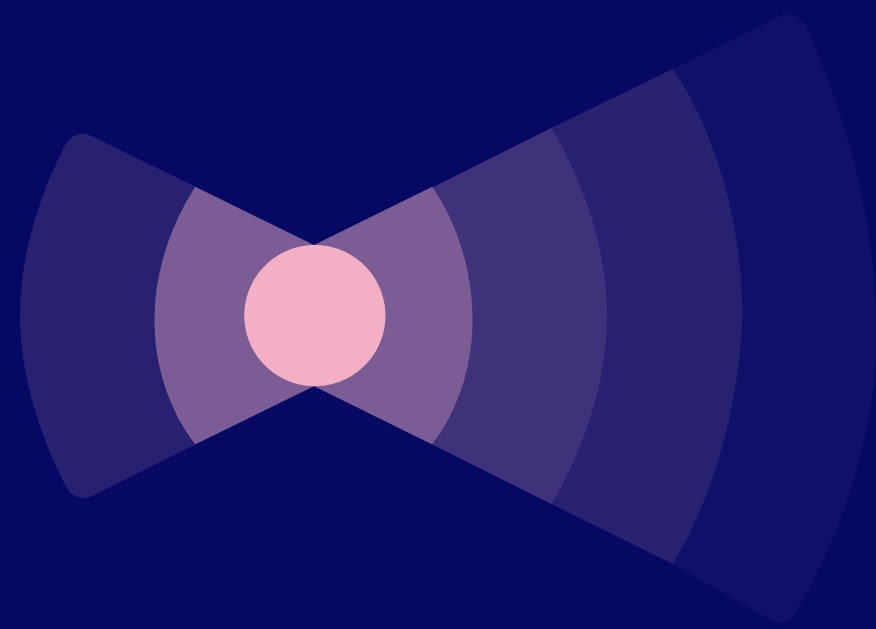
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# You can now...

## Pick technologies

What technologies reveal promising opportunities for the context of your industry and organization?



## Plan innovation

When will these technologies be relevant and applicable? How does this translate to your short- and longer-term innovation strategy?



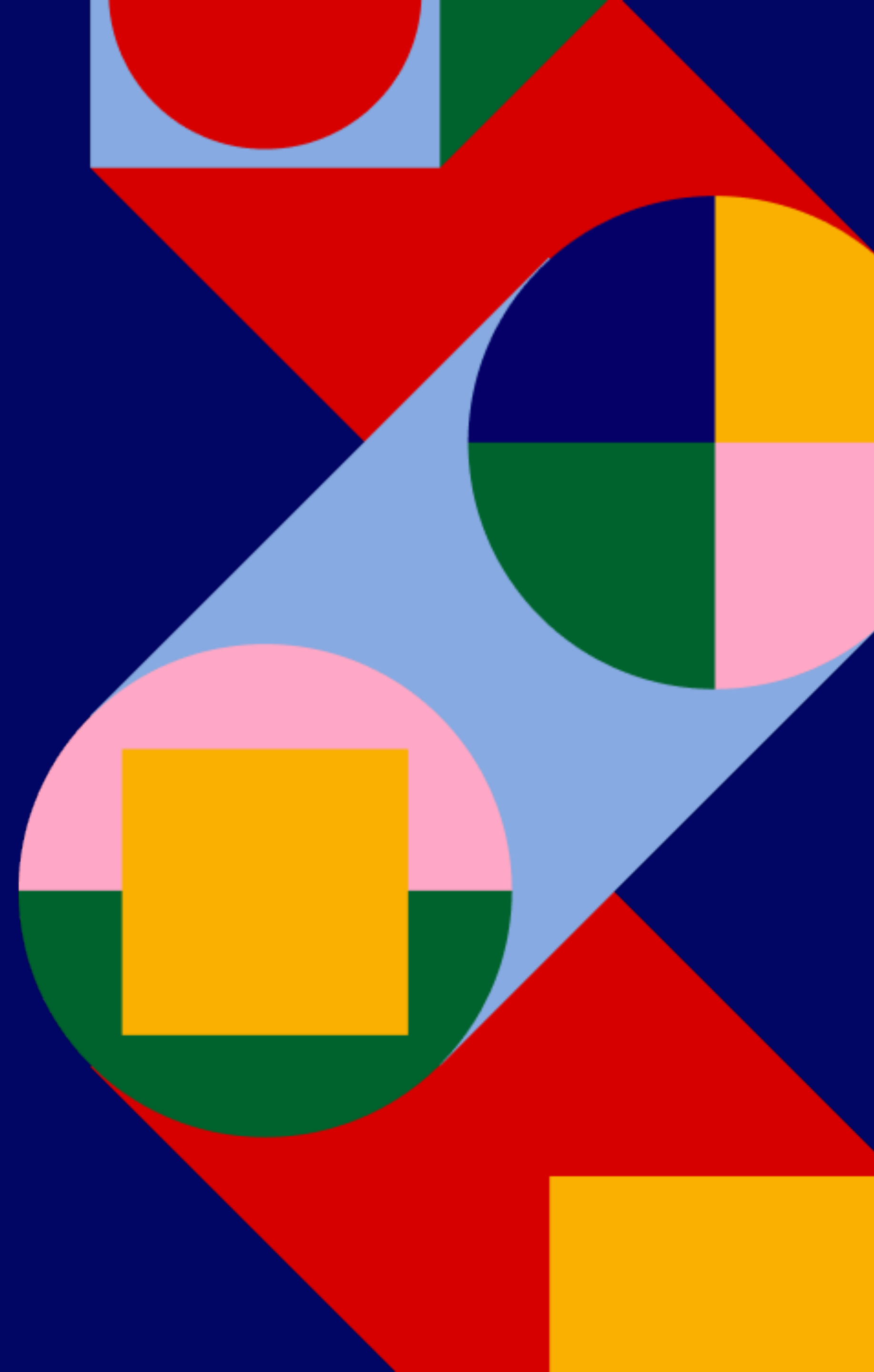
## Start experimenting

What technology fits your challenge and creates a change to early adoption rewards?

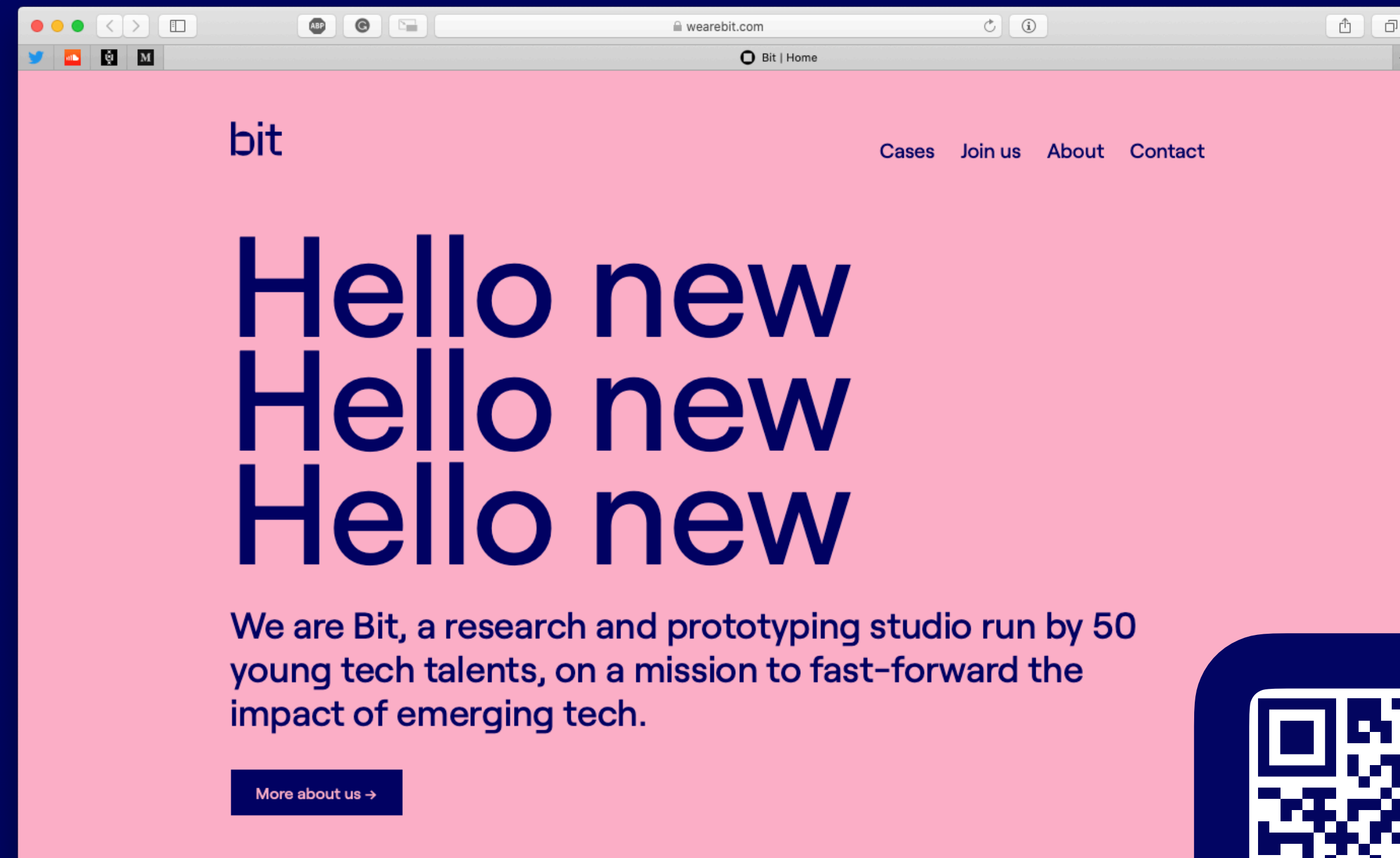




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years earlier! 🚀

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