Are We Ready For An AI-based Minority Report?

David Ogunlesi

December 2020

Word count: 3069

1 Introduction

The Minority Report, a film from 2002, and based on a story by the famous writer Phillip K. Dick, tackles the issues with preemptive incrimination and accusing people of crimes they are yet to commit. The problem arises when you start accusing people of crimes they are going to commit before they have even thought about doing it. It's not a question of how far you can predict a murder, it's how far you should predict a future murder. This is the exact dilemma the main character from the minority report deals with. In 2054 it's psychics, in 2020 it's AI. Powerful AI that is getting smarter and faster every single day.

Moore's Law directly models this growth, stating that the processing power of conventional computers are doubling every 2 years, which in other words, computing power is growing exponentially. However, interestingly, in recent times Moore's Law is actually slowly dwindling off, with yearly improvements becoming less impressive. This is because there is a physical limit to how small transistors get. We can see this by comparing the Cray 1 Supercomputer from 1976 and its successor, the Cray 2, from 1985. The Cray 2 sported 1.9 GFLOPS at peak operation[3]. This is 11 times faster than the Cray 1, in half the size.[2] Compared to today's latest supercomputer behemoths, processing power becomes less of a function of compaction and more of a function of space. This would lead you to believe that AI, which depends on powerful computing to be fully utilised, would hit a brick wall. However a recent technology has started to prop up and may be the sledgehammer needed to break down the wall the laws of physics have constructed.

2 A real life problem - From Fiction to reality

2.1 Currently available methods for finding and arresting criminals

Putting upcoming technologies aside, there are currently a few methods we use to capture and arrest criminals. These methods fall under 2 main categories. SOFT technologies and HARD technologies. Hard technologies are the tangible components that can be assembled into assistive technology systems. This covers everything from policing equipment to computers and software. Hard technologies are the most widespread form of crime prevention, the most extensive being CCTV cameras. Metal detectors, bank security systems, airport baggage screening all fall under hard technology. Soft technologies involve the strategic use of information to prevent crime, This includes predictive policing technologies, crime analysis techniques and video streaming capabilities[8].

Over the past decades policing agencies have slowly been incorporating more technologies which can be considered a significant driving force to modern law enforcement strategies we see today. With the introduction of the telephone and two way radios[14] police strategies moved to becoming a crime response force, relying more on reports on crime, then finding crime. Now in the 21st century, the police are equipped with a variety of tools for crime fighting. Where does predictive policing come in all of this? In recent years, technology has impacted policing so significantly that some methods have become completely obsolete, being replaced with more predictive technologies. This is reflected in a few recent advancements such as location monitoring devices, predictive analysis and crime mapping software which can help decide where to deploy officers on patrol. These are the closest thing we have to true predictive policing, which undoubtedly increases policing capabilities, but are they really effective?

2.2 How effective are the different methods

Though predictive technologies may give police more tools to work with, does it make law enforcement do their job more effectively? Historically "999" police calling systems can get police deployed to a crime scene quicker hypothesising more arrests, however this may not actually be the case. A study by Sherman and Eck in 2002 suggested that response times are not proportional to the volume of arrests, mainly due to the fact that often response times were delayed. There is also the factor of false calls or non-urgent calls which can limit the amount of officers available for a high priority case.

Hard technology seems to be the more effective of the two, with CCTV not necessarily deterring crime, but easily catching people who have committed crimes, more so directly on CCTV. CCTV has shown to be somewhat effective at deterring some crimes though, with vehicle crime decreasing by 51% in car parks which deployed cameras.[4] It can be argued however that only crimes

committed on CCTV are easily dealt with, and many other crimes without lack of CCTV evidence had CCTV playing no role in the ultimate prosecution of the criminal. CCTV also has no predictive powers, same with all hard technologies generally. Though the real focus is on predictive technologies which is really only touched upon with soft technologies.

2.3 Old methods compared to new

Big data is a relatively recent phenomenon which arose with the introduction of newer and faster data processing methods. As processing power got faster, larger volumes of data could be processed generally and all this data needed to be stored somewhere. Soon data centres materialised, bringing large data sets into the limelight of every industry. The world according to IBM, generates 2.5 quintillion bytes of data every day, with a lot of this data being vital to many businesses and organisations. The criminal justice system is one of these organisations. For example millions of DNA fingerprints are stored in databases which allow quick identification of unknown persons. Data can also assist in detecting crime trends or in other words predict crime. The United States department of justice lists a few of their national crime information systems, most notable of which are:

- (NCIC) National Crime Information Centre - stolen property, wanted persons, criminal history, sex offenders etc.
- (NGI) Next Generation Identification - palm-prints, fingerprints and mugshots.
- (NICS) National Instant Criminal Background Check System - firearm purchase eligibility[5]

This small list highlights the significance large data sets have in the justice system. With the rise of GPS came detection, monitoring and geolocation tools for the police to use. One notable example of a system that aids US police departments currently is Gunshot technology which allows departments to view a map of shooting locations, how many shooters were at said location and how many shots were fired. These are just some of the many technologies that have been utilised by police agencies in current times, but what future technologies could we see being used in the police agencies of 2030, 2040, or even 2054 where the minority report takes place? Possibly Artificial Intelligence?

3 An friend in AI

3.1 Current AI solutions that could and do help us today

AI is already beginning to be incorporated into law enforcement as it assists in many different areas whilst improving overall general efficiency. Such as with facial recognition.[15] Facial recognition has proven to be a formidable force when applied to recognising criminals in public spaces or crowds. For

instance, police in south east China were able to arrest a fugitive in a crowd of 50,000 people using facial recognition software which would have been impossible otherwise. This follows a mass movement in China, back in 2015, to build a large database of faces and incorporate facial recognition everywhere, now becoming a daily part of life in China.[11]. However AI doesn't always work, like any piece of software. Consider the case of Steve Talley, the man wrongly accused by AI face recognition software.

3.2 The case of Steve Talley

One thing to note was that a human team of analysts made the final decision, the software merely flagged him up against the bank footage. This raises the question of whether humans are fit for recognising faces, and can they really surpass algorithmic solutions? Though recognising faces seems to depend on innate skill and rigorous training, studies have shown otherwise. One study showed that passport officers did no better than untrained students when recognising faces. Even in cases where the scenarios resembled their day to day work.[10] A concerning reality. Though conflicting reports from the FBI claim that highly trained members of their facial recognition teams easily surpassed untrained individuals, with a miscalculation rate of 7%.[10] It is unsure whether this claim is true, however scientists have recently been doing studies on what are called "super-recognisers". Almost akin to the psychics in The Minority Report, super-recognisers can achieve greater accuracy than those of even the most refined algorithms. Though in the end, human influence will always have its pitfalls. One of which is bias. Bias can cloud a person's judgement and lead them to the wrong answer purely due to their internal confidence and preemptive, subconscious decision making. In many cases, a person can make a decision without being totally aware of that decision[12]. Studies showed that this was up to 7 seconds ahead of time, plenty of time to be given a decision and to decide on it.

Replacing human judgements with calculated computerised ones would make sense given the deep rooted issues with human based decision making. Algorithms can scan through millions of faces in seconds, which no human could ever possibly achieve in one lifetime. Issues with low resolution images can also easily be solved by AI upscaling, suggesting that a computer cannot do anything a human cannot do, and in most cases, it can do it better. However, it's very likely that the same human led error that got Talley sent to jail on a false accusation could also occur with automated recognition. This is because the ultimate outcome of an automated system must be decided by a human individual, which we know to be quite inaccurate. It's a significant conundrum as both paths lead to the same result, though with a level of uncertainty concerning the correct path to take.

It turns out a purely algorithmic approach, with no human input, may not be a good solution either. As facial recognition data sets get bigger, the accuracy of

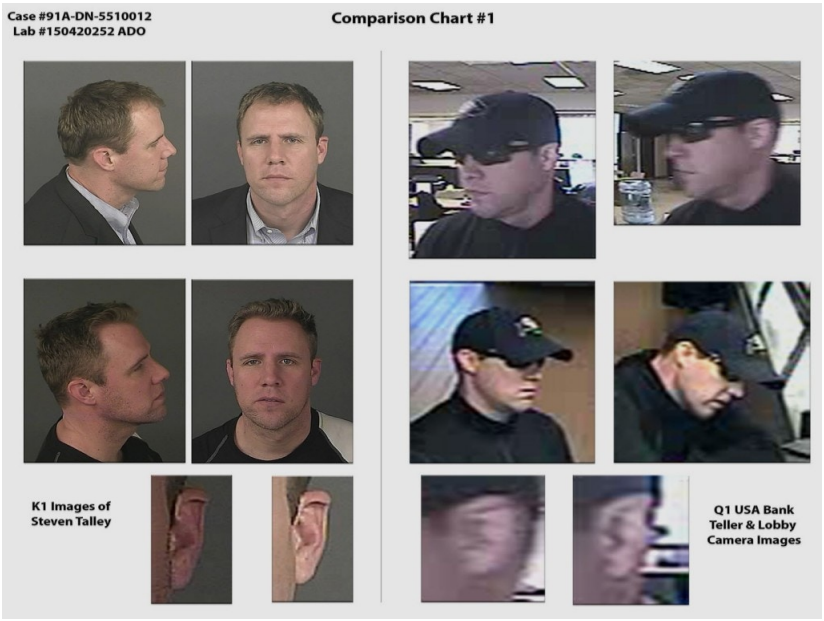

Figure 1: Comparison chart. Credit: Federal Bureau of Investigation

an algorithm gets worse, as larger data sets means there are more faces. This increases the chance of similar faces popping up, and thus mismatches. Again, bringing in a human to evaluate the final result would only lead to more error as if the faces are automatically ranked, this could induce bias, which as we previously discussed, is unfavourable. Randomising the faces could be a solution, but perhaps not a perfect one. This is only one example of where AI presents a tricky situation. Imagine if we were to create this prediction machine which likely would use facial recognition in its design. Many fundamental problems with AI would have to be solved first.

3.3 Quantum computing, complexity in simplicity

Instead of using 0's and 1's, quantum computing uses "Qubits", which instead of being on and off, are rather in a superposition of states in between on and off[9]. This would allow a quantum computer to process every path of a maze instantly. Another quirk of quantum computers is entanglement. Qubits can be linked together, even if they are physically separated. This ultimately means stringing together multiple qubits could solve problems that would take conventional computers millions if not billions of years. The one problem is their reliability. Any electrical interference can knock a qubit out of superposition and render it useless. This is why they need to be cool to near absolute zero and isolated in large containers.

However, a recent discovery has put this disadvantage to rest. Scientists from Russia in collaboration with Swedish, American and Hungarian scientists found a way to manufacture stable qubits that operate at room temperature[13]. Given all this quantum computers could definitely bring the complex solution that is needed for predictive algorithms. It can run complex algorithms quickly on those large data sets, which combines into very fast training of AI models and the possibility to train very complex AI models that could surpass a human driven solution by many magnitudes.

3.4 The ideal AI solution and a realistic AI solution

An ideal solution would be a model that minimises bias. This means that no human intervention, at least on the analysis side of things. Human police officers would still need to respond to said predictions. This ideal solution would also need to be able to access large data sets filled with every citizen that will form part of the solutions scope, i.e. the group of humans it would be able to accuse of crimes. It should store a history of any past crimes and would have to monitor every aspect of an individual, down to maybe every movement they make, website they visit, text they sent or even word they have spoken. All this data could be combined with extreme statistical analysis from decades of past criminal data and physiological studies to perhaps give an individual a rating, with the rating measuring how likely they are to commit a crime, possibly different ratings for different categories of crimes along with a total overall rating. It would have to use every feasible method of keeping track of humans, very likely through facial recognition software. Every instance a person shows up on CCTV, the time and date is recorded and as much data about that event is recorded and added to a master database. Even down to the expression or mood of the individual from the gathered footage. This isn't such a far reach as most of this data is already being recorded by large internet services such as Google and Facebook. But putting aside whether a system like this is even possible, is it ethically right?

4 Ideal AI ultimatum

4.1 Why we should go for it

The fundamental message of The Minority Report is that technology will surpass the needs of the individual and in favour of the group collective. Focusing on social goods such as mass security and safety. This in turn means a sacrifice of an individual's privacy would have to be made. This includes all the information we discussed earlier, such as location, messages and so on. This raises the question of is crime bad enough that people would be willing to give up their social liberties to stop it? Maybe not in our day and age, but perhaps in the future. With terrorism on the rise, and increasingly more horrific acts being committed by the day, would we ever be in a place to allow an AI system to

take over, and monitor every aspect of our lives?

Giving up privacy is not necessarily a bad thing. Eric Horowitz, a managing director at Microsoft's research lab, pointed out that there are innovations that raised the same question that we now take for granted[1]. Such as photography or the telephone. Perhaps society just needs time to adjust to it. Given the state of the information space currently, it seems like we are already adjusting. According to the Cisco Consumer Privacy Survey in 2019, 1.84% of respondents said they care about privacy and of this group, 80% said they were willing to act to protect it[6]. Surveys done by the Pew Research Centre in the US, show that roughly 6 in 10 Americans believe that it is impossible to go through daily life without companies tracking their data. From the statistics, it appears people are already coming to terms with data collection. Maybe an AI prediction machine would be for the best?

4.2 Why we shouldn't go for it

There is also an argument against this ideal AI ultimatum. The fact that privacy is important and sacred to an individual. Privacy gives a person the power to choose their thoughts and feelings and what they do with them. Privacy protects information we do not wish to share or are not ready to share. Privacy can protect our personal safety if our location data is private. Privacy is innately tied to freedom, take a person's privacy and you strip away their freedom. Can you really have free will without privacy? In the end, a life without privacy leads to a life of informed and deliberate choices. Would you feel comfortable having a conversation criticising the government if you knew they were listening in? A lack of privacy could clearly escalate into a dystopian society, where the line being crime and freedom of speech and expression becomes a blurred line indeed.

5 Realistic AI ultimatum

5.1 Can we strike a balance between the ideal and the real?

It may be possible to strike a balance between what we have now and what the "ideal" futuristic solution is. In many ways we already have. Crime mapping, as discussed previously, is the closest thing we have to predictive crime analysis at the moment. To take it a step further, agencies could combine this with external data from CCTV cameras and facial recognition, in parallel with current methods of internet message interception and location based tracking to loosely predict where potential crimes could happen, and distribute officers accordingly. Instead of flagging up specific individuals. Generalising it this way could help bring it more ethically in line, as police would still only be arresting individuals when they are actually about to commit the crime or have just committed the

crime. It's more of a game of predicting the crime a few minutes in advance instead of years in advance.

5.2 Should we consider AI at all?

Even though AI could play some role in future policing, should it play any role at all? AI already plays a role in facial recognition, object identification on cameras and detecting soft crimes like fraud and money laundering, [7] but we may not need AI at all, at least for predictive policing. Predictive policing is a relatively new field and is yet to be fleshed out. However if we shift the focus of policing from present crime to future crime, we may lose focus on what really matters. Preventing crime in the first place. Instead of trying to convict people before they have committed a crime, it would be a better investment of resources to tackle the underlying issues that cause crime in the first place. Then, this would reduce the amount of crime that occurs. Arresting people doesn't stop crime, it just delays it.

6 Conclusion

In conclusion, we have seen that the introduction of new technologies has had its impact on policing over the past few decades. The general trend of crime fighting is that it is getting easier due to the accessibility and utility of technological advances. Though there are always negative consequences, police agencies and governments just need to strike balance, sourcing the advantages and diluting the disadvantages. As AI gets more powerful, it will only get utilised more, but not necessarily in policing. Current methods are satisfactory, and implementing new technologies always comes with costs, especially early in their development. It is real down to whether we are ok with sticking to today's conventional methods, or we take a stab in the dark with AI. But that's a question that can only be answered by future generations, who will also have to face the consequences.

References

[1] Are there benefits to giving up our privacy? Available at https://www.bbc.com/future/article/20140220-can-giving-up-privacy-help-us.

[2] Cray-1. Available at https://en.wikipedia.org/wiki/Cray-1.

[3] Cray-2. Available at https://en.wikipedia.org/wiki/Cray-2.

[4] How effective is cctv as a crime deterrent? Available at https://www.safesitesecuritysolutions.co.uk/knowledge-base/effective-cctv-crime-deterrent.

[5] National crime information systems. Available at https://www.justice.gov/tribal/national-crime-information-systems.

[6] 100 data privacy and data security statistics for 2020, 2020. Available at https://dataprivacymanager.net/100-data-privacy-and-data-security-statistics-for-2020/.

[7] Ai in police work, 2020. Available at https://appen.com/blog/ai-in-police-work/.

[8] James Byrne1 and Gary Marx. Technological innovations in crime prevention and policing. a review of the research on implementation and impact. pages 19–23, 2011-3. Available at https://www.ncjrs.gov/pdffiles1/nij/238011.pdf.

[9] Amit Katwala. Quantum computing and quantum supremacy, explained, 2020. Available at https://www.wired.co.uk/article/quantum-computing-explained.

[10] Ava Kofman. How a facial recognition mismatch can ruin your life, 2016. Available at https://theintercept.com/2016/10/13/how-a-facial-recognition-mismatch-can-ruin-your-life/.

[11] Yujing Liu. Facial recognition tech catches fugitive in huge crowd at jacky cheung cantopop concert in china, 2018. Available at https://www.scmp.com/news/china/society/article/2141387/facial-recognition-tech-catches-fugitive-among-huge-crowd-pop.

[12] Max-Planck-Gesellschaft. Decision-making may be surprisingly unconscious activity, 2008. Available at https://www.sciencedaily.com/releases/2008/04/080414145705.htm.

[13] The National University of Science and Technology MISIS. Qubits that operate at room temperature, 2020. Available at https://phys.org/news/2020-03-qubits-room-temperature.html.

[14] Kevin Strom. Research on the impact of technology on policing strategy in the 21st century. pages 3–1, 2017. Available at https://www.ncjrs.gov/pdffiles1/nij/grants/251140.pdf.

[15] Kathleen Walch. The growth of ai adoption in law enforcement, 2019. Available at https://www.forbes.com/sites/cognitiveworld/2019/07/26/the-growth-of-ai-adoption-in-law-enforcement/.