

# **Computer Vision Technology and its Potential Negative Effects**

## **The Implications of Facial Recognition Technology in Education and the Potential Risks for Societal Standards of Individual Privacy**

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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## **Introduction:**

### **- General Research Problem: The Ethical Implications of Prominent Facial Recognition Technology**

In recent years, the domain of science-fiction has become a reality in our ever-expanding use of technology. Although slowly, facial recognition technology has begun a soft-launch into the daily lives of millions of people across the globe. Facial recognition systems verify an individual solely based on a digitized image and are currently utilized in sectors such as law enforcement, commerce, and transportation. Furthermore, there have been recent pushes to include facial recognition in schools for matters of automated attendance and classroom security. While this new technology has many different impending paths, we must reflect on the moral implications of this new technology on our rights as individuals. For example, the Chinese police have invented the world's most advanced surveillance system. They did so by hanging millions of cameras on street corners and entrances to buildings and subsequently linking it to state-of-the-art facial recognition software and developed it to identify local images. There are many who accept the concept as a natural movement in the flow of innovation, but never consider the underlying motivation behind said innovation. Even more dangerous is exposing young adults to this technology while they have no say in how it affects them. With this emerging issue, there has been significant debate regarding the rights of children and whether or not they should be subject to constant surveillance and scrutiny. Thus, the question remains: *is it ethical for society to impose new potentially invasive technology on the section of society that does not have complete control over their lives? Furthermore, what benefits would computer vision technology bring to our school systems, and eventually our society as a whole?*

## **Technical Research Problem:**

### **- Computer Vision Technology and its Potential Negative Effects**

During one of my summers at UVA, I was fortunate enough to work with a startup named Blueprint Stats. This company sought to use Computer Vision technology in order to better track the statistics and player movements in sporting events. During this experience, I was able to work in a group of developers that were professional, organized, and willing to teach me the ropes of working in a budding tech company. It was an interesting project to work on as I was tasked with training a model that was able to detect whether footage that was fed into our system is actually a sporting event. After training the initial model to recognize and identify a specific type of sporting event, we moved to the issue of automating a player-tracking algorithm based on a defining feature such as jersey number. This was a reflective experience to be a part of as it required my team to brainstorm all the different distinct identifiers for individuals.

While we were discussing our plan of action, the topic of facial recognition was a tangent we explored as a feasible method to identify players. Ultimately, we reached the conclusion that it would be unnecessary to collect such personalized information on these individuals as there are many other ways to correctly identify and track a player over the course of footage. We decided on using a combination of color scheming on jerseys with numbers, as well as shoe type to maintain an aggregator of stats for each player.

However, when I was part of the company, I began to ponder the morality of the technology we were creating and the morality of what it could be used for. For example, the models we trained to identify specific types of sporting events could be used for identifying and tracking individuals with potential criminal intent. Additionally, I began to consider the potential uses for such technology and how it could be used to limit the general public's individual

freedom. In this sense it is important to realize what rights can be infringed upon if we fail to have a discussion about what this new technology will add to our lives. If there is any malicious intent behind controlling society, it would be very easy to do so with facial recognition technology as people can be tracked at any point in the day due to the number of cameras there are placed in public areas. In theory, this should not bother normal citizens who go about their days without committing any crimes. However, we should still consider whether this is the best deterrent to crime, and if this method improperly puts everyday people under scrutiny that is unjustified. Essentially, everyone has the right to privacy and these technological advances may put that right at risk of being violated. Moving forward with this technology may hold unforeseen infringement on individuals' rights, and my personal experience with computer vision has made me wary of the power that can be abused through facial recognition software, and I intend to research the current uses and policies regarding smart surveillance.

### **STS Research Topic:**

- **The Implications of Facial Recognition Technology in Education and the Potential Risks for Societal Standards of Individual Privacy**

I am studying the implications of advancing technology in our society and how it will affect the future generations. I would like to make known the effects of technology on our everyday lives and why people should consider how this will play a role in their day-to-day business. If this technology persists in our places of work, education, and leisure there will be very little privacy when we simply walk down the street. Furthermore, if this technology is exposed to the young members of society who are very malleable and accepting of change, it may cause a cascade of infringements on their rights. Therefore, it is important to consider what

we allow as a society in our own personal lives, and if it is acceptable to take this in stride without any consideration of the well-being of our communities.

Societal concerns regarding surveillance are not limited to those being watched, but perhaps a more pressing concern is ‘who is watching’, and for what purpose (Bala 2020, p. 4). With the state as a watcher of our information, there is a serious power imbalance between authority and individual, one which will only widen as we allow this to persist. Though the violation of individual privacy is often voiced concern, surveillance may cause other forms of loss of opportunity or economic losses, such as: employment and educational opportunities, insurance and societal benefits including housing (Selinger and Leong 2021, p. 9).

There are already concerns from the scientific community as to what potential negative effects could occur if facial recognition technology is not regulated, and there have been considerations of a larger societal issue these may cause. Facial recognition technology used for surveillance may erode trust and may be a precursor of Orwell’s 1984 (Orwell, 1949). Furthermore, there is empirical evidence that government agencies today have much greater powers to collect evidence and conduct surveillance. While there are positive ramifications by enhancing the law enforcement’s ability to detect, disrupt and arrest challenging non-state threats like terrorism and transnational crime (Smith and Miller, p. 1), these powers may be abused to thwart political opposition or diminish legitimate protests against tyrannical regimes. This has become increasingly possible as subsumed by threat of terrorism, society rarely calls to question how personal data is being collected, and used for, by federal organizations. A recent case of this was brought to light by Edward Snowden, a former NSA employee who exposed government agencies for tracking individual activity through personal devices.

With the fast pace of development of sophisticated technology compounded with minimal oversight on its use, creates the potential for power imbalances, wherein those with access to data and technology can wield unauthorized power over others. There are already instances where peoples' everyday lives are tracked, including their whereabouts, habits, and social circles.

This is exemplified in major Chinese cities, where facial recognition systems are utilized in a dystopian totalitarian manner in order to prosecute and punish minor infringements such as jaywalking (Andrejevic and Selywn 2019).

There are two sides to this new technology, one of which could potentially help improve our society, and the other which could send us into an authoritative government that is able to control our actions by instilling fear that one's every action and move is being watched and recorded. This almost seems like the dystopian reality of Police's rock song *Every breath you take, every move you make*. While advancement of technology can achieve societal welfare, such as by limiting and controlling the spread of pandemic (such as COVID), the concerns of violation of personal privacy limit extensive adoption of the technology (Yasaka, Lehrich and Sahyouni 2020). In addition to violation of personal liberties, this technology infringes on individuals' 'right to be forgotten.' As this technology is still in its early developmental stages, it is prone to errors. For example, the London's Met Police was embarrassed when its facial recognition technology could not distinguish between a young woman and a balding man (Grubb 2018, p. 2). New regulations and oversight should keep pace with the development of new technology, so as not to infringe on personal liberties and privacy, the cornerstone of a free society.

As we develop as a society and begin to assimilate this technology in our daily lives, individuals will become even more vulnerable to invasion of privacy and losing their sense of individuality, as it is entirely possible that they will be tracked every minute they are in public.

These concerns are magnified when we expose young adults and children to this technology as if it is an entirely normal way of living, as they may become too accepting of unethical uses of technology. Arguably, since children are not adults they are not entitled to privacy and surveillance is non-intrusive, however, children do require some degree of privacy which grows as their capabilities expand and evolve (Bala 2022, p. 4). Children and young adults are taught to be respectful of authority and not to question teachers, parents or other adults. Hence, it is for the society at large to decide whether young people have a right to privacy, or should they grow up under surveillance and be inured to violation of their personal liberties (Bala 2022, p. 6). Children should not be treated as second-class citizens, rather citizens in training who should be sheltered from potentially harmful behavior, situations, and people. Facial recognition technology would not benefit any of those aspects in the classroom, and frankly would strip children of their unique traits that make education enjoyable. It is unethical to track a child's face with the intention of ensuring that they are paying attention in a class. There have been instances where surveillance in schools has caused discomfort for students, particularly in the UK, where students reported their choice of wardrobe choices influenced how likely they were to be reprimanded. This can be considered an infringement on the right of free expression, as the attire one wears is a form of expression, such as the rainbow armbands used by German soccer players at the recent FIFA world cup. This can also inhibit social growth and learning by 'trial and error', as children are always wary of being monitored and even minor infractions to be severely punished.

Laws and regulations have not kept pace with technological advances. For example, in the United States, the relevant law governing student privacy dates back to 1974, an age before the internet. Understandably, the 1974 Federal Education Rights and Privacy Act, while providing privacy protection to student records, has very little relevance in the current digital age (Galligan, Rosenfeld, Parthasarathy, & Kleinman 2020, p. 23). The lack of regulation makes students vulnerable to the negative and potentially unknown consequences of this technology in their classrooms. It has been argued that incorporation of new technology must coincide with reappraisal of its impact on privacy (Nissenbaum, p. 42). While such thoughts and positions are still developing, we need to accelerate these discussions and institute policies and regulations to protect the future generations.

My research proposal is to further investigate this issue with an extensive literature review leading to a design of a behavioral experiment. The design of the experiment will be influenced by existing research, contrasting a control group and a treatment group, wherein the treatment group will be led to believe that their actions are being recorded and observed by authorities. We will document the change in exhibited behavior as well as seek post-experiment opinion from the participants. We will obtain permission from the Institutional Review Board. Upon receiving the approval of the Board, we will seek volunteers at local campuses to conduct the experiment.

### **Conclusion:**

From these research projects, I would like to understand the effectiveness of facial recognition technology in education, and whether or not the contingency that would have these new technological advancements are aware of the danger they are susceptible to, and if they would accept them in stride. My technical research on the fundamentals of computer vision have



given me the proper background needed to go ahead and implement research involving facial recognition technology in various sectors of society, including education, law enforcement, and public policy. Through the controlled experiment, I hope to be able to shed light on whether people behave differently when they are being surveilled and their reaction to being surveilled. If an adverse effect is detected, it could influence how technology is developed as well as rules and regulation surrounding the use of such technology.

### References:

Andrejevic, M., & Selwyn, N. (2019, November 5). *Facial Recognition Technology in schools: Critical questions and concerns*. Taylor & Francis.  
<https://doi.org/10.1080/17439884.2020.1686014>

Bala, N. (2020, November 16). *The danger of facial recognition in our children's classroom: Duke law & technology review*. Duke Law & Technology Review. Retrieved October 6, 2022, from <https://dltr.law.duke.edu/2020/03/27/the-danger-of-facial-recognition-in-our-childrens-classrooms>

Galligan, C., Rosenfeld, H., Parthasarathy, S., & Kleinman, M. (2020, August 25). *Cameras in the classroom - university of michigan*. University of Michigan - Ford School of Public Policy. Retrieved October 7, 2022, from [https://stpstage.fordschool.umich.edu/sites/stpp/files/2021-07/cameras\\_in\\_the\\_classroom\\_full\\_report.pdf](https://stpstage.fordschool.umich.edu/sites/stpp/files/2021-07/cameras_in_the_classroom_full_report.pdf)

Grubb, B. (2018, January 2). *Facial recognition's ominous rise: Are we going too far too fast?* The Sydney Morning Herald. Retrieved October 27, 2022, from <https://www.smh.com.au/technology/facial-recognition-s-ominous-rise-are-we-going-too-far-too-fast-20180103-p4yy7d.html>

Nissenbaum, H. (n.d.). *Facial Recognition Technology - Cornell University*. Cornell. Retrieved October 28, 2022, from [https://nissenbaum.tech.cornell.edu/papers/facial\\_recognition\\_report.pdf](https://nissenbaum.tech.cornell.edu/papers/facial_recognition_report.pdf)

Leslie, D. (2020). *Understanding bias in facial recognition technologies - arxiv*. Google Scholar. Retrieved October 28, 2022, from <https://arxiv.org/pdf/2010.07023>

Selinger, E., & Leong, B. (2021, February 7). *The ethics of Facial Recognition Technology*. SSRN.  
<https://doi.org/10.1093/oxfordhb/9780198857815.013.32>

SITNFlash. (2020, October 26). *Racial discrimination in face recognition technology*. Science in the News. Retrieved October 27, 2022, from <https://sitn.hms.harvard.edu/flash/2020/racial-discrimination-in-face-recognition-technology/>

Smith, M., & Miller, S. (2021, April 13). *The ethical application of biometric facial recognition technology*. National Library of Medicine. <https://doi.org/10.1007/s00146-021-01236-7>

Wang, Q., Hou, L., Hong, J.-C., Yang, X., & Zhang, M. (1AD, January 1). *Impact of face-recognition-based access control system on college students' sense of school identity and belonging during covid-19 pandemic*. Frontiers. <https://doi.org/10.3389/fpsyg.2022.808189>

Yasaka, T. M., B. M. Lehrich and R. Sahyouni. April 7, 2020. Peer-to-peer contact tracing: Development of a privacy-preserving smartphone app. <https://doi.org/10.2196/18936>