Technical Topic: A Literature Review on the Development of Facial

Recognition Technology

STS Research: A Comparative Study on the Sociopolitical Aspects of Facial

Recognition in Different Societies

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Technical Project Team
Members
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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

The technical project assigned by the Department of Computer Science will somehow combine two computer science upper-level courses; all reviewers of the group will have had to have completed at least one of those courses and be enrolled in the other one. The particular areas that the project covers must somehow draw from the topic areas of these two different computer science courses. The technical project selected involves a review of literature on the topic of facial recognition technology. This involves a thorough analysis of the literature in the topic and a summary that focuses on the contributions of the papers reviewed. This technical project seeks to study a different facet of facial recognition compared to the STS prospectus, namely, its capabilities and development.

The STS prospectus seeks to investigate the sociopolitical and cultural aspect of facial recognition. Facial recognition technology's capabilities have expanded greatly in recent years, bringing with it many different forms of application, whether it be for education, health, commercial uses, or security. Development and integration of facial recognition into different aspects of daily life gives the technology and system increasing agency and influence. However, the growth of facial recognition is not without conflict and controversy, depending on the society and culture in which the technology is developed. This study seeks to compare the social, political, or cultural basis for the differences regarding the application of the technology in the U.S., the EU, and China.

Technical Project

The Department of Computer Science has provided a set of five possible categories for projects. Each project must incorporate two upper level computer science courses. The current tentative project selected for completion in the next semester is a literature review of research regarding the topic of facial recognition technology, and the contribution of the research to the development of the technology. Facial recognition software's capabilities have expanded greatly in recent years, with the potential to impact billions of people around the world. The application of facial recognition can range anywhere from national security applications to commercial technology designed to improve quality of life for people all around the world. The different technologies utilized to develop facial recognition are also improving at a rapid rate, requiring a better understanding of their relationship and particular intricacies. While many computer science courses relate to this topic in some way, some completed upper level computer science courses that relate to facial recognition technology include Statistical Learning and Graphical Models, Algorithms, and Foundations of Data Science.

This literature review involves an analysis a significant amount of research in the chosen topic, while the specific scope of the analysis has yet to be determined. This analysis will be summarized in a single cohesive paper, with the summary and analysis of these papers focusing on the combined contributions of the set of papers and how the set of papers integrates concepts from the two selected courses. By synthesizing and analyzing various research papers and their contributions, as well as their relationships to each other, this research could result in a better understanding of the complex relations required to create facial recognition software and provide a base for further development of this highly critical and widespread technology.

The goal of the literature review is to analyze 3-5 papers, selected from a wide pool of

available scholarly sources related to the topic of facial recognition, per team member. The literature review will also contain a taxonomy for the papers, which is a grouping based on similarity that will further clarify the relationships between different research papers. From this analysis, the findings will be summarized, and the implication of the findings for future studies will be explored.

This project will be completed during the Spring 2021 semester, with the first two weeks for paper selection, and the remainder for analysis and writing of the literature review. This project will potentially be done with other group members, who have yet to be decided, or could be done independently. Deliverables include the literature review itself as well as any potential supporting information gathered during the research process.

STS Prospectus

Introduction

I would like to examine how different cultures respond to the use of facial recognition technology and similar technologies, which many consider a threat to privacy, for the purpose of safety or national security. Facial recognition software's capabilities have expanded greatly in recent years, bringing with it many controversies in terms of its applications. The growth of this technology is already impacting billions of people around the world. Stakeholders involve governments and people in countries with access to such technology, as well as developing countries that haven't taken a stance on the use of facial recognition. As such, I would like to perform a comparative study of the various responses to facial recognition technology as well as the difference in design, arrangement, and deployment of the technology under different social, political, and cultural conditions. Countries that would be suited for this comparison would be the United States, the European Union, and China, which are the farthest ahead in terms of research and development of this technology. Preliminary examination also highlights the very different responses each of these countries have towards the use of this technology, perhaps due to underlying political or cultural norms. With the advancements in this technology, the use of facial recognition is escalating rapidly in the U.S., the EU and China. In terms of influence, each of these groups have demonstrated influence on the laws of neighboring countries, whether directly or indirectly, so the decisions made by these influential nations could cause a ripple effect across their indirect spheres of influence.

In the United States, over 26 states allow law enforcement to run researches against their databases of driver's license and ID photos, while the FBI has access to all driver's license photos in 18 states (Thales group, 2020). From a commercial standpoint, facial recognition software supplemented with artificial intelligence is also experiencing widespread growth across social media platforms and common devices used in everyday life,

for various purposes such as login and verification, personalized ads, health tracking, and more. This is also true in the European Union, where facial recognition is used at border checks and police checks, and CCTV systems are continuously expanded. In China, a video surveillance network is being deployed nationwide, with over 200 million surveillance cameras in use by the end of 2018, with an estimated 626 million by the end of 2020 (Thales group, 2020). These cameras are deployed in banks, airports and on the streets. This extensive facial recognition application is also linked with the developing Social Credit System in order to maintain public order and safety.

This is a study that could be benefitted from the STS investigation to systematically address sociopolitical and cultural conditions that enable or disable the use of this technology in these nations because stakeholders on different sides of the fence have very strong conflicting ideals, both with their own justifications. In countries like the United States, the general mindset seems to be against the use of facial recognition technology due to privacy concerns and worries about the technology being abused for political reasons. In countries like China, facial recognition is more accepted as a way of maintaining public order. Police and governments argue that facial recognition technology could prevent tragedies and loss of lives and that the privacy tradeoff is worth it. In the U.S., opposition has cited instances where facial recognition technology has seemingly been abused, such as to identify protestors during the Freddie Gray protests to be targeted for arrests, as well as concerns that facial recognition was used to identify protestors during recent events (Garvie, Bedoya & Frankle, 2016). These countries also have very different approaches towards the implementation and breadth of this technology. In the European Union, privacy and personal information is considered a fundamental right, with the Charter of Fundamental Rights in the European Union stating that everyone has the right to the protection of personal data (Pernot-Leplay, 2020). The United States, on the other hand, has a very minimalist approach in terms of data

protection and privacy laws, leaving many areas fairly vague, leading to controversies and protests during significant social and political events as a result of the use of the technology (Pernot-Leplay, 2020). China on the other hand, provides strong biometric data protection against private entities, but increases the government's access to personal information, while public attitude is less opposed to the idea (Thales group, 2020).

With all of this in mind, I believe that this issue is important and suitable for research.

Research Question

1. What is the social, political, or cultural basis for the differences regarding the politics, design, arrangement, and deployment of facial recognition technology in the U.S., the EU, and China?
2. How do different societies define and draw the boundary between public safety and individual privacy, and what factors influence this boundary drawing process in regulating the use of facial recognition?
3. What power relationships are evident during this boundary drawing process? What groups or parties have the influence or authority to influence the design and use of facial recognition? Who are the key stakeholders and what is the power relationship among these stakeholders in designing and promoting facial recognition technology?
4. Is there a consistent definition about privacy and safety across these countries, or do different societies have different definitions and beliefs regarding these ideas? What are the arrangements, or legal conditions regarding data ownership in each of these areas?
5. What are the differences in public perception and government perception regarding facial recognition technology and what does this tell us in terms of trust in technology and trust in government in each of these areas?

Literature Review

In order to compare and analyze the differences in these societies' approaches to and thoughts regarding the development and application of this technology for various purposes, topics examined range from differences in national approaches to privacy and data protection, ethical issues raised for various applications of the technology, as well as statistics regarding the acceptance or rejection of the technology for different purposes.

Ethics of Facial Recognition Technology in Various Applications

One of the most widely used and argued for application of facial recognition is for security purposes. After the 9/11 terrorist attacks in the US, video surveillance and facial recognition systems became the subject of increased interest and controversy. In favor of face recognition technology, there is the promise of a powerful tool to aid national security. On the negative side, there are fears of an Orwellian invasion of privacy (Bowyer, 2004). Given the ongoing nature of the controversy, and the fact that face recognition systems represent leading edge and rapidly changing technology, face recognition technology is currently a major issue in the area of social impact of technology. Ethical issues posed in the context of facial recognition for national security mainly revolve around violation of privacy, or the lack of detailed legal guidelines regarding implementation of the technology.

Andrejevic and Selwyn examined ethical concerns regarding the burgeoning integration of facial recognition and facial detection into compulsory schooling to address issues such as campus security, automated registration and student emotion detection. They noted that so far, these technologies have largely been seen as routine additions to school systems with already extensive cultures of monitoring and surveillance. In countries such as the US, UK and Australia, these technologies have so far prompted little controversy or push-back (Andrejevic and Selwyn, 2019). They noted that the various benefits from the incorporation of the technology, such as more efficient and secure transactions, greater

accountability, enhanced public safety and security, improved economic productivity, and commercial services may cause the public to openly welcome the technology. However, concerns being raised include issues of diminished accountability, compromised civil rights, and limitations on the concentration of power. In schools, Andrejevic and Selwyn argue that extensive incorporation of facial recognition could lead to ethical problems such as foregrounding of gender and race, dehumanization of schooling, increased authoritarian nature of schooling, and possible oppression of marginalized groups.

In terms of healthcare applications Martinez-Martin notes that there are also various different ethical dimensions of facial recognition technology. The use of facial recognition in health care suggests the importance of informed consent, data input and analysis quality, effective communication about incidental findings, and potential influence on patient-clinician relationships, so privacy and data protection are thought to present challenges for the use of the technology for health applications. There could also be ethical issues in terms of liability, if the software develops to the point where it can replace a physician's judgement (Martinez-Martin, 2019).

The various different concerns associated with each particular application of the technology illustrates the complexity of the ethics regarding facial recognition, and how there are different justifications for its extensive use in each case. This suggests that further exploration when comparing responses across different cultures and sociopolitical backgrounds require a more detailed approach, as opposed to purely statistical quantitative data collection.

Cultural Norms and Changes and Their Implications

While artificial intelligence and facial recognition technology itself may be relatively new, the mediums through which they are applied have existed for a long time and have become similar to a way of life in most societies. The past 20 years have seen the enthusiastic

adoption of CCTV in the US, UK and Australian schools, meaning that many campuses already have surveillance camera systems with campus-wide coverage, so the inclusion of facial recognition seems like a logical next step (Andrejevic and Selwyn, 2019). As a result of this, systems have been sold to thousands of US schools, with vendors 'pitching the technology as an all-seeing shield against school shootings' (Harwell 2018). CCTV and video surveillance networks are of course not limited to just schools, and are widely utilized in most public areas in the US, EU, and China. China in particular already had over 200 million surveillance cameras in use by the end of 2018, with 626 million expected by the end of 2020 (Thales Group, 2020).

Technologies such as smartphones and computers are basically considered to be essential to a regular way of life. Due to the fact that facial recognition technology is being portrayed as an extension to these technologies, there is a high amount of general acceptance for the sake of conveniences and facilitation of various daily activities. However, this acceptance is not without various concerns. Many individuals acknowledge the various ethical problems identified above, and feel uncertainty towards facial recognition.

Although there is a significant amount of concerns and backlash against facial recognition technology in both the United States, the EU, and China, the primary issues of concern are different. For example, in China, a survey released in 2019 by the Nandu Personal Information Protection Research Center found that 74% of respondents said they wanted the option to be able to use traditional ID methods over the tech to verify their identity (Shead, 2019). Respondents were also concerned about biometric data being hacked or otherwise leaked, and approximately 80% of respondents were worried that facial recognition operators had lax security measures. In the United States and the EU, on the other hand, backlash towards facial recognition comes in the form of accuracy concerns. A December 2019 National Institute of Standards and Technology (NIST) study evaluated the

effects of factors such as race and sex on facial recognition software. The study analyzed 189 facial recognition algorithms from 99 developers, using collections of photographs with approximately 18 million images of eight million people pulled from databases provided by the US Department of State, the Department of Homeland Security and the Federal Bureau of Investigation. The study found disproportionately higher false positive rates for African American, Asian and Native American faces for one-to-one matching, and higher rates of false positives for African American females for one-to-many matching (Jehl and Prochaska, 2019). There is also concern about abuse of facial recognition by law enforcement agencies, leading to increased regulatory scrutiny. One example of abuse that was fairly significant was reports about Clearview AI, which counts many law enforcement agencies as clients, was found to have amassed more than three billion images scraped from publicly available social media websites. The company was allegedly collecting data without notice or consent. Despite this however, a Pew Research poll found that more than half of US adults are more accepting with police using the technology (Smith, 2019). A study conducted in the United Kingdom, on the other hand, found that there was an almost 50/50 split between acceptance and rejection of facial recognition for police use (Bradford, Yesberg, Jackson and Dawson, 2020).

These different areas of concern hint at the differences in reasoning and justification while drawing the boundary between public safety and individual privacy, once again supporting a detailed analysis of underlying sociopolitical and cultural factors in these different societies.

STS Framework and Method

Frameworks that could be beneficial in examining this issue wicked problem framing, as there is no clean solution that will address all parties and stakeholders' needs and concerns, and there are only different levels of compromise. Langdon Winner's theory of technological politics could be utilized to see how the design, arrangement, and deployment of the technology represents the sociopolitical order and bring a certain form of life into the society. The adoption of a technology means more than just accepting an artifact but embracing a particular form of life represented by the technology, as seen in how the technology is being incorporated into the Social Credit System in China (Thales Group, 2020). Negative attitudes towards the technology in the United States could be furthered examined, to explore the underlying factors, such as values and beliefs. As such, utilization of Langdon Winner's theory of technological politics will provide a way to address the research questions presented above.

Methods for Data Collection:

In order to analyze and answer the proposed research questions, primary and secondary data will both be utilized. Secondary data will come in the form of public opinion surveys conducted in the United States, the European Union (and the United Kingdom), and China. These surveys will be collected from various sources such as the Pew Research Center for data on the United States, the Ada Lovelace Institute in Europe, and other research organizations. This quantitative data will provide a basic general understanding of the proportions of each society in favor of and against the use of facial recognition technology for various purposes.

The main primary data collection method will be through document analysis in order to better explore the social and cultural basis behinds the results of the quantitative data. In order to determine the sociopolitical factors behind the quantitative data collected from other

sources, various types of documents can be analyzed. News articles and opinion pieces from each of the three regions could be analyzed to judge public perception and the mindset behind that public perception regarding facial recognition technology. Privacy laws in each of these three regions could be examined in order to determine the differences in approach from a political point of view.

Timeline

If the research proposed in this prospectus is related to the technical topic, then the research timeline should be as follows:

Collection of secondary data such as polls and public opinion surveys regarding facial recognition technology should be done in the first two weeks. Afterwards, collection and extensive analysis of important documents as stated in the research method above will use the remainder of the available time, with the final week used to summarize and explain the research.

Conclusion

The research proposed in this STS prospectus seeks to investigate the social, political and cultural factors behind the differences in the politics, design, arrangement and deployment of facial recognition technology in the U.S. the E.U. and China. Research will be mainly conducted through document analysis and any insights could contribute to a better understanding of the various STS factors regarding facial recognition, which is increasingly important as the technology develops.

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