A formative program evaluation to implement facial recognition for law enforcement guided by statutory compliance and policy-relevant research.

Matthew T. Walker

University of Colorado Denver

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**EXECUTIVE SUMMARY**

The use of facial recognition technology by law enforcement is a highly debated and controversial topic due to reported inaccuracies concerning potential bias and the eventual "technological creep" that has been witnessed with the introduction of new technology by law enforcement. There also exists a lack of trust in the community when law enforcement adopts similar technologies based on perceptions of an authoritarian governmental entity. The state of Colorado is by no means excluded from this debate, and so to address those issues the Colorado Legislatures have adopted SB22-113 to regulate the use of facial recognition (FR) technology by law enforcement. The Bill has been codified into state statute under C.R.S. 24-18-301 thru 309. This regulatory guidance has been set up as a guide for law enforcement to adopt this new technology as a tool to assist in criminal investigations and aid in the identification process for potential suspects that would otherwise continue to commit crimes without facing justice. This Bill is a clear message to law enforcement that the legislative body is not opposed to the use of FR technology, but would like there to be regulatory guidance in its use. Also within the regulatory guidance, there are some regulations that make the adoption and implementation of the FR program a challenging task. That guidance comes in the form of a presentation to the elected officials having authority over the law enforcement entity requesting to use the technology and a minimum of three community meetings. This gives my client at the Arapahoe County Sheriff's Office (ACSO) an unprecedented opportunity to engage with stakeholders in the community and explain in detail how the technology will be used, bringing transparency to the technology. This is also an excellent opportunity for the community to provide input into the implementation of the technology.

To assist with the adoption of an FR program the ACSO has requested an "evidence-based" research project and additional help engaging important stakeholders within the community to assist in the implementation of the program. This project was launched with several meetings that began with the construction of both an FR policy and a compliance (accountability) report guided by the regulatory guidance with additional input provided by secondary research through a literature review in the areas of FR regulation, reducing bias, and finally, public trust and perception. The evidence-based research was used to mitigate mistakes on the front end rather than through lessons learned after implementing an FR program.

After the completion of both an FR policy and compliance report/accountability report, the ACSO requested additional research in the form of a program evaluation for FR implementation. To gauge ACSO's response to the legislation for FR implementation the author constructed interview questions that included purposive sampling methods from area law enforcement investigative leaders to answer the posed research question. "How have Colorado law enforcement agencies responded to recent legislative changes in how facial recognition is used in criminal investigations?" The interview questions were designed to elicit responses from local law enforcement agencies on how they are dealing with the legislative changes for FR. The responses were also designed to further the conversations for law enforcement technology implementation with stakeholders in the community and bring transparency for newly adopted technology in the future. The primary data collection was also designed to assess the importance FR plays in developing investigative leads in developing a suspect based on a comparative digital image.

The overwhelming majority of the respondents indicated that FR is a very important tool in identifying suspects and/or potential leads in a criminal investigation. The responses also

revealed that many law enforcement agencies used FR in the past for just that very purpose but post-legislation there is no one in the Denver metro area currently implementing this investigative tool, with the exception of a few that are working towards that goal. Of the respondents who have not addressed or attempted to address the legislative requirements, it is due to a lack of support from stakeholders at the local government level or within the community. One response that the author did not anticipate, from a non-participating FR agency, was that when asked the follow-up question, "How important is FR to you." The response was a quick "very important," because one of his units uses FR to identify online predators who post pornographic pictures of themselves in attempts to lure underage persons. Without that digital image for comparison, which can be done in short order, it may take weeks for the production of records to reveal the owner of the IP address, which may not even be the sender. Meanwhile that predator continues to communicate with children without being identified. It is that very response that could be used to at least further the conversation about the importance of FR to those stakeholders, and just one example of why the ACSO should continue with an FR program.

Based on the results of this research I believe that the ACSO is on the appropriate track for FR program implementation and my client should move forward with the following recommendations:

- Continue to develop a policy and accountability report for eventual FR implementation.
- Present the policy and accountability report to the Board of County Commissioners (BOCC).
- Use this evidence-based research project and associated data to support the need for an FR program with the BOCC.
- Be transparent and engage all stakeholders to address their concerns over the ACSO's use of FR technology.

- Implement and train investigators to use FR as a tool to assist in solving criminal cases, thereby upholding the mission of the Arapahoe County Sheriff's Office.

## Introduction

Facial recognition is the latest controversial technological advancement in law enforcement, and analogous to previous technological advancements adopted by law enforcement that are misunderstood, they are met with skepticism and oftentimes downright contempt by the public. This is due to a lack of information sharing and transparency, "Similar to other forms of technology, technology in policing tends to emerge in a low-information environment" (Braga, Sousa, Coldren Jr., and Rodriguez, 2018, p. 513).  The public perceptions and attitudes on law enforcement's adoption of technology are well established. They stem from prior cases of technological abuse and the public's lack of trust and understanding of the technology used by law enforcement. Many are concerned about a potential intrusion on people's privacy, or what some are quick to label as the governmental "big brother" (Ritchie, et al., 2021, p. 8). Some of the community concerns may have been influenced by popular Hollywood movies where government agents track subjects in real-time using facial recognition and relentlessly pursue them, characterized in the film(s) Enemy of the State (1998) and Minority Report (2002).

In an attempt to avoid such abuses and prevent technological "function creep" by law enforcement, the Colorado legislature adopted SB22-113 (SB113) to help mitigate the negative perceptions of the public (Guo & Kennedy, 2022, p. 9). The Bill is designed to regulate the use of this new technology and provide transparency to the public regarding facial recognition technology and how it will be used by law enforcement. The Bill also requires public hearings, allowing the public to weigh in on a law enforcement agency's intent to adopt and use facial

recognition (FR) technology. With an additional clause to report any potential abuses or mistakes made in misidentification when using facial recognition.

In its most simplified explanation, facial recognition technology (FRT) uses computer software algorithms to compare the facial biometrics of an unknown individual versus a known individual to generate a possible identification based on a numerical accuracy score. "Biometrics refers to the characteristics of a person which can be used to identify them," which can include more commonly known human biometrics such as fingerprints or DNA (Ritchie, et al., 2021, p. 1). Identification can be done using a one-to-one or a one-to-many comparison. The most common method for a law enforcement application of FRT is accomplished by taking a still photograph in digital format of a potential suspect and comparing it to a database of existing photos or a catalog of existing booking photos from prior arrests.

**Figure 1**.



1. • Image Capturing
2. • Face Detection
3. • Feature Extraction
4. • Database Matching
5. • Person Identification

Image provided by (Kaur & Sharma, 2020, p. 133).

In the identification process, the use of still photos is less complicated than using real-time comparisons of active surveillance video. "FRT is used for three main purposes: facial detection, verification, and identification" (Chan, 2021, p. 308). As such, the use of still digital

images to conduct one-to-one or one-to-many identification with FRT is the focus of this research project. The findings will be used to support my client's intentions in implementing a program and an eventual policy and compliance report for the use of facial recognition. With the eventual goal of assisting with the development of investigative leads and solving criminal investigations through suspect identification.

For this project, I have partnered with the Arapahoe County Sheriff's Office (ASCO) to conduct research on FR technology that will assist in implementing a program and constructing an agency policy that is compliant with SB22-113 and meets the Commission on Accreditation for Law Enforcement Agencies (CALEA) accreditation standards. The application of facial recognition technology (FRT) will also be in accordance with the Colorado Information Sharing Consortium (CISC), a state law enforcement entity that regulates the technological sharing of information amongst partnering law enforcement agencies in Colorado. While the CISC has a suggested model policy for the use of facial recognition by Colorado law enforcement agencies, it may not meet the requirements of an individual agency policy. Hence, the ACSO is requesting a formative program evaluation and additional research on FRT that applies to their agency to develop a policy. The purpose of the formative program evaluation is to assist in the planning of the program and improve the program prior to implementation. The ultimate goal for ACSO is to design a policy that meets both statutory and agency guidelines and conduct a formative evaluation of the FR program using a combination of peer-reviewed research from the literature review and primary research from the author. The result is a policy and FR program that has its foundation built on evidence-based policing practices.

The ACSO was founded in 1855 and Arapahoe County has the distinction of being the first county in Colorado. Originally the county boundaries extended from the City of Denver

well into the Kansas territory. Today the county is bordered by Denver, Adams, Douglas, and Lincoln counties and covers approximately 797 square miles with a population of just over 655,000, according to the United States Census Bureau (2020), and is the third largest county in Colorado. The ACSO has a rich history and tradition that includes the likes of E.W. Wynkoop, who was the first Sheriff, and historically famous characters such as Bat Masterson who served as a deputy sheriff. Currently, the Sheriff's Office employs over 700 people that are a combination of commissioned personnel and support staff. That history and tradition continue today with the ACSO being only one of 49 sheriff's offices in the country to earn triple-crown accreditation status under four sheriffs, beginning in 1993. Building on that rich tradition in law enforcement, the ACSO believes that additional transparency of the application of FRT will reduce public mistrust of law enforcement that has surfaced when adopting similar technological advancements in the past. The foundation for transparency and trust will be strengthened through community engagement and information sharing designed to educate the public about FRT and how it will be used at the ACSO. The ACSO's Investigations Section intends to use facial recognition as a technological tool to assist with criminal investigations when there is an unknown suspect, but a potentially identifiable photographic image exists. That image will be used to develop a lead in a case that would otherwise have no leads. Without that lead, the case is closed out or deactivated, all due to the inability to match a possible identity to an existing digital image, and so the case may never be solved. These situations can be very frustrating and lead to an erosion of trust between law enforcement and the communities they serve, leaving investigators and victims feeling helpless with a suspect that may continue to cause physical or mental anguish to more victims without facing justice.

By conducting a formative program evaluation using relevant research, which includes existing policies, in combination with additional research on facial recognition regulation, potential bias, and public perception, the ACSO can design an accountability report and policy that supports FR implementation. A formative evaluation affords my client at the ACSO the ability to utilize strengths and recognize the limitations of the FRT program and provides suggestions and guidance for implementation that recognizes and addresses the needs of the community. The policy will also be compliant with state statutes and CALEA accreditation best practices standards, reinforcing the rich history and tradition at the ACSO. The research will also be used to educate the public during any public hearing, required by statute, on the use of facial recognition technology by the Sheriff's Office. Thereby upholding the mission of the Sheriff's Office by serving the community and bringing solutions to crime problems.

**LITERATURE REVIEW AND STATEMENT OF PURPOSE**

The amount of peer-reviewed research on the use of facial recognition technology (FRT), artificial intelligence (AI), or what some researchers are calling automatic live facial recognition (AFR or LFR) is vast and covers many topics within the field of criminal justice research. As for this project, I will narrow it down to the use of FRT for law enforcement, and more specifically the use of FRT to develop a lead in a criminal investigation. As stated previously my client intends to use FRT at the Arapahoe County Sheriff's Office Investigations Section to develop leads in criminal cases that will increase the likelihood of successful prosecution and continue the quality of service that the Sheriff's Office is committed to in its mission statement.

The Arapahoe County Sheriff's Office Investigations Section is comprised of approximately 50 full-time investigators and supervisors, with about 15 support staff that include intelligence & crime analysts, administrative assistants, crime scene investigators (CSI), and

victims' assistance personnel. Reports come into the Section from several sources but the primary source of written reports sent to the Section is from deputies in the Patrol Section that are in direct contact with residents or persons within the Sheriff's Office service area that call to make a report related to a criminal offense. Those reports are then assigned by the supervisory staff to individual investigators based on the investigator's assigned specialty whether it be a person's crime or a property crime. From those reports taken by patrol personnel, the property crimes section by far receives the majority of the reports, and of those reports, many go unsolved for a lack of evidence. This happens for many reasons, but the most common is that there is very little evidence to recover from property crimes that could lead to a suspect let alone a successful prosecution apart from maybe a digital image of a potential suspect. Without excluding the person's crimes section, there are person crimes that take place where the victim and the offender have no relation, and it is for those reasons that the Arapahoe County Sheriff's Office wants to adopt an "evidence-based" FR program. The ACSO desires to apply the technology to aid investigations in both property and person crimes that are equally transparent to the community and supports the victims of crimes and reinforces the goals of "evidence-based" policing as outlined by Lum &Koper (2021).

**Regulatory Guidance**

A primary focal point in the literature is the need for monitoring and regulation of FRT, followed by an explanation to the public on how law enforcement entities intend to use this newly adopted technology. The regulatory guidance is determined by recently adopted state statutes in the form of SB22-113 which is codified under Colorado Revised Statute (C.RS.) 24-18-301 thru 309.  Statutes like these guide law enforcement agencies within the State of Colorado on compliance and how to use facial recognition technology. Statutory regulation also

provides mandates regarding information sharing with the public which includes explaining FRT's intended use, when and where it can be appropriately applied, and how to apply the technology ethically through an accountability report. All of this is designed to provide clear guidelines to law enforcement and bring transparency to the community while preventing "function creep" (Guo & Kennedy, 2022, p. 11). Function creep occurs when there are advances or innovations in the technology used by law enforcement that pushes the boundaries of the original intent, and the expanded use is viewed as questionable by the public. These same topics on FRT regulation as well as ideas for a co-constructed policy through community engagement are abundant in empirical peer-reviewed research (Guo & Kennedy 2022; Gates 2011; Chan 2021; Hill et al. 2022; Ferguson 2021; Jones 2022). "Public understanding and trust in these technologies will have an important impact on their development and use" (Guo & Kennedy, 2022, p. 3).

Chan (2021) argues that an outright "ban" on facial recognition technology would be presumptuous without a full understanding of the technology and its applicable uses but cautions that it should be developed in a "calibrated" approach that mitigates risks. Chan (2021) also argues that if FRT is banned we may miss out on the developing benefits and risks, but through understanding the use of FRT in law enforcement on the front end, it can be met with regulations that can mitigate those potential risks ensuring it is developed and used appropriately. There has been a large and disproportionate focus on the risks and potential negative impacts of FRT such as bias in algorithms and technological abuse by law enforcement, and the public and legislatures have lost sight of the benefits of FRT. Many cities on the west coast banned the use of FRT by any governmental entity until recently when legislatures in the state of Washington (2020) passed a law that does not ban FRT but rather imposes regulations to prevent abuse and bias and

promote community engagement. Additionally, the law requires an accountability report by entities wishing to use FRT, conduct public hearings, and additional human review before any decision is made to use the image for any legal action. This sounds very similar to what happened last year in Colorado under SB113, which includes some of the same language and regulations. So, it appears that instead of an outright ban on FRT, many are seeing the potential benefits of FRT, but they are proceeding cautiously through regulation by using a "calibrated" approach (Chan, 2021).

Chan (2021) also describes the "three pillars" that make the foundation for the calibrated approach, and those are "stakeholders, normative standards, and implementation" (p. 323). Stakeholders include everyone from the firms designing the facial recognition algorithms down to the public or private entities using the algorithms, which Chan contends through transparency is the beginning of the foundation for a trusting relationship between the public and the entities using FRT. The normative standards are dependent on how each user or entity will deploy FRT and by what standards or "ethics" they are following for its use. This is where public entities such as law enforcement agencies need a well-constructed policy based on legal guidance, state statute, accreditation standards, and ethical considerations that best serve the community. This also presents an opportunity for community input on the policy regulating the use of FRT by the police for a "co-constructed" policy (Chan, 2021; Hill et al. 2022). Implementation is dependent upon the use of FRT and specifically for law enforcement, this is accomplished through public transparency and a clearly defined policy that prevents abuse and function creep.

**Reducing Bias**

Another focal point of the research is that no matter how FRT is to be used there should be a process for reducing the number of errors or potential for error, especially when applied in

minority or marginalized communities. "Analysis of these issues could provide the factual bases, as well as an analytical framework, to inform the development of laws and policies" (Guo & Kennedy 2022, p.2), which is supported by additional research from Chan 2021; Johnson et al. 2022; Grother 2019. Many of the errors in facial recognition are revealed in two forms, and this is through a false positive or a false negative result. A false positive occurs when an image is falsely matched to another which could potentially lead to a misidentification. The other result is a false negative which is an image that is not matched at all, even though the comparative image is the same, which is why Colorado state statute (SB22-113) requires independent review for FRT results and independent evidentiary evidence to establish probable cause before an arrest warrant is sought or an arrest is made (C.R.S. 24-18-301 thru 309). Thus, reducing technological errors and human interaction that could "automate officer decision-making" (Johnson et al. 2022, pg. 4).

A major piece of the research revealing the potential for racial bias is done through a quantitative research project by Johnson et al. (2022) comparing self-reported data from the Law Enforcement Management and Statistics (LEMAS) report to the Bureau of Justice (BJS) in conjunction with the Uniform Crime Report (UCR) statistics on arrest rates of whites versus blacks for agencies that self-reported the use of FRT. Johnson et al. (2022) examined the reports from 1136 police entities that met all of the listed requirements and compared the arrest disparity rates of whites versus blacks for agencies that use FRT against agencies that do not use FRT. Their basic research question is "whether agency FRT deployment contributes to racial disparities in arrests" Johnson et al. 2022, pg. 6). Their findings reveal that agencies using FRT have a %55 higher arrest rate of blacks versus whites when compared to agencies that do not use FRT technology, but they also recognize some limitations in their study that would need

additional research. Johnson et al. (2022) make note of the self-reported data used for their study does not indicate how the FRT technology is being used or deployed or if FRT was used to make the arrest, nor does it include policy and compliance, which leaves room for additional research on these topics. Johnson et al. (2022) close by stating that the use of FRT does reveal racial disparity in arrest rates, but the overall message for agencies currently using FRT is to increase training and awareness of bias and the possibility of unintended consequences such as disparate arrest rates.

The National Institute of Standards and Technology (NIST), which is a research partner affiliated with the U.S. Commerce Department, conducts independent research on the accuracy/error rates of facial recognition algorithms from various vendors and publishes their findings in an annual report (Grother, Ngan, & Hanaoka, 2022). NIST research in this area revealed that there are potential errors with darker-skinned persons but that with the advancements being made in the field of FR they are becoming negligible, especially with more advanced detection algorithms from vendors with very low error rates at < .05% (Grother, Ngan, & Hanaoka, 2022).

**Public Trust and Perception**

The literature also provides insights into public sentiments related to the use of facial recognition technology by the police. The results vary depending on the questions asked by researchers in various public opinion polls, but many demonstrate support for the police when using facial recognition to eliminate terrorist threats, conduct criminal investigations, and locate or identify missing or deceased persons. Conversely, findings indicate that the public is not in favor of using FRT to identify individuals involved in a free speech First Amendment situation such as a peaceful demonstration or protest, nor are they in favor of using it against someone

solely because they are in a protected class (Kostra et al. 2021; Hill et al. 2022; Ritchie et al. 2021; Fleet & Hine 2022; Bragais et al. 2021; Bradford et al. 2020).

Public perceptions and acceptance of the limited use of FRT by police have been analyzed by numerous researchers in the criminal justice field using several survey methods that are representative of all demographics and their peer-reviewed published results use both qualitative and quantitative data to support their findings. Their findings are very telling about how the public views facial recognition technology used by the police and recommend viable solutions for regulation and policy so it can be used as a successful tool for law enforcement to establish investigative leads and to aid in solving crime. Most of the research centered on public perception and acceptance is concentrated in the areas of trust in legitimacy on how law enforcement intends to use FRT.

The research by Fleet and Hine (2022) supports these sentiments and further states that their findings from their sentiment analysis can be used to develop policies for technology use by law enforcement, and additionally provide a blueprint for community engagement and information sharing. "Overall, the discourse was mostly positive for the use of FRT by police," the public still has reservations about the police application of FRT and they are slow to trust its use based on reported inaccuracy (Fleet & Hine, 2022, p. 1). While reported inaccuracies are true, they are based on prior laboratory algorithmic testing and in real-life situations for which there exist three well-publicized cases of wrongful arrest based on FRT. Despite this low number of wrongful arrests based on FRT, it is not acceptable, but those factual reports weigh heavily on public opinion. The majority of public opinion based on these cases and the reported inaccuracies of facial recognition are based on what several researchers call "agenda setting" and "framing" where the media presents the information and frames it in a manner for the public to

consume it, and depending on how the story is framed, it will impact public opinion on a topic (Fleet & Hine, 2022, p. 3). "Media framing essentially introduces a constructed perspective using selective language, commonly held assumptions, and curated sources to present a particular 'angle' to the audience" (McLeod and Detenber, 1999; Park et al., 2012; Scheufele, 1999; Fleet & Hine, 2022, p.3).

In the study conducted by Fleet & Hine (2022), they used an agenda-setting theory to conduct a sentiment analysis of YouTube viewers based on the search criteria of "police" and "law enforcement" combined with "facial recognition." The focus was based on the video postings from media outlets and private parties and how they were portrayed, and the posted reaction of the poster/viewer. They were able to establish a data set of 203 videos from several countries that included, but not exclusively, the U.S., the U.K., and China for use in their study, most of which focused on the controversy of FRT and the number of cities banning FRT, but did include a positive story for the use of FRT when police captured the Capital Gazette shooter in Annapolis, Maryland through the use of FRT.

The results of the study revealed that there was an overall positive sentiment (61.44%) based on the language used with only 38.56% being negative comments with eight additional sub-categories for emotional responses included in the study as well. The results indicate that there is an overall accepting sentiment about the use of FRT based on a foundation of a positive agenda from both the poster of the video and the viewer. This is contrary to the author's original expectations about media "framing," but they also conclude that there exists research that states that YouTube tends to be more favorable to law enforcement than traditional television news media outlets. The postings also indicate that YouTube can be a good source for the public sentiment on FRT and what the public concerns and perceptions are for the use of FRT by law

enforcement, in turn, law enforcement can address those concerns through transparency and policy construction. According to the Police Executive Research Forum (PERF), 83% of police departments use social media for messaging, and 70% use social media to receive messaging from the public (Stroshine, 2021).

Bradford et al. (2020, pg. 1502) support the same claim that "public trust and legitimacy are important factors predicting the acceptance or rejection of LFR." In their research, they use a public opinion poll based on the responses of 1092 Londoners from 2018 that is derived from over 800,000 respondents who agree to take part in governmental research polls. The first question was a basic "yes" or "no" response question based on the acceptable use of LFR by the police, with the remainder of the questions being a response based on a Likert scale from 1 to 9 with the higher scores being in favor of the police use of LFR. Bradford et al. (2020) also designed two different vignettes with a slight variation differentiating the two, one stated that all images would be retained for future use, and another that stated only matches for subjects of interest were retained by the police. The vignette was administered on a 50/50 split to respondents of the poll. For this research, it is important to focus on only the responses that would pertain to the retention of images of subjects of interest (e.g. persons with an arrest warrant, etc.) which is similar in function to FRT for this project, but a note of interest was that despite the difference in the vignette or question the responses were 58% (discarding images) and 56% (retaining images) in favor of the police use of LFR. There were also compelling differences amongst the demographic groups for the responses to the vignettes, but when broken down by specific crime type such as identifying terrorists or identifying serious violent offenders the responses were overwhelmingly in support of the use of LFR, regardless of demographics.

One final note about the responses was that the degree or severity of the crime played a large part in the acceptance of LFR amongst all respondents in both groups.

To complete their study Bradford et al. (2020) tested several hypotheses using structural equation modeling with several variables including trust, worry about crime, political orientation, privacy concerns, and legitimacy. When the results were analyzed together Bradford et al. (2020) concluded that the biggest concern for the use of LFR by the police was privacy which Kostra et al. (2021) agreed with, and concerns that the police were going to be intruding on the daily lives of persons in the community which the researchers conclude is a direct link to legitimacy.

In 2019 Kostra et al. (2021) conducted a non-probability online survey using quota sampling employing over 40,000 online apps and representing groups from China, Germany, the United Kingdom (UK), and the United States (US) to gauge public perception of the acceptance of FRT. From the qualifying survey responses, they were able to narrow their focus to a sample size of 6,099 (N=6099) by validating responses from respondents who understood facial recognition technology. Thus, identifying their dependent variable of interest as "social acceptance" for the use of FRT. They also made sure to represent subgroups and regions equally by using census data and weighted quotas for age (18-65) and represented gender equally. The sample size was further broken down by country with 1628 qualifying responses from China, 1538 from Germany, 1524 in the UK, and 1409 from the US.

The data was analyzed using ordered logistics regression specifically on socio-demographic factors, political context, and the perceived functions of FRT using the dependent variable identified earlier as the "social acceptance" of FRT. The basic survey question reads: "In general, do you accept or oppose the use of facial recognition technology?" with the responses for US participants ranging from strongly oppose (9%), somewhat oppose (14%),

neither oppose nor accept (28%), somewhat accept (35%), or strongly accept (15%) (Kostra et al.

2021, p. 678). Revealing that the majority of the US is in favor of the use of FR, but as noted

earlier by Bradford et al. (2020) the biggest concern was the privacy of individual information.

**Facial Recognition Accountability Report and Policy Review**

A formative FR program evaluation with the eventual goal of program implementation

and adoption are the central themes of this entire client-based research project, which will focus

solely on Colorado due to recent legislation and required compliance for accountability

reporting. SB22-113 is a Colorado Senate Bill that was passed and signed into law during the

regular session on June 6, 2022, and requires any local government agency, to include higher

education entities who plan to use "facial recognition service" (FRS) to comply with the

guidelines outlined in the Bill. The Bill was codified in state statute under C.R.S. 24-18-301 thru

309 and provides guidance on accountability reporting and policy construction, so every current

agency policy will have the bulk of the requirements outlined by statute. The statutory guidelines

are as follows:

- Communicate its intended use to the reporting authority through an accountability report (which in this case is the Board of County Commissioners).
- Publicly post the intention to use FRS and the accountability report for public comment.
- The accountability report must include a separate clearly established policy.
- Requires a secondary meaningful human review before any legal action is taken.
- Conduct "periodic" training for all individuals using FRS.
- FRS results are not to be used as the sole basis for probable cause.
- Disclose the use of FRS to a defendant before trial.
- Prohibits its use for real-time surveillance without a warrant, and prohibits discrimination based on religious, political, or social views through the use of FRS, and using it as the sole basis for probable cause, or manipulating an image to a degree it is not acceptable in the FRS's providers intended use.
- Establishes a task force for reporting to the state the use of FRS by agencies (Use of Facial Recognition Services by State and Local Government Agencies, 2022).

As structured as these requirements are it opens up the opportunity to amend the policy or modify the accountability report to meet individual agency needs based on the recommendations of community members during public hearings. This will assist in the formative evaluation of the program before the utilization of the technology. There is also an allowance for individual processes used for digital image input and clarification for the "meaningful human review" of the results, along with clarification processes for discrepancies in the review process. Each agency also has the option to choose the FRS/FRT software service provider and how those images are gathered unless they abide by the rules established by the CISC.

Because of the recent legislative changes only a few metro Denver area agencies have followed through with an accountability report and/or a policy that meets those requirements. The FRT program deployment at the majority of the agencies has not yet started due to the statutory requirement for public hearings that are mandatory after the posting of the accountability report, which serves as a notice to begin using FRT.

Two of the policies provided for this research project are constructed in a policy format but they contain verbiage directly from statute (C.R.S. 24-18-301 thru 309), which is neither a good nor bad thing, but it makes it difficult to delineate from the accountability report for public comment and the policy to be adopted by the agency. Additionally, one agency has chosen a software service provider and included their processes for facial recognition and the vendor's limitations, which would again need to be separated from the policy. This would be more suited in a training environment post-adoption and prior to usage as outlined by statute in C.R.S 24-18-305, which identifies the need for training for all users of FRS/FRT.

The third policy reviewed contained both an accountability report and an additional policy which makes it easier to distinguish between the two because the policy is written in a standard format outlined by Rennison and Hart (2019). Beginning with the purpose, and the definitions, followed by the policy and procedure or governing rules of the policy. Even though the policy was well formatted and thorough it contained definitions at the beginning that were not necessary because they were included later in the procedures. The policy also contained a section for records retention, security, and auditing which again is thorough but that additional information could be referenced in another policy and just notated rather than being written out in its entirety. This is also where participation in CALEA accreditation is essential because those particular policy items usually have a set standard and are again notated by a simplified accreditation standard versus a full description. The accompanying accountability report is also drawn-out in description and again cites state statutes, making it excessively long and difficult to comprehend. Accountability reports and policies should be written in plain language and easy to understand for the personnel they apply to.

The last policy for review was very brief and due to its brevity lacked content for guidance and specific procedures for users of the FRT system. There is no procedure for a "meaningful human review" nor is there a descriptive procedure to remedy a disagreement in the human review process. Furthermore, the policy does not state that the results of an FRT image match do not establish probable cause, and therefore the image is not grounds for legal action until additional evidence is presented to establish probable cause. Both requirements are incorporated into state statutes.

The facial recognition accountability report and policy review are the most meaningful segment of this evaluation because those accountability reports and policies can be used by the

ACSO to avoid roadblocks in establishing an FRT program. Thereby giving ACSO a distinct advantage in developing a comprehensive accountability report and an effective policy for the use of FRT.

**METHODOLOGY AND RESEARCH DESIGN**

**Research Question:** How have Colorado law enforcement agencies responded to recent legislative changes in how facial recognition is used in criminal investigations?

**Framework**

The methodology for this formative FR program evaluation project is guided by the needs of my client with the aim of answering the proposed research question with the eventual implementation of an FR program. My client's needs are clearly stated in that the ACSO wants to develop a program to use FRT by constructing a comprehensive policy and accountability report for the use of FR that is backed by statutory compliance and evidence-based research. The evidence-based research to support policy construction comes in the form of secondary data from published research in the areas of statutory regulation, building community trust, and preventing bias that meets the needs of victims in the ACSO service area, which is provided in the literature review. But in order to gauge law enforcement's response to the recent statutory changes the author will collect primary data from several Denver metro area law enforcement agencies using purposive sampling to assess and evaluate how my client should proceed with the current process for FR implementation and mitigate potential obstacles. These additional research elements will enhance and improve the policy and accountability report and the eventual implementation of an FR program to aid in criminal investigations at ACSO.

**Study Design**

Once the accountability report and policy are complete it is required by statute to be presented to the Board of Arapahoe County Commissioners (BOCC) and then posted for public comment with additional public hearings before program implementation. This is where the FR program needs evaluating, and the primary data collected from purposive sampling interviews from several Denver metro agency investigation supervisors is best suited to answer an FR program evaluation prior to implementation. The phone interviews will collect both quantitative and qualitative data to assist in evaluating the FR implementation process and determine how Colorado law enforcement agencies and the ACSO are responding to the legislative changes. The survey will consist of eight respondents, including the ACSO. The decision to use eight respondents was made based on recent statutory changes in how law enforcement uses FR in criminal investigations and the fact that there are only four known agencies in the Denver metro area currently attempting to meet statutory compliance and adopt an FR program. The responses from the additional four agencies that are not seeking an FR program, or at least at this time, will be used to ascertain whether they plan to use FR in the near future or not based on the legislation. The sample size is an obvious limitation on the amount of data that can be collected but it is still relevant to law enforcement in the State of Colorado, or any law enforcement agency dealing with a legislative framework for the use of FR.

The respondents are based on whoever at the agency is in charge of the FR program or at least in charge of the investigations section due to FR being an investigative function. Especially when the primary use of FR is to develop a lead in a criminal investigation. The advantages to this approach are that the author can make direct contact with the person in charge of the criminal investigations section, or designated intermediary, and clarify responses over the phone

if necessary, and it is an efficient way to gather data for an FR program evaluation. The disadvantages are very similar, specifically if the agency has no plans to adopt an FR program. Then there is no data to support an FR program evaluation other than the reason for not adopting an FR program, which may be that the statutory requirements are an arduous undertaking and they are going to forgo the process for compliance.

The interviewees were chosen based on information the author received from the CISC for agencies that were planning to adopt FR technology, of which there were only four at the present time. So, the decision to target eight respondents was made to have an equal distribution of answers from four agencies that are planning to adopt FR, and four that are not currently planning to adopt FR. The author then made contact with several agencies to ascertain their position on the use of FR technology, of which ten responded, but only eight responses were used due to time constraints for the data evaluation. When making contact with the participating agencies the author identified who at that particular agency would be best suited to answer the interview questions. Once that contact information was obtained the informed consent and questions were emailed to them and then a follow-up phone call was made to complete the interview. All responses were then recorded in an Excel (2016) spreadsheet (Appendix II).

**Data Analysis**

A qualitative analysis will be used to organize and analyze the data which will be coded systematically according to response themes for agencies that use or plan to use facial recognition versus those that do not plan to use FR or currently do not. This data will then be further analyzed to see what type of response, or planned response the agency has for the recent legislative changes for the law enforcement use of facial recognition (FR). The benefits of using a qualitative data analysis based on purposive sampling to answer the research questions are that

the respondent can give a detailed response on how they plan to deal with the recent legislative changes for using FR as an investigative tool, and follow-up questions can be used for clarification. This can also lead to bias if there is a desired response elicited especially with a small sample size. So, the goal is to remain objective in the responses received and use descriptive coding and organize them into themes for thematic analysis and apply inductive reasoning, from specific to broad themes. Using this approach may assist in developing future research for the use of FR. The inductive approach is also used for this process because the author cannot predict each individual agency's reasoning for either using or not using FR because there is little known about the process for compliance to date. The qualitative data (open-ended questions) will be specifically used to answer the proposed research question which will be supported by the quantitative data or closed-ended questions for the eventual continuation of FR implementation by my client.

The quantitative data will then be organized in Excel (2016) for agencies that use or plan to use facial recognition versus those that do not plan to. The basic demographic questions will be analyzed using basic statistical analysis for the mean average of citizens served, agency size (sworn), number of investigators, and average caseload for both persons and property investigators for all respondents. This data will be used to support any theme generated from the qualitative data analysis.

The nominal data for the yes/no portion of the survey will again be organized in Excel (2016) and organized in a crosstab table for agencies planning to adopt or in the process of adopting FR versus those that are not in the process. This is done to support the quantitative data and gauge the benefit of an FR program and determine the overall value of continuing with FR implementation by the ACSO.

**FINDINGS/RESULTS**

The ACSO has gone above and beyond most and taken guidance from Chan's (2021) "three pillars" concept and included all three pillars in its policy construction and program evaluation "stakeholders, normative standards, and implementation" by partnering in this research project (Chan, 2021, p. 323). The ACSO will have open communication with the community as required by statute and meet regulatory compliance by submitting all the necessary documentation to the Board of County Commissioners for community input. The process will bring all stakeholders together in an open communication forum and solicit input from the involved stakeholders as well. The supporting literature and primary research will strengthen ACSO's efforts in engaging the community and provide answers to relevant questions.

**The Relevance of facial recognition for Colorado law enforcement**

After organizing the open-ended and closed-ended questions from the survey into themes it is undeniable that FR is a valuable resource for law enforcement as indicated by all respondents within the survey. Every respondent with the exception of one reported using FR prior to the legislative changes and indicated that it was an invaluable investigative aid (Table 1), but only four of the eight respondents are currently seeking compliance. One respondent indicated that FR is a "very important investigative tool," because the child victim unit uses it to identify potential online predators, but sadly that agency is not currently seeking compliance due to the statutory requirements for stakeholder engagement. This theme was again highlighted later as a roadblock to FR implementation.

The respondents included law enforcement representatives from five of the largest counties in CO including Arapahoe, Douglas, Jefferson, Denver, and El Paso Counties, who combined serve over 2.6 million people with law enforcement services. In a state that has a population of 5.8 million (Census 2021), those law enforcement agencies represent 45% of the state's total population. Of those agencies that represent 45% of the state's population, there are only 4581 sworn police officers/deputies to serve 2.6 million people, which equates to 1.76 police officers/deputies per 1000 residents in each of those jurisdictions, and without prompting two respondents stated they are "down" a large number of officers/deputies and those positions remain vacant.

**Table 1.** Agency survey participation/service area population/currently use FR or plan to use FR

| Agency | 1. Service Area Pop.* | Commissioned Personnel | 6. Reduce Cases thru Solve Y/N | 7. Currently Use FR Y/N/plan to use FR |
|---|---|---|---|---|
| Arapahoe Co S.O. | 204,000 | 532 | yes | no/yes |
| Aurora P.D. | 389,000 | 748 | yes | no/yes |
| Lakewood P.D. | 156,000 | 280 | yes | no/yes |
| Denver P.D. | 711,000 | 1,390 | yes | no/yes |
| | | | | |
| Douglas Co S.O. | 294,000 | 408 | yes | no/no |
| Jefferson Co S.O. | 190,000 | 500 | yes | no/no |
| El Paso Co S.O. | 737,000 | 524 | yes | no/no |
| Westminster P.D. | 113,00 | 199 | yes | no/no |

*2021 Census Data

**How are local law enforcement agencies working within the current legislation?**

The first open-ended interview question was designed to elicit how the respondent's agency has dealt with the legislative changes for facial recognition in criminal investigations. The four agencies that do not currently have a plan in place for the new legislation, have not even started initial talks for that process with their administration. For the four that are currently seeking compliance, each respondent reported that they drafted a proposed policy and

accountability report that has yet to go to the local government officials and posted for a public hearing. Two respondents said the documents are held up in 'legal review" with the agency legal team. For the respondents who are not currently seeking to use facial recognition recognize its value in their individual responses when they responded "yes" to using FR previously and "yes" that it would reduce caseloads through solvability. However, they have either determined that their agency is not interested in using facial recognition in criminal investigations at this time, or they have resolved that is too large of a task to accomplish and decided to forego the effort.

**Roadblocks to facial recognition implementation**

When the respondents were asked what they believe would be the toughest roadblock to implementing facial recognition. They all indicated that stakeholders at all levels would be the toughest hurdle to overcome in implementing facial recognition. A few indicated it would be "their administration", and of those responses, they were from agencies who have not even attempted to introduce facial recognition to their agency post-legislation, despite using it prior. For the agencies who are planning to introduce facial recognition, they responded that the toughest roadblock would be at the local government level and then from the citizens, or "community members" in their service area who would view facial recognition, as one respondent indicated, as the "big brother" approach to government. This controversy was also outlined in the literature, but as the authors indicated transparency was the best approach to resolving the "big brother" issue with stakeholders. This is what makes the next question so valuable when introducing new technology and should be an argument to promote community engagement in the future.

**The importance of community engagement for new technology**

The last open-ended question posed to the respondents was whether or not their agency uses community engagement when implementing any new technology. There was only one respondent who is currently seeking to use facial recognition that uses community engagement on a continual basis, and when asked why, the response was that "it's required by the city". As for the other three that are planning to use this technology, they based their response on statutory compliance. The remaining four agencies that are not currently seeking to use facial recognition all responded that they "normally do not use community engagement to introduce law enforcement technology". This is very telling and important based on the legislative requirements and indicates how important community engagement and transparency are to the community. This is also reinforced by the existing literature and by the emphasis put on technological transparency through community engagement.

**The importance of facial recognition to develop leads in an investigation**

As indicated in Table 1, Colorado law enforcement agencies recognize the importance of facial recognition as an investigative tool, but yet with the population of Colorado growing exponentially, Colorado law enforcement agencies are struggling to keep up. All of the respondents indicated that their staffing numbers are lower than normal and they are trying to hire more qualified applicants. Not only is the population expanding but the technological criminal sophistication for committing crime is expanding as well. This is where a new technological response to assist in solving crime would seem appropriate, but the author could only find four agencies within the Denver metro area that are currently making attempts to gain new technology such as FR to assist in those efforts. As noted in the figure below the crime rate

for the City and County of Denver has been on a steady rise over the past three years, but as

indicated by the UCR report, clearance rates are relatively low.

**Figure 2.**

### NIBRS Crime: Year to Date

| Crime Category | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|
| **Violent Crime** | **1283** | **1525** | **1761** | **1660** |
| sexual-assault | 203 | 176 | 197 | 176 |
| robbery | 270 | 286 | 359 | 296 |
| murder | 17 | 25 | 25 | 20 |
| aggravated-assault | 793 | 1038 | 1180 | 1168 |
| **Property Crime** | **7540** | **11490** | **12671** | **10945** |
| theft-from-motor-vehicle | 2211 | 3724 | 4184 | 3672 |
| larceny | 2577 | 2694 | 2618 | 2504 |
| burglary | 1239 | 1697 | 1310 | 1333 |
| auto-theft | 1486 | 3337 | 4499 | 3405 |
| arson | 27 | 38 | 60 | 31 |
| **Other Crimes** | **7201** | **6953** | **7789** | **8406** |
| white-collar-crime | 384 | 333 | 331 | 280 |
| public-disorder | 2248 | 2893 | 3463 | 3163 |
| other-crimes-against-persons | 1002 | 822 | 973 | 1285 |
| drug-alcohol | 1089 | 812 | 948 | 1202 |
| **Total** | **16024** | **19968** | **22221** | **21011** |

*\*2023 is not completed but indicates a steady increase in the crime rate.*

*\*Among violent crimes, the individual offenses and their respective clearance percentages are murder and non-negligent manslaughter, 61.4 percent; rape (revised definition), 32.9 percent; robbery, 30.5 percent; and aggravated assault, 52.3 percent. Of property crimes, the individual offenses and their respective clearance percentages are burglary, 14.1 percent; larceny-theft, 18.4 percent; and motor vehicle theft, 13.8 percent.* (FBI, 2019).

When this is compared to the number of detectives/investigators in the City and County

of Denver it means that of the reported 22221 crimes reported in 2022, there are only 250

detectives to handle those cases. The result is that each detective is assigned close to 90 cases per

year, depending on the assignment. Not only are they assigned an excessive number of cases, of

which very few are actually solvable due to a lack of evidence, but only a small number of them are actually cleared by arrest. Of the 12,671 property crime cases reported in 2022, and with an average clearance rate of 15.4%, only 1951 cases were cleared by arrest for property crimes in 2022. So, if FR can increase the clearance rate by even 1% it would result in 127 more cases cleared by arrest each year.

**Table 2.** Agency survey participation/number of investigators/average caseload persons/property

| Agency | 3. Number of Invest. | 4. Avg. Caseload Persons | 5. Avg. Caseload Property |
|---|---|---|---|
| Arapahoe Co S.O. | 57 | 25 | 40 |
| Aurora P.D. | 107 | 11 | 15 |
| Lakewood P.D. | 60 | 40 | 22 |
| Denver P.D. | 250 | 35 | 80 |
|  |  |  |  |
| Douglas Co S.O. | 50 | 10 | 20 |
| Jefferson Co S.O. | 40 | 12 | 35 |
| El Paso Co S.O. | 60 | 25 | 45 |
| Westminster P.D. | 32 | 15 | 20 |

This is not a phenomenon experienced by only law enforcement in the City and County of Denver, but it is occurring all over the Denver metro area. So, it would be safe to assume that Colorado law enforcement agencies are behind in their efforts to adopt new technology in response to recent legislation despite the increase in crime rate and criminal sophistication.

**DISCUSSION AND RECOMMENDATIONS**

The majority of the published research in the criminal justice field on specific topics within FR technology, as outlined in the literature review, including the potential for bias, public perception, and regulation, does not conclude with any researcher proposing a ban on the technology. "We do not propose prohibition-but effective regulation and an ethical framework for it" (Guo & Kennedy, 2022, p. 39). Similarly, when the legislatures in the Colorado State House and Senate passed SB22-113 they were like-minded and did not ban FRT because of the

potential benefits it provides to law enforcement, but rather proposed an ethical framework as a guide outlined within the Bill. However, they do recommend a shift in focus by the police on the legitimacy of its use. That shift includes educating the public on its purpose, and engagement with the community on the use of FRT and the development of a "co-constructed" policy (Chan 2021; Hill et al. 2022). It is for those very reasons that I recommend my client at the Arapahoe County Sheriff's Office move forward and use this "policy-relevant research" as a guide to continue developing an accountability report and policy for the adoption of FR technology (Rennison & Hart, 2019, p. 422).

The next recommendation for my client would be to continue with the FR program implementation using the information revealed in the themes that were developed through the primary data collection to further that process. This is accomplished by using this research to engage stakeholders at the BOCC and within the community to educate them about the benefits of an FR program.

This research uncovered several applicable themes that were derived from the answers provided by the respondents. The first theme identified is that Colorado law enforcement as a whole is not prepared to overcome the legislative requirements for compliance to implement an FR program, and this is for several reasons. All respondents from the survey used this technology prior to the legislative changes and found it to be a beneficial resource in criminal investigations when identifying individuals involved in criminal activity, but post-legislation they identified stakeholders as the greatest roadblock to implementation. Several identified internal stakeholders within the department, external at the local government level, and even stakeholders within the community, but to resolve those issues they need to first develop an evidence-based policy and accountability report. That process will help inform and engage

stakeholders by having a better understanding of the process and assist in transparency by providing critical information for stakeholders to understand and have buy-in for the processes and usage of an FR program. This community education and engagement piece can also be used to bring an understanding of the FR process to those individuals in the community who view this process as the governmental "big brother". The importance of stakeholder engagement was recognized by criminal justice researchers as outlined in the literature review and by state legislatures when it became a requirement for FR implementation.

The second theme identified is that Colorado law enforcement is understaffed and underutilizes technology to assist in areas that could help resolve or at the very least reduce those staffing issues. Budgets are very difficult to manage with numerous entities vying for the same finances, but when resources for both time and money are stretched thin, the response is for law enforcement to adopt new technology to make up for those resources. Technology will never replace a good employee, but it is usually less costly and when properly trained on its use technology can be used as a force multiplier to reduce the number of persons and time spent on an investigation. Not only is training on the use of FR mandatory by legislation but it is also recommended by researchers, and therefore pertinent to my client at ACSO before implementing an FR program.

It is without a doubt that additional research is needed in the field of facial recognition technology and its application for law enforcement, especially when used for developing investigative leads, but the simple fact is that FR technology is here to stay. The use of facial recognition technology (FRT) at the local law enforcement level is relatively new despite the federal government using FRT technology for almost two decades. The federal government began using FRT post-9/11 in the wake of a tragic act of international terrorism. Federal agents

use it in the field at border crossings, TSA agents use it at major international airports, and the

U.S. military in occupied areas overseas, all in attempts to identify potential domestic and

international threats. For that reason, advances are being made every day in the software and

algorithms that are used in facial recognition technology that will reduce errors in

misidentification and the potential for bias to an almost negligible level, which is supported by

the testing and research done and sponsored federally by NIST (Grother, Ngan, & Hanaoka,

2022). In response to this potential for bias, my client has been using the approach suggested by

Johnson et al. (2021) and has an anti-biased policing policy in place and mandatory training on

implicit and explicit bias.

Even with a significant reduction in the algorithmic error rate and additional training,

there remains the need for oversight by regulation and legislation to prevent its abuse and to

bring transparency to the public on how it is used by law enforcement. I would also recommend

that law enforcement and my client work with stakeholders, legislators, and researchers in the

field of FRT on developing regulatory guidelines to prevent "function creep" rather than being

committed to a cycle of adopting technology and imposing a moratorium after mistakes are

made. The importance of stakeholder engagement cannot be overstated and was made very

evident throughout this research project.

There is proof that evidence-based policing works because it has a foundation on prior

research based on previous outcomes, and that earlier research can mitigate some of the potential

risks faced when law enforcement implements new technology. The additional research should

focus on its effectiveness as a tool for law enforcement and its ability to identify the suspect of a

criminal act and bring justice to victims. Every criminal justice professional would agree that

there exists a need for equitable justice, but in that messaging, we sometimes forget about the

victims of crime and instead focus on offender equity, which is a common occurrence in a complex system such as law enforcement. This complexity in law enforcement was recognized almost a century ago by August Vollmer who served as police chief from 1905 to 1932 in Berkley, California when he stated:

> The citizen expects police officers to have the wisdom of Solomon, the courage of David, the strength of Samson, the patience of Job, the leadership of Moses, the kindness of the Good Samaritan, the strategic training of Alexander, the faith of Daniel, the diplomacy of Lincoln, the tolerance of the Carpenter of Nazareth, and finally, an intimate knowledge of every branch of the natural, biological, and social sciences. If he had all these, he might be a good policeman! (Cited in Bain, 1939; Dunham and Alpert, 2021, pg. 8).

This ever-increasing complexity of law enforcement has made conducting policy-relevant research on the topic of FRT for policing in Colorado a daunting task because there exists very little in the way of accountability reporting and policy for FRT due to recent statutory changes. Most of the empirical peer-reviewed research that exists on FRT is based on previous outcomes and perceptions from previous uses of FRT, followed by suggestions for law enforcement on potential implications and pitfalls to avoid, with a few scattered recommendations for policy development.

So, from my understanding, this research is the first of its kind, and therefore applicable and pertinent for policy and accountability report construction on the use of FRT by law enforcement, and very beneficial to my client from a formative FR evaluation project standpoint. I would also be safe in assuming that this project is indeed policy-relevant research and provides some unique insights that are not only good for policy development but for FR program implementation as well. Moving forward ACSO's FR program will be guided by research and regulation and provides the foundation for additional evaluation research based on the results of the implementation of FRT at the Arapahoe County Sheriff's Office.

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Appendix I

**FR program evaluation survey**

Primary data collection will be conducted by telephone survey for a facial recognition program (FR) evaluation due to recent (06/08/22) legislative changes in the state of Colorado.

Collected by: Matt Walker – 303-514-2812

Sponsored by the Arapahoe County Sheriff's Office in conjunction with a review from Professor Paul Taylor and Professor Lonnie Schaible at CU Denver's criminal justice graduate program.

There will be no incentives or rewards for survey participation.

The data will be used to determine how Colorado law enforcement agencies are dealing with recent legislative changes on how FR is being used, and if my client at ACSO should continue with the current process for FR implementation.

Each respondent will be informed that their identity will not be revealed nor will it be linked to any particular response and used only for the purposes of collecting data on FR in the state of Colorado pre and post-legislation requiring statutory compliance. Once the project is complete each respondent can contact me to access a copy of the research.

**Research Question:** How have Colorado law enforcement agencies responded to recent legislative changes in how facial recognition is used in criminal investigations?

**Survey**

1.) What is the population of your agency's service area?
2.) How many sworn or commissioned personnel do you have at your agency?
3.) How many investigators/detectives do you have?
4.) What is the average caseload for your person's investigators/detectives?
5.) What is the average caseload for your property investigators/detectives?
6.) Do you believe facial recognition could reduce that caseload through solvability?
7.) Does your agency plan to use facial recognition as a tool for criminal investigations?
8.) Have you or your agency ever used facial recognition in solving a criminal case?
9.) Do you think facial recognition would assist in solving cases where only a comparison image of the suspect exists?

10.) How have you or your agency dealt with the legislative changes for using facial recognition in criminal investigations?

11.) What do you believe would be the toughest roadblock to implementing a facial recognition program post-legislation?

12.) Does your agency use community engagement when implementing any new law enforcement technology?

Thank you for your participation!

Appendix II

**Survey Results**

| Agency | 1. Service Area Pop.* | 2. Commissioned Personnel | 3. Number of Invest. | 4. Avg. Caseload Persons |
|---|---|---|---|---|
| Arapahoe Co S.O. | 204,000 | 532 | 57 | 25 |
| Aurora P.D. | 389,000 | 748 | 107 | 11 |
| Lakewood P.D. | 156,000 | 280 | 60 | 40 |
| Denver P.D. | 711,000 | 1390 | 250 | 35 |
|  |  |  |  |  |
| Douglas Co S.O. | 294,000 | 408 | 50 | 10 |
| Jefferson Co S.O. | 190,000 | 500 | 40 | 12 |
| El Paso Co S.O. | 737,000 | 524 | 60 | 25 |
| Westminster P.D. | 113,00 | 199 | 32 | 15 |

| 5. Avg. Caseload Property | 6. Reduce Cases thru Solve Y/N | 7. Currently Use FR Y/N/plan to use FR | 8. Ever Used in the past  Y/N | 9. Solve Cases with Comparative Image |
|---|---|---|---|---|
| 40 | yes | no/yes | yes | yes |
| 15 | yes | no/yes | yes | yes |
| 22 | yes | no/yes | yes | yes |
| 80 | yes | no/yes | yes | yes |
|  |  |  |  |  |
| 20 | yes | no | no | yes |
| 35 | yes | no | yes | yes |
| 45 | yes | no | yes | yes |
| 20 | yes | no | yes | yes |