

Facial Recognition in Inmate Population Identification and Counts

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Abstract

The purpose of this research paper is to determine if facial recognition technology is capable of identifying inmates and completing counts utilizing this technology. Research shows the identification and verification of the inmate population is feasibly possible. The counts associated with inmate populations are technically possible, but the issue lies with the time it would take to complete the count and identify the inmates. The research will show that technology has advanced tremendously, but is not advanced enough to complete these tasks in a timely manner that would be acceptable by correctional standards.

Introduction

Correctional professionals are continually researching ways to advance their abilities to accurately identify incarcerated individuals and have accurate accountability of their inmate populations. The means of identifying an inmate by taking exemplar prints on ink cards has evolved into utilizing Live Scan to electronically take the prints for identification. The days of counting inmates using a clipboard, roster and reading an inmate's wristband have advanced to inmate identification cards and barcode scanning. These advancements in technology have allowed correctional professionals to integrate biometrics and computer-based systems to enhance security, inmate identification, authenticate an inmate's claimed identity and accountability of an inmate.

The emergence of biometrics has become an innovative technological tool that correctional professionals have utilized in identifying inmate populations. Biometrics identification can be utilized to verify and/or identify a person searching a database of individuals for matching. There are several other types of biometrics that a correctional professional may use and they include fingerprint and facial recognition, retina and iris scanning, hand/finger geometry and voice recognition. There has been improvement in the technology of facial recognition. This is displayed in the Face Recognition Vendor Test (FRVT) 2002 and 2006 results. There has been improvement in the algorithm performance. All though the technology for facial recognition is not infallible at this time, it may possess the future potential for inmate population identification, to include the possibility of conducting inmate counts at correctional facilities.

Literature Review

One technology area that rapidly is emerging in the private sector and has tremendous potential for application in jails and prison environments is biometrics (Turner, A. 2000). Biometrics comprises automated methods of recognition by identifying measurable physiological or behavior characteristics. Biometric recognition can be used in the identification mode or the verification mode. In the identification mode, the system identifies a person from the entire population by searching a database for a match. In the verification mode, the biometric system authenticates a person's claimed identity from his or her previously enrolled pattern (Turner, A. 2000). The most widely used biometrics to identify individuals is fingerprints.

Biometrics has been used previously to track the movement of staff, visitors and prisoners in and out of correctional facilities. In an effort to improve how inmate movements are tracked within prisons and jails, the National Institute of Justice (NIJ) tested the use of biometrics at the U.S. Naval Consolidated Brig in Charleston, South Carolina (Miles + Cohn, 2006). Over a 3-year period they tested all biometric methods, which include iris, facial, retina, finger and hand geometry, voice and fingerprints. They were all found to have advantages and disadvantages. Facial recognition produced too many false positives on prisoners (Miles + Cohn, 2006). The correctional officers still had to visually identify the prisoners, which slowed the process, which is a major concern in today's correctional environment. Government studies have shown that there have been a high rate of false-positive and false negatives when face-recognition software was used. The National Institute of Standards and Technology (NIST) found false-negative rates for face recognition verification of 43 percent using photos of subjects taken 18 months earlier (ACLU, 2003). Recent changes in the technological advances in facial recognition software have increased its verification rates of identification. This includes the advancement of 3-dimensional (3D) processing to conform the facial alignment to process the picture for facial recognition (Phillips, Scruggs, O;Toole, Flynn, & Bowyer 2007)

All the literature-reviewed has suggested that facial recognition software has to have perfect conditions to be utilized. Facial recognition software is affected by the lighting and camera angles. Facial recognition requires a digital camera and a very controlled environment to be effective (Turner, A. 2003). Prince George's County Correctional Facility, in Maryland, is conducting a project in which it is utilizing facial recognition to process their staff in and out of the facility. The project is closely evaluating the application of facial recognition technology in a jail environment (Turner, A. 2003). There was a survey conducted by the National Institute of Justice (NIJ) in which it found that few correctional facilities utilized biometric identification systems. It found that the correctional facilities that used biometric identification systems utilized iris scans, hand geometry and fingerprints for biometric identification. The biometric systems that are not widely utilized, such as facial recognition, is due in part to the lack of knowledge, systems that are fairly new and untried systems (Turner, A 2000)

There have been several test and trials of biometric technologies. There are two widely known tests that were completed and the results of these tests verify the advancement in the facial recognition technologies. These tests are the Face Recognition Vendor Test (FRVT) 2002 and 2006. The FRVT 2002 was a large-scale

evaluation of facial recognition. It was designed to provide performance measures for the application of facial recognition. It found that the larger the database of people, there was a decrease in performance. There were four key lessons learned from this test:

- a) Given reasonable indoor lighting, face recognition is 90% verification at a false rate of 1%
 - b) Morphable models can significantly improve non-frontal face recognition
 - c) Performance using smaller watch list is better than using larger watch list
 - d) Facial recognition application should use demographic information, because age and sex can significantly affect performance
- (Phillips, Grother, Michaels, Blackburn, Tabassi, Bone 2002)

The FRVT 2006 documented a decrease in the error rate by at least an order of magnitude over what was observed in the FRVT 2002 (Phillips, Scruggs, O'Toole, Flynn, & Bowyer, 2007). In the FRVT 2006 test, it utilized 2 dimensional and 3-dimensional facial recognition algorithms. In these tests, it shows the advancement in the algorithm design and sensors. In the FRVT 2006, systems were tested on controlled and uncontrolled illuminations. Also, for the first time, human facial recognition performance was evaluated under controlled and uncontrolled illuminations. There are three primary components to the improvement in algorithm performance since the FRVT 2002:

- a) The recognition technology
 - b) Higher resolution imagery
 - c) Improved quality due to greater consistency of lighting
- (Phillips, et al, 2007)

Current projects have demonstrated the usefulness of certain biometrics, such as iris and fingerprint scan, hand geometry and facial recognition in specific applications (Turner, A., 2003). The National Institute of Justice has funded the development and evaluation of still- and video-image approaches for facial recognition that will allow law enforcement, corrections officers and court officials to correctly identify cooperative or non-cooperative individuals and to secure the identity of those individuals in the justice system (National Institute of Justice, 2007). Some suggest that the facial recognition devices will not change, but they are expected to become less expensive, easier to use and become more accurate. With these benefits of expense, easier use and accuracy; the expansion of use in facial recognition should increase. The use of biometrics in correctional facilities greatly depends on the improvements in technologies and how innovative correctional professionals will be. Biometrics is a technology that can be utilized to enhance security of correctional facilities (Turner, A 2000). Facial recognition is one of the technologies that is rapidly advancing and continually being tested and enhanced.

Methods

A survey was emailed to 16 county jails within the State of Florida. The surveys were sent to the county jails based on their locations in the state and their inmate population size. Survey Monkey was utilized for the survey. It was designed on their web site, www.surveymonkey.com, and was distributed to the administration of each county jail. The distribution of the survey was also completed through the web site and sent to the jail's administration utilizing email. I obtained these email address utilizing the world- wide-web and a list that was obtained from my organization. When determining which locations to send the survey, I divide the state as follows:

- North Florida
- Central Florida
- South Florida

The county jails that were surveyed were located in the following counties:

- Walton County
- Alachua County
- Okaloosa County
- Jackson County
- Osceola County
- Pinellas County
- Citrus County
- Hillsborough County
- Volusia County
- Polk County
- Flagler County
- Hernando County
- Broward County
- Miami-Dade County
- Sarasota County
- Manatee County

Four of the counties are located in North Florida, eight counties in Central Florida and four counties in South Florida. It was determined that the information returned may be too large if given to all 67 counties and their jails. This determination was decided on the rural versus urban populations and the fiscal budgets of the counties.

The inmate population size was divided into four areas:

- 500-1000
- 1001-2000
- 2001-3000
- Over 3000

As a result, the 16 county jails were determined to give sufficient data for the research paper based on the timetable given to complete the research paper. This survey asked a series of 10 questions, 9 of which were pertaining to facial recognition and biometrics. These questions asked if their departments have facial recognition. If so, how do they utilize it and if not, have they thought of incorporating facial recognition into their department? The other question verified information on their inmate population size. The email explained the reasoning for the survey; the survey pertained to facial recognition and biometrics, and a completion date of June 24, 2011.

Results

Of the sixteen county jails that were asked to complete the survey, only seven county jails responded to the survey resulting in a response rate of 44%. I was unable to determine which county jails responded, because there was no question in the survey asking their identity. Not all county jails answered all of the questions. The survey was designed to allow certain questions to be skipped, based on their answers to the questions at the beginning of the survey.

The first question in the survey asked if their department utilized facial recognition and two out of the seven counties responded yes. This shows that 28.6% of the seven counties already utilize facial recognition. Therefore 71.4% of the counties said they do not have the facial recognition technology. The two counties that answered yes were sent forward to question six while the other five county jails were moved to question two.

Since the five county jails did not utilize facial recognition, they were asked if they utilize any type of biometrics in their jails. 80% or four of the five counties do utilize some sort of biometric technology. There was only one county that did not use any type of biometrics. Question three asked what type of biometrics did they use. All five counties stated that they used fingerprints (electronic) and one of the five counties also utilized hand geometry. The five counties were asked if they had every thought of utilizing facial recognition and the all five answered no.

Question six asked how the two county jails, that answered yes to question one, utilized facial recognition. Their choices were inmate identification, inmate verification, inmate counts and other. One county stated it utilized facial recognition for inmate identification and the other county utilized it for inmate verification.

There were two questions that specifically asked the two counties with facial recognition what advantages and disadvantages that their departments have encountered. The advantages were:

- Rapid identity
- Mobile
- Investigative identity
- Verification of identity
- Quick and easy process to perform
- Identification of unknown faces
- Has helped in identification of unknown homicide victim

The disadvantages were:

- Images quality dependence
- Face has to be recorded at angle close to 90 degrees
- Difficult to capture photos of bank robber with photo taken with bank cameras or other related crimes

In the very last question, I wanted to gather the inmate population size of the departments getting surveyed. Out of the seven counties that responded to the survey, only one skipped this question. The inmate population size was listed as follows:

- 500-1000 42.9% (3)
- 1001-2000 28.6% (2)
- 2001-3000 0.0% (0)
- Over 3000 14.3% (1)

Discussion

The research has shown that facial recognition has advanced significantly since it was first conceived. There have been test and studies that have shown the vast amount of progress the technology has made. The advancements have equipped correctional professionals with a unique opportunity to integrate a technology that will, some day, make identification and counts of the inmate population expedient and without error. The corrections profession needs to rely on their innovative ideas, such as facial recognition to complete inmate counts, in order to make sure the technology would advance. Without the original ideas the possibility of advancements in the biometrics field will be void. The use of facial recognition in identifying an inmate is being used today. The results of my survey showed that two county correctional facilities utilize facial recognition. One county utilized it for inmate identification and the other utilized it for inmate verification.

I had the opportunity to visit a county that utilizes facial recognition and see a demonstration on how facial recognition works. They explained to me that they have been utilizing this technology since 2000. Since they have started, the technology has advance so rapidly, that they have had to make four advancements in their software and equipment. When facial recognition first evolved; the lighting, camera angle and environment had to be perfect. If there were any variations in the specifications required, an error would occur and give a false positive.

Today, the advancements have allowed variations in these requirements. These advancements have come, in part, from the private sector applications of facial recognition. As a result, the technology has allowed 3D technology of the pictures and mobilization of the equipment possible. Therefore, inmate identification has become ever more accurate and reliable.

The technology has not advanced enough to allow facial recognition for inmate count purposes. While it is possible, the time required would not be feasible and not be

within acceptable standards of correctional professionals. For example, my department is currently housing approximately 3500 inmates. In order to complete a count utilizing facial recognition, we would need several hours. While the time frame is unacceptable, the possibility of advancements to allow inmate counts to be completed in a time manner is exciting. As the research shows and as stated earlier, it is just going to take innovative ideas to allow these types of advances to come to fruition. All it would take is some modification to the way facial recognition is used today. A possibility is to have facial recognition be used more on a one to one comparison, instead of several individuals and take the human need for the comparison out of the equation for the verification and identification. There would still be the need for the correctional officer to physically verify the inmate, facial recognition would just enhance the verification and identification of the inmate while the count is being completed.

My department is currently looking at the possibilities of having facial recognition utilized for inmate population identification, which is currently possible with today's technology, and inmate counts. We are currently looking at different facial recognition systems and inquiring with different vendors to see if their technology is capable of completing inmate counts accurately and in a timely manner. With all the research I have completed on this subject, all the continued advancement with facial recognition and different visits with several vendors and other counties; I envision that inmate population identification will continue to advance and become more accurate. The possibility of completing timely inmate counts utilizing facial recognition will be in the near future. The modifications needed to make this happen will eventually be created and correctional facilities will be utilizing this technology as part of their daily operations. If other agencies would like to looking into this biometric technology for their department, I would recommend completing preliminary research into the technology. Secondly, I would meet with an agency that has a vast amount of knowledge of its application and view its application at that agency. Finally, I would challenge vendors to see if they have the capability to create and implement any technological ideas that would benefit your department.

Captain Michael Martin has worked for the Orange County Corrections Department since 1992. He started his career as a civilian in the jails laundry and was promoted to Correctional Officer in 1995. He was promoted to the rank of Corporal in 1998, to Sergeant in 2005, and to Lieutenant in 2008, and Captain in 2011.

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Appendix

Survey (Facial Recognition)

1. Do you utilize facial recognition within your department? If yes, go to question 6.
 - Yes
 - No
2. Do you utilize any type of biometrics within your department? If no, go to question 4.
 - Yes
 - No
3. What type of biometric do you utilize? (Select all that apply)
 - Iris scanning
 - Fingerprint (electronic)
 - Hand geometry
 - Voice recognition
4. Have you thought of incorporating facial recognition into your department?
 - Yes
 - No
5. If yes to question 4, what would you utilize it for? If you answered no, the survey has completed.
 - Inmate identification
 - Inmate verification
 - Inmate counts
 - Other
6. How do you utilize facial recognition? (Select all that apply)
 - Inmate identification
 - Inmate verification
 - Inmate counts
 - Other
7. How long have you had facial recognition?
 - 1-2 years
 - 3-4 years
 - 5-6 years
 - 7 years or more

8. What are the advantages you have experienced with facial recognition?
9. What are the disadvantages you have experienced with facial recognition?
10. What is the size of your inmate population?
 - 500-1000
 - 1001-2000
 - 2001-3000
 - Over 3000