



Facial Recognition

Assessing Its Viability in the Corrections Environment

By Mike Bone and Carl Crumbacker

As recently as 1993, facial recognition was thought of as a technology that would probably never work, and if it did, it would have limited use in the real world. The Department of Defense (DOD) Counterdrug Technology Development Program Office's Face Recognition Technology Program (FERET) changed that opinion through numerous development efforts, data collection and evaluations. When FERET was completed in 1997, the algorithms that were merely in developers' minds four years earlier were being transitioned to the marketplace.

Today, there are dozens of facial recognition systems available that have the potential to meet performance requirements for numerous applications. But which of these systems best meet the performance requirements for given applications? Repeated inquiries from numerous government agencies on the current state of facial recognition technology prompted the DOD Counterdrug Technology Development Program Office to establish a new set of evaluations. The Facial Recognition Vendor Test 2000 (FRVT 2000) was co-sponsored by the DOD Counterdrug Technology Development Program Office, the National Institute of Justice (NIJ) and the Defense Advanced Research Projects Agency, and was administered last spring. This article provides an overview of FRVT 2000 and discusses follow-up efforts that will evaluate the feasibility of facial recognition in a correctional environment.

Facial Recognition Vendor Test 2000

FRVT 2000 was developed using the evaluation methodology proposed in the *IEEE Computer* article, "An Introduction to Evaluating Biometric Systems," by P. Jonathon Phillips, Alvin Martin, Charles L. Wilson and Mark Przybocki of the National Institute of Standards and Technology. This methodology proposes a three-step evaluation protocol: a top-level technology evaluation followed by a scenario evaluation, and finally, an operational evaluation. FRVT 2000 performed a technology evaluation titled "Recognition Performance Test" and a limited scenario evaluation titled "Product Usability Test."

For the Recognition Performance Test in FRVT 2000, vendors were given 13,872 images and were asked to compare each image to all the other images (more than 192 million comparisons). These data were used to develop experiments that show how well the systems respond to numerous variables such as pose, lighting and image compression level.

The product usability tests consisted of two timed tests, which were used to measure the response time of the overall system for two different access control scenarios: the Old Image Database Timed Test, which tested using existing gallery images (the images/templates in the database to which a new image is being compared) and the Enrollment Timed Test, which allowed vendors

to enroll subjects at the testing location. Each of the timed tests was performed for both verification and identification and was performed once with overhead fluorescent lighting and again with the addition of back lighting.

Results from FRVT 2000 show mixed conclusions regarding the viability of facial recognition for the correctional environment. The Recognition Performance Test within FRVT 2000 indicated that changes in media types, compression and resolution did not significantly affect performance. Varying subject-camera distances, pose variations, illumination and temporal (time difference between enrollment and recognition) are areas that require additional research. The Product Usability Test within FRVT 2000 showed that systems perform quite well when subjects are enrolled at the same location and using the same equipment where they eventually will be subjects for recognition, but perform considerably worse when the location and equipment vary. These factors were taken into consideration while developing the operational evaluation and demonstration.

Operational Evaluation

Based on results from the technology evaluation and limited scenario evaluation from FRVT 2000, an operational evaluation is being developed at a correctional facility in Prince George's County, Md. The operational evaluation will be the third step in the three-step evaluation process outlined in "An Introduction to Evaluating Biometric Systems" and will be in place for several months for demonstration to other correctional agencies. The method through which facial recognition is being used at the facility could change throughout the evaluation as more about the system capabilities are learned as well as the interaction between the system and Prince George's County personnel.

Overview of the Prince George's County Correctional Facility

In 1987, the Prince George's County Department of Corrections (DOC) opened a direct-supervision facility in Upper Marlboro, Md. Rather than "guarding" tiers of barred cells from afar (the image often associated with incarceration), correctional officers in a direct-supervision model manage inmates in housing units from within the unit. Staff are trained to effectively use interpersonal communication skills rather than physical boundaries or intimidation to maintain an orderly, safe unit. When order and safety are threatened, a highly trained emergency response team is prepared to respond quickly and decisively neutralize the threat.

The Prince George's County DOC is charged with responsibility for care and custody of offenders committed by the courts. The average daily inmate population is 1,200, two-thirds of whom are awaiting trial. The remainder have been sentenced and may serve up to 18 months at the correctional center. A small number of inmates who receive sentences of more than 18 months are held pending transfer to the Maryland Division of Correction. Prince George's

County also has a contract with the U.S. Marshals Service to hold pretrial federal inmates pending court adjudication.

In 1997, the DOC began a construction expansion project that still is ongoing. The project includes:

- Four additional housing units capable of accommodating an additional 384 inmates in a direct-supervision environment;
- Expanded medical housing;
- New administrative office space;
- A countywide central booking facility;
- A reconstructed facility entrance for employees and visitors with new technology;
- A reconstructed Central Control area with new technology; and
- New and updated computer technology that enhances security and services.

The Prince George's County DOC has served as a direct-supervision model for 14 years and has regularly received visitors from government agencies throughout the United States and foreign countries. Ongoing, collaborative relationships with NIJ, the American Correctional Association, the National Institute of Corrections, DOD, High Intensity Drug Trafficking Area (HIDTA), the state department, and other correctional and law enforcement agencies help the DOC to be pro-active in the criminal justice community. The Prince George's County DOC also trains other correctional agencies in direct supervision, emergency response, managing juveniles in adult facilities, critical incident stress management and other areas.

Description of Installed System

When discussions first started with Prince George's County, it wanted a biometric-based access control system for its employees and volunteers. It also was interested in facial recognition technology because it eventually would like to use the system to screen visitors using existing mug shot images to determine if they are ex-inmates. Since facial recognition technology is new to the department's correctional officers, a gradual phased-in approach was selected.

The initial phase of this operational evaluation and demonstration uses proximity card readers and facial recognition technology to assist correctional officers in their decision to unlock an electronically controlled door providing access to the facility. Employees enter the facility via a 20-foot hallway with an electronically controlled door on the far end and an open-wall office for access control personnel along the side of the hallway. A proximity card reader will be placed at the entry to the hallway for employees entering the facility and another inside the secured area of the facility for exiting employees. Correctional officers will unlock the electronically controlled door leading into the facility based on information from the proximity readers. The access control system, manufactured by American Magnetics (AMAG), with modifications and installation by the Naval Sea Systems Command (NAVSEA) Crane Division, logs access through this door in both directions and will be able to inform correctional offi-

cers exactly which employees are in the facility at any given time. This is an important officer safety feature of the system previously unavailable at the Prince George's County facility.

The system described above already is an improvement over existing access control methods at the facility, but it is limited because the access control would rely on what a person has (proximity card) rather than who they are; only biometric technology can provide that information. When an employee walks past the proximity reader on the way out of the facility, his or her information is provided to access control personnel from the proximity card reader and database information. The proximity card information from the proximity card reader also is automatically sent to the facial recognition system (manufactured by Visionics Corp). The facial recognition system then compares the stored template of this individual with an image from a closed-circuit television camera and returns a similarity score to access control personnel. An audible alarm will sound if the similarity score for an individual is low enough to cause concern. Access control personnel then will be able to respond to the situation and ensure that an inmate is not attempting to escape using an employee's badge.

There are two goals for this first-phase evaluation and demonstration. The first is to provide technology that will increase the safety of correctional officers. This is being provided by the access control system and its logging capabilities to determine which employees are within the facility at a given time. The second goal is to familiarize

employees with facial recognition technology and to determine how well these employees can interface with the facial recognition system. Future phases will be determined based on results from this evaluation. Possible options include addition of volunteers to the evaluations, a more direct interaction between the electronically controlled door and the facial recognition system so that results from the facial recognition system are automatically used to provide a go or no-go decision for the electrically controlled door, and migration of the system to the visitor area to determine if visitors are ex-inmates who should be watched more closely during visits.

Impact on Future Developments

In addition to access control and facial recognition subsystems, a third subsystem has been installed that will not have an immediate impact on the facility. As part of a government-sponsored program, Visionics Corp. developed the Surveillance Evaluation Toolkit (SET). A copy of this system has been installed at the Prince George's County facility. SET accepts input from the proximity card readers and the facial recognition system and automatically generates statistics that show how well the system is operating over an extended period of time. SET also automatically records the closed-circuit television feed for each individual as he or she passes through the hallway. The statistics and video recordings will be periodically analyzed to determine if there are areas in which the facial recognition system could be improved, both for this specific application and for all other applications.

This operational evaluation and demonstration project is being funded by NJ and should be in use at press time. Both NJ and Prince George's County would like to invite all interested parties to tour the facility and observe this application of biometric technology within a correctional environment. If you are interested in touring the facility, please contact Carl Crumbacker at (301) 952-7024; e-mail: clcrumbacker@co.pg.md.us or Vicki Duncan at (301) 952-7013; e-mail: vdduncan@co.pg.md.us.

More information about the FERET program or the FRVT 2000 evaluations can be found at www.dodcounterdrug.com/facialrecognition.

REFERENCES

Phillips, P.J., A. Martin, C.L. Wilson and M. Przybocki. 2000. An introduction to evaluating biometric systems. *IEEE Computer*, February, 56-63.

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