



*Faced with staff reductions and budget cuts, the Pierce County Sheriff's Department (PCSD) in Washington State initiated a pilot in mid-2008 to examine the use of automated face recognition to enhance the efficiency of its forensics operations. PCSD first applied the technology to minimize the manual work involved in its booking process and free up time for forensic technicians to support criminal investigations. Based on the success of the trial, PCSD determined that by adding face recognition to fingerprint identification in a fully automated 'lights-out' workflow, it may ultimately save 80 percent of the staff time required to process and validate the identities of repeat offenders. In September, PCSD expanded use of the technology into criminal investigative work on an identity theft case. In its first application, automated face recognition matched a grainy ATM photo of a suspect with an archived mug shot, allowing detectives to make an arrest in the case.*

## MorphoFace™ Investigate

**Pierce County Sheriff Speeds Bookings and Solves Crime with Automated Face Recognition System**



Biometrics in Action



**Sagem Morpho Inc.**  
SAFRAN Group

# Case Study

## Pierce County Sheriff Department

### PCSD - An Early Adopter of Technologies

Pierce County Sheriff's Department has a tradition of being an early adopter of automated tools and technologies – including biometric identification – in the fight against crime. In July 1986, the department became the first law enforcement agency in the country to purchase an Automated Fingerprint Identification System (AFIS) from Sagem Morpho, headquartered in Tacoma, Washington. This technology later formed the basis of the FBI's current IAFIS system, which today houses more than 70 million fingerprint records, and in early 2009 processed a record 163,000 fingerprint searches in a single day.

PCSD serves a population of more than 800,000 in an area encompassing the southern portion of the Seattle – Tacoma Metroplex. Like commercial businesses and other law enforcement agencies around the nation, PCSD is continually expected to find more cost-effective ways to deliver services during a time of reduced budgets and increased operational demands.

*"The budget shrinks every year, making it difficult to replace people or enlarge the staff when necessary," said Steve Wilkins, PCSD Forensic Services Manager.*

Faced with these challenges, Wilkins looked for ways his department could utilize emerging technologies to reduce the time required to verify the identities of suspects during the booking process. He reasoned that by eliminating some of the time-consuming manual efforts involved in this process, his group of forensic technicians could better support their fellow officers, as well as the public at large, by applying more time to criminal investigations.

One such promising technology was MorphoFace Investigate (MFI), an automated face recognition biometric system being introduced by Sagem Morpho.



### MorphoFace™ Investigate

Facial recognition solution for law enforcement agencies

*MorphoFace Investigate is a robust and scalable facial recognition application including case evidence management, biometric matching, and forensic evaluation tools for intelligence analysis and investigative crime solving tasks.*

*Based upon Sagem Morpho's award winning, highly-scalable MetaMorpho AFIS architecture, MorphoFace Investigate can accept remote submission of facial images from mobile devices such as camera equipped cell-phones and digital cameras connected to squad car laptops, enabling law enforcement to quickly identify the potential use of aliases and suspect identities while in the field.*

Automated face recognition is a biometric technology that only recently reached the level of maturity where it can be deployed operationally in security and law enforcement environments for the purposes of identification and investigation. Like fingerprint identification technology, facial recognition can recognize unique individuals by using one image to search against a database of enrolled images. But the similarity between face and fingerprint recognition ends there. While fingerprint algorithms utilize features which remain stable over time, such as ridge endings, bifurcations and skin pores, face recognition algorithms must be far more sophisticated because the appearance of faces can change drastically with age, emotion, presence of facial hair and even the level of sobriety and health.

### Speeding The Booking Process

Going into the 2008 pilot, PCSD's Wilkins estimated that up to 85 percent of suspect bookings in a given day involved repeat offenders, i.e., criminals who have been arrested and processed by the Sheriff's Department previously. As repeat offenders, the vast majority have both their tenprints and mug shots in PCSD databases. The department began storing digital photographs of suspects in 1992, amassing a database of more than 500,000 mug shots today.

During the typical booking process, the suspect is fingerprinted and photographed. The tenprints are input into the Sagem Morpho AFIS as part of the identification process to determine if the individual is already in the database with a history of prior arrests and convictions. Fingerprint

matching is considered the initial phase of the identification process; while the mug shot is used as the secondary identifier enabling forensic technicians to verify fingerprint results.

Prior to the pilot, forensic technicians manually retrieved records for repeat offenders from the PCSD criminal record database (CHRI) as identified through fingerprinting. The technician then visually compared the new mug shot with the old one to positively confirm the suspect's identity. If both fingerprints and mug shots point to the same identity, it is considered conclusive. The CHRI would then be updated with new prints, photo, and booking details, and ultimately be forwarded electronically to the state and the FBI for inclusion in their respective databases.

This manual process takes hours of staff time each day, explains Wilkins. Not only could the forensic technicians' time be better spent on more critical tasks, but the delay in updating criminal files slows investigations.

"My three technicians work Monday through Friday from 8 am to 5 pm," said Wilkins, adding that details of an arrest on Friday night won't make it into the departmental, state and FBI databases until Monday at the earliest.

To evaluate the accuracy of Sagem Morpho's face recognition algorithms, PCSD began using mug shots of known repeat offenders from each day's bookings as a source for searches against the database of nearly 500,000 images. Without fail, the system routinely returned matches within seconds. After more than 10,000 searches, the system correctly matched new mug shots with mug shots from the individual's previous arrests an impressive 94.4 percent of the time.

What makes the 94.4 percent success rate impressive is the fact that many of the matched mug shots were taken 10 to 15 years ago. Needless to say, facial features change considerably over such a period. Wrinkles and changes in facial hair, weight gains or the dramatic weight loss attributed to meth addiction, and widely varying emotional states, can make current facial

## Solving Crimes with Face Recognition

In September 2008, PCSD expanded the application of MFI beyond booking suspects to investigating crimes. In one such case, detectives were investigating a series of identity thefts in which the suspect was stealing ATM cards and then using them to withdraw money from the victims' bank accounts. Unfortunately, the only evidence available were grainy photographs acquired from ATM cameras where the perpetrator had made fraudulent withdrawals of cash.

A detective working the case thought he recognized the perpetrator but didn't know the individual's name. Four photographs from four separate thefts were sent to the forensics laboratory where Wilkins used the MFI system to compare them against the mug shot database. Despite the bad camera angles and low image resolution, the system returned two mugshots belonging to one suspect, in a matter of seconds.

*"From the time I received the email [with the attached photos], the process took about 15 minutes," said Wilkins.*

related crimes, she issued an arrest and search warrant. In October 2008, detectives confronted the suspect and searched her residence. A cache of additional evidence linking the suspect to numerous cases of identity theft was found.

Not only were ATM cards found for the known cases of ATM theft, but detectives discovered additional materials, such as credit cards, bank statements, bank account and routing numbers, pertaining to dozens of other individuals that could eventually have been used to perpetrate additional crimes. The suspect plead guilty to 11 crimes in connection with the ATM thefts and was sentenced to 9 ½ years.

appearances differ greatly from those of a decade ago. Despite these issues, the MFI facial recognition algorithms repeatedly found correct matches.

*"In my opinion, [the system] has passed with flying colors," said Wilkins.*

Wilkins estimates that by fully automating the booking process – or making it 'lights-out' – staff time will be reduced by 80 percent on

arrests involving repeat offenders. Identification is already a semi-automated process using fingerprint technology at PCSD, but with the integration of automated face recognition into the workflow, a fully autonomous process is expected. Once fingerprints and mug shots are taken during the booking process, the identification of repeat offenders as well as the updating and distribution of criminal files will occur automatically with no additional manual intervention – the task will be completed within minutes, rather than days.

The secret behind MFI's high accuracy lies in the intensive development and research behind its algorithms, and its specific focus on workflows related to law enforcement, defense, and intelligence identification tasks. Sagem Morpho and its parent company Sagem Sécurité are involved in biometric activities worldwide, providing unparalleled opportunities to work collaboratively with academia, law enforcement, defense and commercial interests in the advancement of biometric technologies.



## Finding Suspects Faster

Traditionally, the selection of candidate mug shot records depended on developing one or more suspects in a case. A labor intensive, and usually impractical, alternative was to select a larger group of mug shots consisting of persons possibly involved in the crime (given the type of offense, geographical location and other investigative factors). In the extreme, an entire set of records might be searched in cases of sufficiently high priority. When records are selected in this fashion the comparison process is referred to as a 'cold search'. Until the computerization of these records, such cold searches could not be routinely performed.

Face identification, or the irrefutable determination of an identity, cannot be performed solely by a computer using technology available today – the subtleties of the process, especially when one considers the wide range of images available from modern day crime scenes, make it dependent on expert opinion. Still, automated face recognition has a dramatically effective auxiliary role of selectively retrieving candidate records from large databases. This capability allows cold searches to be conducted routinely, and has proven to provide investigators with candidate pools of sufficiently high confidence that many crimes are now being solved where continued investigation was not previously possible.

# MorphoFace™ Investigate

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## A Strong Future in Investigations

Impressed with the 94 percent accuracy rate of the MFI system within the Identification Unit, Pierce County hopes to move forward with plans to fully deploy an integrated multi-biometric 'lights-out' identification system using fingerprint identification and face recognition. Additionally, based on the recent criminal case successes, PCSD's Wilkins believes that face recognition technology will quickly be embraced throughout the Criminal Investigation Division for its crime solving abilities.

"Once this technology catches on, it's going to be routine for officers in the field to ask if there is any surveillance video available, and it will be automatic for technicians to run matches," said Wilkins.

Businesses have a role to play though. Most video surveillance technology already in place in high-crime areas is deployed so that it can capture a global view of the environment, or focus on the business' cash register to monitor for employee theft. Because of this, many videos of crime simply do not provide enough detail for either computer or human face recognition tasks.

Face recognition systems typically require a more direct view of the suspect's face than what these systems currently provide. Businesses can better assist law enforcement with investigation of crimes committed on their premises if they add, or redeploy, at least one camera so that a better image of the suspect's face can be captured. Placing a camera so that it captures individuals as they enter the business, or as they look at a bank teller or cashier, will go a long way to providing usable imagery. An optimal image for face recognition systems should be as close to a frontal view as possible, have enough resolution such that at least 50 pixels of data is available when measuring the distance between the individual's pupils, and be free from extreme shadows. Most reputable video surveillance solution provider should be able to assist business owners in addressing these issues.



Steve Wilkins - Pierce County Sheriff's Department,  
Forensic Services Manager

## Investment Yields High Value Benefits

PCSD sees a definite pay-off from an investment in automated face recognition. In terms of the booking process, Wilkins said his limited staff is overworked trying to keep up with the important, yet mundane, manual task of identifying repeat offenders and updating their rap sheets. Wilkins estimates that this time can be reduced by 80 percent through the automation of the process, thanks to the introduction of automated facial recognition. For PCSD, the hourly savings can easily be estimated.

But more important is the value of what the staff does when it isn't involved in routine bookings, which in most cases includes providing forensic support to investigators. By reducing the amount of time spent on validating booking related identifications, staff has more time to devote to solving crimes – the value of this is enormous, but impossible to quantify.

In terms of applying MFI to criminal investigations, such as the ATM crimes, the return on investment is not directly measurable without knowing whether other evidence would have emerged in the case. However, PCSD is certain that additional thefts would have occurred to the existing victims, and others, had the suspect not been brought to justice quickly. Moreover, thanks to the fast identification, an indefensible amount of evidence was still in the suspect's possession; making any attempts at denying involvement impossible. This quick response to the crime likely saved tens of thousands of dollars in court expenses and legal fees had the County needed to engage in a drawn-out investigation and trial.

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