

TATT

Anil Jain, MSU University Distinguished Professor of computer science and engineering, has developed an automatic image retrieval system, whereby law enforcement agencies will be able to match scars, marks, and tattoos to identify suspects and victims.

In a world filled with homeland security concerns, identity fraud, and natural disasters, the need to establish the identity of an individual based on something other than a driver's license or demographic and personal data is vital, according to Jain. "Identity is usually established using passports, licenses, or personal identification numbers, but these are easily forged, lost, or stolen."

"There is a very real concern that these types of credentials for identity determination are neither sufficiently reliable nor secure," Jain says. "There is a need to recognize people based on physical characteristics like fingerprints, iris, or face. This is the field of biometric recognition where we have been working for the past 15 years."

Biometrics refers to the automatic identification of an individual based on that individual's anatomical or behavioral characteristics. Jain is taking biometric recognition to the next step by adding scar, mark, and tattoo recognition capability to the identification tools available to law enforcement, government, and military agencies.

Called "Tattoo-ID," the system Jain has been working on is a software pro-



TATTOO-ID MATCHING TATTOOS TO ID SUSPECTS, VICTIMS

gram that accepts databases (provided by law enforcement agencies) that contain images of scars, marks, and tattoos. Each tattoo image in the database is linked to the criminal history records of all the suspects and convicts who have tattoos. If users, like police officers, provide a tattoo image query, the system automatically retrieves the most similar tattoo images from the database along with the linked criminal history records.

"The number of people getting tattoos is rapidly growing. About 20 percent of the population has at least one tattoo, and this percentage is even higher among delinquents," Jain says. "In fact, many gangs have a unique membership tattoo. So, with the rising popularity of tattoos, it makes sense to put these markers to good use."

"Presently, the only way to identify someone from his or her tattoo is to sift through a large tattoo database and try to visually match tattoos based on some keywords. This takes a lot of time, and the process is often inaccurate," Jain says.

The Tattoo-ID system directly matches the images of a suspect's or a victim's distinguishing marks against an image database and determines the individual's identity with very high accuracy. While a scar, mark, or tattoo cannot uniquely identify a person, it can help the authorities narrow down the list of potential identities; it can indicate membership in a gang, social and religious group, or military unit.

"This system has huge implications

for helping law enforcement with suspect and victim identification," Jain says.

Jain says that if an officer arrests a person who does not have any identifying documents and uses an alias, but has a tattoo belonging to a known gang, the tattoo gives additional evidence to identify which group this person belongs to. The system will help law enforcement agencies to quickly identify and apprehend criminal suspects.

It is also capable of identifying victims, including those of mass disasters.

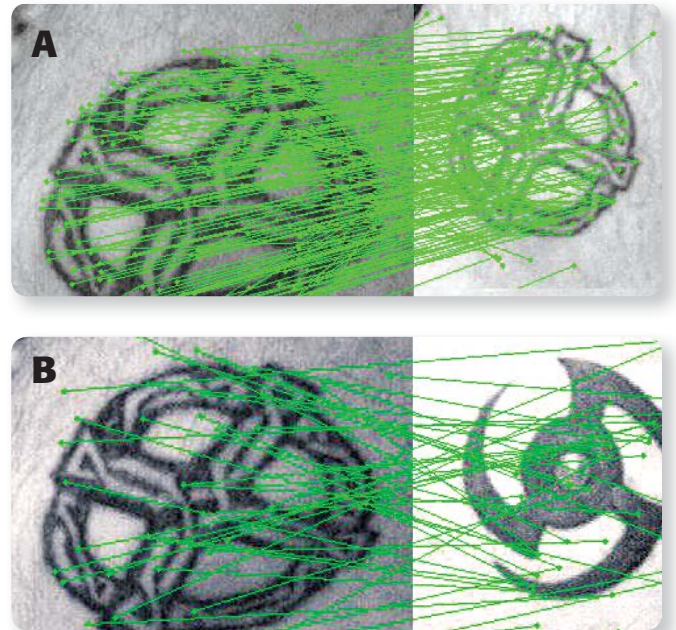
"Many of the Indian Ocean tsunami victims in 2004 were identified by tattoos that indicated what group or village they came from," Jain says.

"A body can decompose quickly, particularly in adverse climate conditions, making it difficult to perform face or fingerprint identification," Jain says. "Because tattoo pigments are deeply embedded in the skin, even severe skin burns often do not destroy tattoos. If there are distinguishing tattoos, it can be crucial evidence in identifying a victim."

There is an increased awareness among law enforcement agencies for using tattoos for suspect and victim identification. This is the reason FBI's Next Generation Identification (NGI) system calls for an automatic image retrieval system like Jain's.

"Such a system will be of great societal value," Jain says.

Jain's team is continuing its research to improve the tattoo image matching performance in collaboration with the Michigan State Police, which



HOW TATTOO-ID WORKS. Upon receiving a tattoo image query, the system automatically computes the landmark points and then retrieves the most similar tattoo images from the database, based on the number of landmarks they share. Image A shows a correctly matched pair with 194 matching landmark points. Image B shows a falsely matched pair with only 47 matching landmark points.

has provided him access to its large tattoo image database.

His research team consists of Rong Jin, an MSU assistant professor of computer science and engineering; Jung-Eun Lee, an MSU doctoral student in computer science; and Nick Gregg, an MSU junior in computer science.

To read an article co-authored by Jain in *Scientific American*, go to www.sciam.com/article.cfm?id=beyond-fingerprinting.

For a podcast conversation with Jain, visit <http://spartanpodcast.com/?p=422>. 🎧



IMAGES COURTESY OF THE MICHIGAN STATE POLICE