Computer programs improve fingerprint grading

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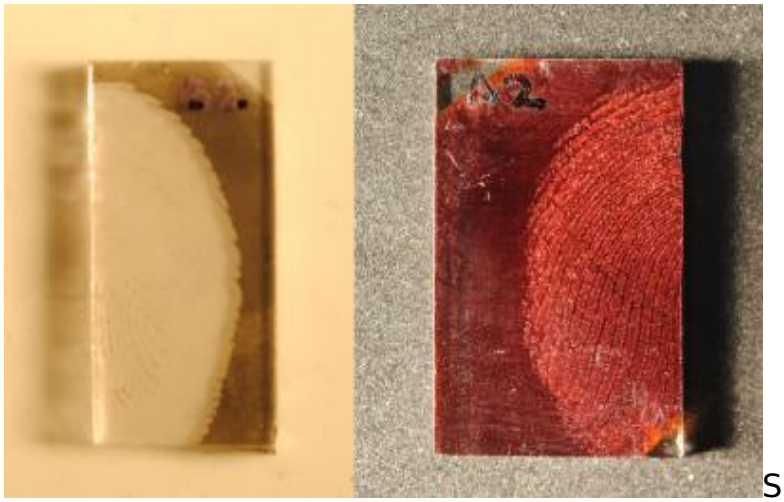

Subjectivity is problematic when evaluating fingerprints, and quality is in the eye of the examiner. But three computer programs used together can give fingerprint grading unprecedented consistency and objectivity, according to Penn State researchers.

"People leave behind all kinds of fingerprints, and the job of a forensic examiner is then to look at a fingerprint and identify a person who could have left it," said Akhlesh Lakhtakia, Charles Godfrey Binder Professor of Engineering Science and Mechanics, Penn State. "Various scenarios can be envisioned where a fingerprint can be seriously altered. Once it is altered, it can conceivably lead the examiner to a false conclusion."

Fingerprints usually undergo environmental weathering and smudging. The condition of a fingerprint affects how reliable a match can be between a collected print and prints on record. Knowing a fingerprint's dependability can minimize the chance of a wrongful or delayed conviction.

Lakhtakia's team created a process using three inexpensive computer programs to grade a fingerprint for the availability of ridge detail for subsequent identification. Computerized grading ensures standardized evaluation to a degree finer than any human can accomplish. They report their results in the current issue of Forensic Science International.

"The quality of a fingerprint can be graded finer than on a zero, one, two, three scale," Lakhtakia explained. "Two point three per cent is worse than fifteen per cent, but both could be graded as a zero by the naked eye. Humans can't grade finer than the zero to three scale. But computers can."

The three separate computer programs include the FBI's Universal Latent Workstation -- usually free to qualified agencies, the open-source image editor GIMP and a simple custom program written in Mathematica to count pixels.

Investigators photograph the fingerprint—developed for visualization or not—and run the picture through the Universal Latent Workstation. This program creates a simplified map of the fingerprint by designating colors to four area types. The background area is black, areas with definite ridges are white, and debatable regions are yellow and blue.

The GIMP editor converts the map file into an image file with red-green-blue color values. The RGB values are stored as number clusters that a computer program can easily translate into binary sequences useable in a mathematical equation.

A pixel-counting algorithm in Mathematica calculates the total percentage of white pixels from imported RGB pictures, essentially creating a grading scale ranging from 0 to 100. A high-quality fingerprint would have a high number of white pixels, while a potentially unreliable print would mostly appear in yellow and blue.

The ease and relative speed of this grading system may help to standardize fingerprint quality assessment in an inexpensive, efficient manner.

"The next step of this kind of research is, is there false detail created by development techniques?" Lakhtakia said. "That can happen. Looking at the thin-film technique that my group has developed, I don't imagine so, but we would obviously have to prove it."

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