Wright State researchers developing skeletal scans to recognize terrorists

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The Wright State Research Institute is developing a ground-breaking system that would scan the skeletal structures of people at airports, sports stadiums, theme parks and other public places that could be vulnerable to terrorist attacks, child abductions or other crimes. The images would then quickly be matched with potential suspects using a database of previously scanned skeletons.

The idea was born when a Wright State University scientist went online as his young daughters were preparing to go trick-or-treating and discovered that convicted sex offenders were living in his neighborhood. What if there was a way to positively identify sex offenders as they arrived at theme parks and other venues populated by young children? Better yet, the scientist wondered, what if there was a way to recognize terrorists in disguise at airports or U.S. ports of entry?

The answer came quickly enough—skeletons. Virtually every person has a unique skeletal structure nearly impossible to alter.

As a result, the Wright State Research Institute is developing a ground-breaking system that would scan the skeletal structures of people at airports, sports stadiums, theme parks and other public places that could be vulnerable to terrorist attacks, child abductions or other crimes. The images would then quickly be matched with potential suspects using a database of previously scanned skeletons.

Trying to recognize terrorists and other criminals through fingerprinting,

facial-recognition technology, and scanning the retinas of the eye has limitations. Fingerprinting and retinal scans are intrusive contact technologies and require a subject's cooperation. Facial recognition can be defeated with disguises, beards or plastic surgery.

"But they can't disguise their bones. That's where we thought this technology has some merit," said Phani Kidambi, a research engineer at the institute who is helping lead the effort. "Think about a scenario where the face doesn't match, but the bones match," Kidambi said. "That definitely is a person of extreme interest because it appears he's tried to change his face."

The adult skeleton has 206 bones. Size, shape, density and joint structure make each skeleton slightly different. Throw in an extra lumbar vertebrae or extra rib—which some people have—as well as previously broken bones, implants, screws and other identifying characteristics, and the signatures become even more individual. And the skeletal structural features are fairly stable throughout adulthood. X-rays, gamma rays or other forms of body scanning would be used to create a bone signature for each person. Wright State researchers are currently working on identifying key elements and measurements of the skeleton that differentiate one person from another.

"We also believe that you may not need an entire body scan," said Kidambi. "Maybe just part of the body is sufficient." One option would be to focus on the clavicle—or collarbone—one of the most varied or individually distinctive bones in the body. The skeletons of suspected terrorists who are taken into custody or sex offenders who are convicted would be scanned and the image features cataloged into a database. Custom computer software would enable newly scanned skeletal images taken of people are airports, stadiums or theme parks to be quickly compared with those in the database. Researchers acknowledge that the system would only recognize people whose skeletons are already on file.

“You build up your database from known offenders,” said Julie Skipper, Ph.D., associate research professor with WSRI. “And you look for these offenders to show up in the wrong place again.” Ryan Fendley, the research institute’s director of operations and strategic initiatives, said scanners could be used wherever there is a controlled point of entry. “It could go anywhere,” he said. “It could be in every airport. You could put it in a hotel if it gets down to the right scale and cost.”

The scanners could even be used as security devices for the government or private companies, ensuring that only authorized workers could gain access to important facilities or rooms. “Right now we do that with badges,” Skipper said. “Badges can be lost or stolen or forged.” Candidate sensors in the scanners require people to be within about six feet of the equipment.

A scan would likely take about five seconds, and a match could be found within another 10 seconds, Kidambi said. “That’s our biggest challenge—to accurately acquire bone signatures at a distance,” said Skipper, adding that federal officials would like to see accurate skeleton recognition from 50 meters.” “If we had that problem solved, we’d be in market right now.” Unlike full-body airport scanners that see through clothing and expose personal body features, skeletal scanners would look beneath the skin’s surface.

Depending on the selected technology, a skeletal scan would only expose a person to radiation that is the approximate equivalent of taking one cross-country airline flight. Basing the scanners on currently available bone density scanners could allow the technology to be deployed in the field within a year, Kidambi said. Wright State has a couple of bone-density scanners that could be used to build a prototype. The scanners could be deployed in the field within a year, Kidambi said. Fendley said a big challenge is compiling the body scans of suspects and building the database. “You can have a great tool that collects body scans of the

general public, but if you don't have anything to compare them to you haven't done anything."

A half dozen Wright State engineers and scientists are working on the research project, which began in October. Currently, investigators are trying to measure the subtle changes in particular bones in order to identify the features that discriminate individuals. The geometric, structural and densitometric patterns of the bones of the hand are being identified and then compared with images of the same hand taken years before. Wright State submitted its idea to the Intelligence Advanced Research Project Activity, a U.S. research agency formed to meet important technical challenges faced by the intelligence community. Of the 500 research teams that submitted proposals, Wright State was among the dozen invited to discuss their ideas at an IARPA conference in Washington D.C. "It was quickly determined that our approach was by far the most novel," Fendley said. "If you look at the other participants at that conference, several have expressed interest in partnering with us."

Provided by Wright State University