

TECHNOLOGY

Technion twins solve face recognition puzzle

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The Bronsteins' algorithm system could be used at airports or border crossings where a 3-D security camera could scan passengers' faces and compare them with a database of three-dimensional pictures of suspected criminals or terrorists. (Photo: Technion)

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Leave it to identical twins to develop an advanced 3D face recognition method that has far-reaching implications in the global fight against terror.

In a post-September 11th world, catching the bad guys is more critical than ever. Identifying their faces would be an ideal way to do so, but in recent examinations, face recognition devices have been deemed 'less accurate than a coin toss.' Some of the weaknesses of current recognition approaches are sensitivity to head position, illumination and other changing factors. Scientists have been working on methods to get around these limitations.

The two identical twins at the Technion Israel Institute of Technology in Haifa - 22-year-old students Michael and Alex Bronstein - think they have the answer. They've applied a new technology to recognizing faces in a way that may yet revolutionize international security.

"I said it to them as a joke: if you succeed in building a system that can distinguish between the two of you, you'll get 100," the twins' professor, Ron Kimmel told *Reuters*. "They succeeded and got 100. They are brilliant."

The twins' work, which began last year, involves recording the facial surface geometry, which is not influenced by head position or lighting. That involves comparing 3D surfaces, considered quite a difficult task, made more so by the fact that the face is not a rigid object - it moves and changes. This 'bending' is what has made facial surface matching so difficult until the Bronstein twins breakthrough.

Now Kimmel of the Technion Faculty of Computer Science, together with his former student Asi Elad, has pioneered a method based on the twins' research called "bending-invariant canonical representation" to carry out accurate matching of deformable surfaces. It appeared that this algorithm could be a core of a 3D face recognition system.

The idea was hatched when the Bronsteins took Kimmel's course called "Numerical Geometry of Images." Kimmel challenged them to use the bending invariant canonical representations for face recognition. Kimmel and Elad had already developed the algorithms used as building-blocks for the face-recognition system. The Bronstein twins constructed a 3-D scanner and applied the ideas to face recognition.

Kimmel jokingly probed the twins to put their machine to the test: Could the algorithm differentiate between the

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two of them? Indeed, it could!

"We decided to use a facial expression of mine that the computer did not have. For a match, it gave three options; the first two were mine, and the third was Alex's," explained Michael, the younger twin. "These were the right answers, as the computer is expected to make matches from the most similar to the least."

Newer versions of the algorithm used in recent experiments showed not even a single false match between the two.

The twins and Kimmel say they want to turn the technology - registered for a patent in the United States - into a commercial product, with applications ranging from airports and border crossings to security zones and teller machines.

What began as a thought-provoking challenge has blossomed into a method with tremendous marketing potential and importance in the security industry. After the September 11 attacks, the market for biometric technologies, including software, hardware and service, is expanding. According to the International Biometric Group's Biometric Market Report 2003-2007, "current biometric industry revenues of \$601 million are expected to grow by 35.2% in 2003, and to exceed \$4 billion in 2007."

"We have a prototype and we saw the idea works," Michael Bronstein told Reuters. "There is a hope that this will become a commercial product and allow all of us to feel more secure."

The system could be employed at airports or border crossings where a 3-D security camera could scan passengers' faces and compare them with a database of three-dimensional pictures of suspected criminals or terrorists, the twins said. Facial signatures could also be embedded in credit cards or entry permits. People withdrawing money from an automated teller machine or seeking access to a secure compound could have their identity verified by an on-site camera.

The Bronstein twins know first hand the importance of face recognition. They immigrated to Israel from Russia in 1991 and say they have always shared the same interests.

"We always studied the same things and it was always connected to science, if sometimes indirectly," said Alex.

Asked by Reuters if there was any way to distinguish between them, except for Michael's shorter haircut, Alex said: "I must say that I've got a girlfriend." Michael chimed in: "We don't share those."

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