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From Handwritten Captchas To "Smart Rooms," Tech Solutions Start With Pattern Recognition

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Buy something online, enter your credit card number and mailing address. Simple. Then you come to the box with the CAPTCHA, the Completely Automated Public Turing Test to Tell Computers and Humans Apart. Here, the website attempts to confirm that you're a human, not some robot about to commit a cybercrime. You dutifully copy down the warped, watery-looking letters.

Incorrect. Another captcha appears. You try again. Also incorrect. A third captcha appears. You start rethinking your purchase.

University at Buffalo computer scientist Venu Govindaraju, who, along with his UB colleagues, pioneered machine recognition of human handwriting, believes that this annoying 21st-century problem has a decidedly old-fashioned solution: handwriting.

"Here at UB's Center for Unified Biometrics, we're the only ones who have proposed and thoroughly studied handwritten captchas," says Govindaraju. "Our perspective is that humans are good at reading handwriting, machines are not. It comes naturally to humans. But computer scientists typically consider handwriting a hopeless case, until someone comes along and shows them that it isn't."

Govindaraju should know. Research he and his UB colleagues conducted in the 1990s helped the U.S. Postal Service establish the first machines that could read handwritten addresses, a feat that many at the time -- especially in industry -- said simply could not be done. In 1996, after years of research, the UB research enabled the USPS to be able to start machine-reading of handwritten addresses, boosting efficiency and saving the agency millions of dollars each year.

Govindaraju believes a similar success can occur with captchas. One of his doctoral students at UB has graduated and was hired by Yahoo! on the basis of his work developing "simulated" handwritten captchas.

"We developed an archive that can automatically generate as many different styles of handwriting as we want," says Govindaraju.

The research is based on pattern recognition, a subfield of machine learning in computer science that is concerned with developing systems based on detecting patterns in data.

Similar issues are being studied by Govindaraju and his UB colleagues in order to develop "smart room" technologies, supported by an HP Labs Innovation Research award.

"Smart rooms" are indoor environments equipped with sensitive, but unobtrusive devices, such as cameras and microphones that can identify and track the movements and gestures of inhabitants for a broad range of applications, from providing supplemental supervision in assisted living facilities for the elderly or disabled, to monitoring office workplaces and retail establishments for security. Eventually, the goal is to extend "smart room" features to larger arenas, such as shopping centers, airports and other transportation centers.

Biometrics that CUBS researchers are studying for "smart room" applications include hand gestures as well as the more common biometrics of facial, voice and gait recognition.

"This, too, is all pattern recognition," Govindaraju says, "but instead of letters, here, we're trying to standardize gestures.

"It's like developing an alphabet of gestures so machines can be programmed to do gesture recognition. The idea is to control objects on a monitor without technology," he says.

Since its founding in 2003, CUBS has attracted approximately $10 million in federal and industry funding and has produced 17 doctoral-level graduates. The center advances machine learning and pattern recognition technologies to build engineered systems for both civilian and homeland security applications. It develops new methods for customizing devices that use data from physical biometrics, such as fingerprints, hand geometry and iris scans; behavioral biometrics, such as signature, voiceprint and gait; and chemical biometrics, such as DNA and body odor.

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