A Face In The Crowd

UI researchers shape the future of facial recognition technology

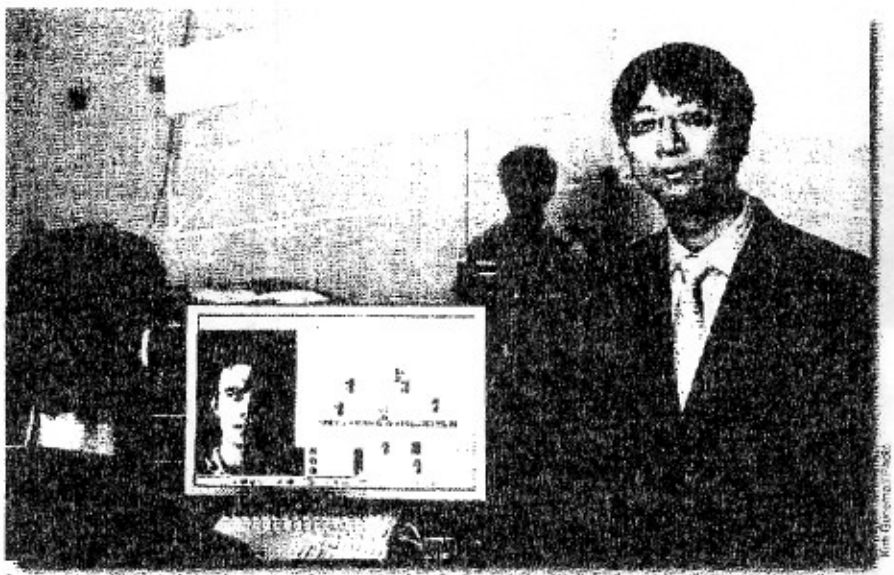
This story will begin with a story, about how, in June 1967, my brother Paul left home at age 17 to take an appointment at the U.S. Naval Academy. Some weeks later, Dad loaded the rest of us into the family station wagon and aimed it for Plebe Parents' Weekend in Annapolis, Md., U.S.A. Beyond the front gate of the Naval Academy, we drove into a world thronged with hundreds of close-shaven plebes (a sneering designation the Academy bestows upon its freshmen), each in white uniform and hat, some ranked and drilling, others marching individually about, in a kind of vast cloning of future U.S. Naval officers. We were trying to figure out what to do next, when Mum told Dad to stop the car.

"There's Paul," she said.

"Right, Mother," he said.

But she *was* right. There indeed – quite by coincidence – was Paul. Though even close up he seemed nigh identical to all the other haggard first-years in white, his mother knew her son when she saw him.

Now, a team led by electrical and computer engineering professor Yi Ma has gotten my mother – or, rather, an amplified echo of her preternatural perception – into a computer in the basement of the Coordinated Science Laboratory at the University of Illinois. A development that will shortly transform electronic photo-sharing and could fast-forward security and selling on scales both small and large, this technology hums – with questions about privacy, concerns about corporate and government control and the unstoppable urgency of utility in a world growing ever-more crowded and unpredictable.



Researcher Yi Ma, right, is on hand as graduate student John Wright has his picture taken at a special photography studio in the U of I's Coordinated Science Laboratory. Under Ma's leadership, a paradigm-shattering algorithm by Wright has been translated into computer technology with facial recognition accuracy levels nearing 100 percent.

Using paradigm-shattering mathematics developed by UI graduate student John Wright '04 ENG, MS '07 ENG, Ma's team can enable computers to identify people even when their faces are obscured – by sunglasses, for example, or (as with my brother) by hat, haircut and weight loss.

"Family members can still recognize you if you wear sunglasses. ... Right?" Ma, a cheerful researcher admired by his UI colleagues, observed in an interview at his office in CSL. "The computer used to have really no chance in competing with humans in these kind of occluded or corrupted images or partially occluded faces or disguises." But the technology developed by his team "turns out to be extremely good in this kind of scenario," Ma said. "It turns out that the capability is far beyond human capability." Which means – correctly identifying facial imagery in which the pixels have been garbled by almost 100 percent.

In the project's studio, volunteers are photographed by a special camera that takes 30 views of each person's face under varied lighting. These views yield data that allow the computer to identify the overall pattern of information that makes each face unique – "recognizing" people somewhat in the way people themselves recognize each other, by matching up incomplete information to the memory of a face.

The computer, Ma said, "has the information. It just has to know a small

portion of that information to really recover the full. That's a special property that the human face has."

It's also a special property of the work done by Wright, whose discovery of the algorithm behind the recognition software is an achievement itself rated "worthy of a doctoral dissertation in mathematics" by his adviser, UI math professor Robert Fossum. For this work, Wright was honored in March with the $30,000 Lemelson-Illinois Student Prize, presented annually through the Technology Entrepreneur Center at the U of I. The previous month, Wright had received a two-year, $40,000 fellowship from Microsoft.

Ma said of Wright's algorithm, "This actually, through new mathematics, revealed completely new phenomena even to the mathematical world." (Now an intern for the visual computing group at Microsoft Research Asia in Beijing, Wright is doing the Urbana/China intercontinental shuffle, as is Ma, who has taken a two-year post as a senior researcher there.)

With some companies already poised to use the software and more clamoring to do so (the University patented the technology last winter), two major initial uses for the facial recognition technology have emerged. First, it could prove to be a very desirable feature for photo album programs, such as Apple's iPhoto and Google's Picasa, allowing users to electronically index their photo archives according to the faces that appear in each photo.

Far more pressing, though, is its potential for use in security systems. Some of Ma's graduate students are, in fact, at work on the first of these, a test system at the Coordinated Science Laboratory building. The system, which will admit people to the UI facility after-hours by reading their faces, is expected to be operational in a year or less. Assuming the success of these efforts, the possibility that this system will be used in airports before long seems realistic.

Computer vision may also soon be literally in the face of the retail world. The Associated Press reports that video screens embedded with small cameras already have the capacity to identify the age, ethnicity and gender of shoppers who stop to read the displays. (Ma said that he and his group "have not explored those directions with our techniques so far.") Perhaps store cameras will one day identify shoppers as they arrive and send them messages on specials by cell phone – or even scroll photos on a public screen with welcoming messages, à la "Minority Report," the sci-fi thriller that pictures actor Tom Cruise haunted by his own image on screens in a shopping mall.

"I imagine there would be some consumers who like that and some who don't," predicted Patrick Vargas over coffee at a gathering spot near his office on the Urbana campus. A psychologist who teaches courses on advertising, communications and psychology at Illinois, Vargas drew an analogy with a customer being approached by a service representative – which some shoppers desire and others shun. A study by Vargas and UI marketing professor Sharon Shavitt suggests that the more intrusive the advertising, the less consumers like it. In-store face recognition and advertising will succeed, he said, to the extent that it can be used "to help consumers take control of the buying experience."

Beyond the security and convenience promised by facial recognition technology looms the ogre of surveillance, all the more scary for possibly being both widespread and invisible. In a telephone interview, Larry Solum, who is Cribbet Professor of Law at Illinois, parsed some of the questions raised by the technology. First, he asked, "Will people allow the government to have potentially pervasive information about where they are and what they're doing?" Second, Solum queried "people's fear of when government goes bad." Facial recognition technology, in his view, could put the government "in a position to create a Big Brother scenario" – referring to "1984," the George Orwell novel of a totalitarian society that constantly watches its citizens on cameras. Ultimately, Solum feels the issue comes down to "privacy interests balanced against a strong social interest in fighting crime and preventing terrorism."

The sense of being lost in a crowd has its own allure – especially in a society that prizes individualism and independence, as America does. Yet, who hasn't recognized a friend or family member from a distance, in a crowd, as my mother did that day in Annapolis? Who hasn't connected with a special angle of cheekbone, a slope of nose, a tilt of eye and in it seen complete a friend or family member, an enemy or a lover? Computers will be my mother one day. She's coming. She sees me. And she knows it.

– Mary Timmins

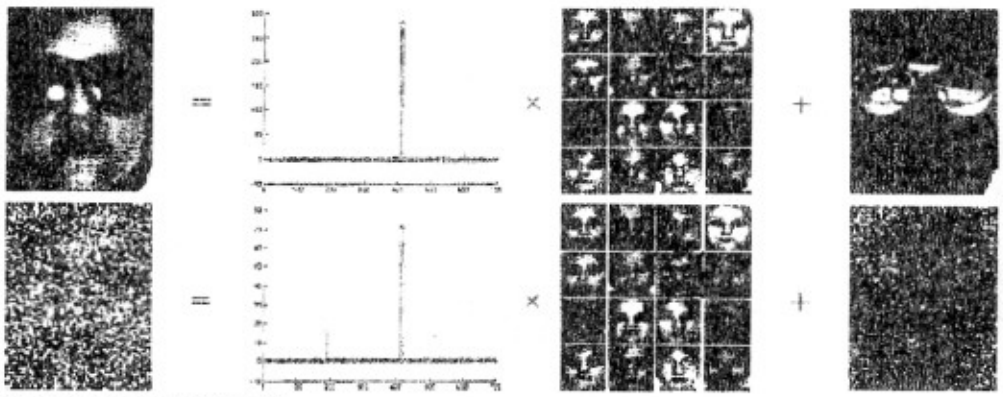


Image Courtesy of CSL Facial Recognition Group

The technology developed by Ma's team allows the computer to "recognize" people whose faces are obscured, as by sunglasses, top left. Even with the pixels in the image scrambled by more than 95 percent, bottom left and right, the computer can still pick faces out from a "crowd," center top and bottom.