

Picture This



TWO INNOVATORS COMBINE THEIR EXPERTISE TO DEVELOP FACIAL RECOGNITION SOFTWARE.

The events of September 11, 2001 and continued threats of terrorism have prompted the demand for heightened security measures and inspired a new generation of surveillance equipment with multiple applications for security, law enforcement, and the military. Enter Ausif Mahmood, Ph.D., Chair of the Department of Computer Science and Engineering and Professor of Computer Science and Engineering and Electrical Engineering, whose list of research interests includes distributed architectures and algorithms and biometrics, the use of unique physical characteristics for identification; and Tarek M. Sobh, Ph.D., P.E., Senior Vice President for Graduate Studies and Research, Dean of the School of Engineering, and Distinguished Professor of Engineering and Computer Science, who is a renowned expert in the fields of robotics and computer vision.

They began to develop their idea for facial recognition software that could pinpoint and aggregate unique facial physiology into a composite of identifiers to be matched with database files for positive identification. The idea itself is not new; multiple researchers have approached this subject with varying success since the early 1970s and different face recognition strategies began to proliferate in the 1980s. Mahmood and Sobh's work further refines the process of one of these well-known strategies, the Eigenface technique, and incorporates the use of computational tools such as wavelet transform and principal component analysis.

For a year and a half, Mahmood and Sobh combined their expertise in computer science and computer engineering to work on developing efficient modules for full and partial face recognition, including recognition of specific facial features. A continuous cycle of research and testing resulted in refinements and improvements, and as the team received inquiries and consulted with various companies, they continued to develop and test partial

and full recognition algorithms. Applications of their early facial recognition software ranged from aiding the process of police artist sketching of alleged perpetrators to providing probabilistic facial matching for dating web sites, in addition to other uses in the security sector.

Fast forward to 2011, when Alan Dressler, co-founder of Central Computer Forensics Lab (CCFL), a high tech startup company housed in UB's C/Tech IncUBar, met Mahmood and Sobh. Dressler, a seasoned investigator and expert in cyber crime, computer forensics, and digital CCTV camera network installation, saw the potential for Mahmood and Sobh's software when packaged with a personalized database and simple video camera. He proposed partnering with them to develop the facial recognition software prototype and launch the product, named Face Checks™.

The Face Checks™ software program builds off of the Eigenface technique, employing hierarchical subgroups of individuals to search for the best facial match within each subgroup until the potentially best match is achieved. The improved technique shows an increase in recognition rates with various established databases. The additional use of a two-dimensional wavelet transform, combined with principal component analysis, enhances two-dimensional signal processing and analysis. Recognition efficiency is improved even more by using partial algorithms in artificial neural networks "trained" via sets of images in a database for convolution/feature matching. Mahmood and Sobh continue to improve the product's precision and reliability, which are critical for commercial application. The team is also developing a prototype for the adaptation of their facial recognition software for use in federated (third-party) authentication.

Face Checks™ is also being developed to work with moving targets, which adds additional layers of complexity. The goal is to work with people in natural motion, rather



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than individuals standing in a line that moves forward in increments as each person stops and is screened.

Applications of the facial recognition product are numerous, with uses for border control, crime investigations, surveillance at high profile sporting events and concerts, and access control to high security facilities such as government legislative buildings, military installations, and school buildings. The implications of determining database populations can become quite complex. Of course, in a smaller population size such as a university, it is much simpler to pinpoint identities compared to the volume of people who flow through an airport. There's also the issue of personal freedom if an individual's photo is available in vast networks. Although the technology has the potential to identify security risks, it may raise some constitutional and other legal issues. Non-security applications are in

demand as well, with uses including automated attendance monitoring in schools and offices.

It was a natural fit to launch the product through a partnership in UB's C/Tech IncUBar, where business acumen, faculty expertise, and student involvement are combined to adapt the software into a valuable and marketable security tool. The potential for this product drew the attention of Connecticut Innovations (CI), which translated into two \$25,000 small business grants to Face Checks™. CI, Connecticut's quasi-public authority responsible for growing Connecticut businesses through innovative financing tools and assistance, is UB's partner for the C/Tech IncUBar. The funding has enabled the acceleration of prototype development through the hire of UB engineering students and equipment purchases. ■