Abhishek Dutta received a Bachelor’s degree in Computer Engineering from Tribhuvan University (Nepal) and went to the University of York (UK) for his MSc in Computer Science (by research). Based on his previous research in the field of automatic face recognition, he received a Marie Curie Fellowship for the BBfor2 project (Bayesian Biometrics for Forensics).

What is the topic of your thesis?
“Although there are CCTV cameras everywhere, they rarely contribute to strong evidence in the court of law because even the best trained forensic investigators find it difficult to compare and interpret the low quality face images. State-of-the-art automatic face recognition technology cannot be applied because these systems are finely tuned to deliver good accuracy for well illuminated and sharp frontal face images. My research aims to develop a mathematical model that explains the relationship between deviation in face image quality and the corresponding variation in recognition performance. In my study, I consider five quality parameters: the pose of the head, illumination, image resolution, noise, and blurring. Face recognition systems always compare two face images. Most researchers consider only the quality of the CCTV image. They assume that the suspect’s picture is well illuminated and a sharp frontal face image. However, my preliminary experiments show that comparing a poor quality image with a high quality picture does not necessarily give the best results. Recognition improves if the illumination, pose, and blur of both pictures match. Forensic investigators do not have any control over the quality of images captured by the CCTV camera but they have some control over the suspect’s picture. By judiciously choosing the suspect’s picture quality, it is possible to improve face recognition performance.”

What do you hope to achieve?
“The mathematical model will help to find the answers to two questions. First, for a given quality of image captured by CCTV, what is the quality of suspect’s picture that will help attain optimal performance using a particular face recognition system? With that knowledge we can either capture suspect’s images with approximately the optimal image quality, or synthesize the suspect’s picture to optimal image quality based on his mugshots. Second, what recognition performance can you expect for the image quality pair (the CCTV image and the suspect’s picture) on a general population using a particular face recognition system? Such performance data would help improve the evidential weight of face recognition results in a forensic case.”

What is the societal relevance of your research?
“My research is a step forward in establishing automatic face recognition as a robust and reliable forensic tool. In general, the field of forensic face recognition is not very mature. I hope my research gives more insight into why systems fail, thereby opening the way towards systems that do better than humans, even when the picture pair is of poor quality.”

Why did you choose this subject?
“The thought of machines having the capabilities of human visual system excites me. During my undergraduate study I worked on a final year project involving real-time tracking and recognition of faces. While I was amazed to learn about existing face detection and recognition algorithms, I was also disappointed with their performance under extreme pose or illumination. The Marie Curie Fellowship that I received to pursue my PhD research is to explore face recognition performance variation with image quality: a question that I first encountered during my undergraduate project.”

CTIT

Since 1994, the Centre for Telematics and Information Technology of the University of Twente (CTIT) has drawn from its broad integrated research spectrum to do cutting edge technical research, in tune with the societal and economical challenges of today and tomorrow. CTIT is a strong team player within the innovation chain at both the European and local level, through alliances, public-private partnerships and spin-off companies. Whether it’s pushing the limits of cognitive radio and sensor networks, enabling servitization, powering sustainability or strengthening IT security: our researchers are involved. >> www.ctit.utwente.nl
Facial and fingerprint recognition

And when they do, illumination is often not optimal." In another project therefore, research was done on correcting the illumination of the 'live' image. Facial recognition is also important in forensics, where it must be established whether the suspect is the person on a CCTV camera image. Research in this area is often done in cooperation with the Netherlands Forensic Institute (NFI). "In one of our projects, we are exploring the use of 3D facial reconstruction to improve the reliability of facial recognition. Surveillance footage may be of bad quality but on the other hand, CCTV cameras provide a large number of images. With these, we hope to improve performance by reconstructing a better 2D picture from the 3D model."

"You need to store biometric information in such a way that it cannot be traced back to the person"

Smart homes

Smart homes is another application for facial recognition. The system can personalise its settings and information supply to the residents when it knows which person is in which room. "But as a user, you also want privacy, so you don't want to be filmed all the time", says Raymond Veldhuis. "Therefore, we are looking into a solution where cameras are built into doorposts, so the occupant is only on film when passing through a doorway. However, having only the facial side view at your disposal makes it much more difficult to recognise a person reliably."

In the area of fingerprint recognition, the prevention of identity fraud is one of the important research topics for the SAS group. "You need to store biometric information in such a way that it cannot be traced back to the person", Raymond Veldhuis explains. "After all, you can change your pin code but you can never change your fingerprint." The group is therefore working on a solution where a binary code is generated based on the fingerprint. The code does not contain information about the fingerprint image and if needed, it can be replaced by another code.

Forensics

Most of the biometric projects of the group are in the area of facial recognition. "At Schiphol for instance, we have evaluated a system for automatic border crossing control. The question was how well the system performed when comparing a picture from the passport with a 'live' camera image of the passenger", explains Raymond Veldhuis. Because illumination and pose are fairly optimal in this case, facial recognition proved to be much more reliable than in camera surveillance. "Here, people are not motivated at all to look straight in the camera and then be denied access to a football stadium or public transportation.

3TU.Netherlands Institute for Research on ICT

The Netherlands Institute for Research on ICT (NIRICT) brings together over 70 research groups and 1,200 researchers from the three Dutch technical universities. Their work is strongly guided by current and future societal and economical challenges. Associate Professor Raymond Veldhuis is head of the Biometric Theme of the Signals and Systems group at the Centre for Telematics and Information Technology (CTIT) of the University of Twente.

The biometric research in the Signals and Systems group focuses on facial and fingerprint recognition. "The combination of biometrics, pattern recognition and signal processing is very interesting", says Raymond Veldhuis. "Applications are for instance user-friendly and reliable access control, improving evidential weight of face recognition in forensic cases, and prevention of identity fraud."

NIRICT is the Netherlands Institute for Research on ICT and comprises all ICT research of the three technical universities in the Netherlands: Delft University of Technology, Eindhoven University of Technology and University of Twente. NIRICT brings together over 70 research groups from the disciplines Computer Science, Electrical Engineering, Mathematics and several ICT application domains. More than 1,200 researchers collaborate, which makes NIRICT the most important academic research partner in the Netherlands. >> nirict.3tu.nl