



Fraunhofer Institut Graphische Datenverarbeitung

3D Face

3D Face Recognition

Department

Security Technology

Head of Department

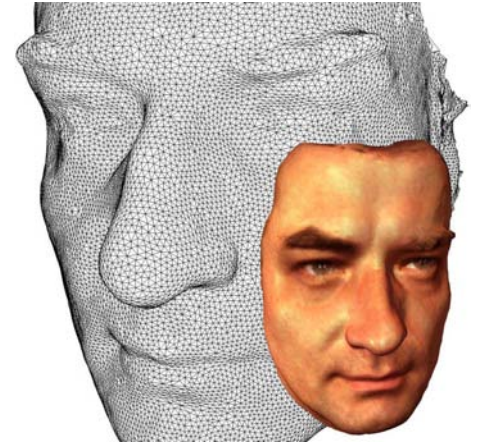
Alexander Nouak

Biometric Features are used to characterise and thus identify individuals. Their availability together with the ability to analyse create a basis for the development and efficiency of social structures.

In history of human evolution the essential necessity to recognise and distinguish reliable from potential threatening persons resulted in the development of a specialised brain area assigned to face recognition.

Faces are the main biometric feature used for interpersonal identification but not the only feature. The development of complex social and cultural structures has initiated an early need for »offline«-authentication of contracts and communication which was solved e. g. by fingerprint or subscription.

The computer based simulation and automation of human abilities in the field of face and fingerprint recognition has enforced the usage of alternative and previously unknown or unused biometric features as iris, retina, vein pattern, hand contours or DNA.



Face recognition

However, the traditional primary role of face recognition is still given in current practise. The new passport generation integrates digital face images used for future border controls. The main advantage of face based biometrics is the flexibility to exchange or combine hu-

Fraunhofer-Institut für Graphische Datenverarbeitung IGD

Alexander Nouak
Fraunhoferstraße 5
64283 Darmstadt
Germany

Phone: +49 (0) 6151/155-147
Fax: +49 (0) 6151/155-499
Email: alexander.nouak@igd.fraunhofer.de
Web: <http://www.igd.fhg.de/igd-a8/>

man and computer based recognition. Important criterias as the contactless and wide range acquisition of necessary features are fulfilled too.

Currently off-the-shelf face recognition systems are performing very well under ideal conditions. Unfortunately, in real environments the performance will often be degraded e.g. by varying head poses. In simplified cases the system may additionally be bypassed by impostors presenting photos or videos.

Extension

A significant improvement of recognition performance as well as resistance against impostor attacks is promised by the acquisition of the three-dimensional surface and the texture of the human face. The three-dimensional information allows the correction of face images acquired in unfavourable poses or viewing angles.

A further important advantage of three-dimensional acquisition is given by the invariance against scaling. Two-dimensional snapshots do not include information about the distance of the head and the image has typically to be normalised on basis of the extracted eye distance. In contrast three-dimensional face measurements are resulting in surfaces which are metrically correct and free of perspective or radial deformations. Thus the real proportions – e.g. the eye distance – will be preserved and

will not vanish by conversion to a uniform format of the image (including uniform interocular distance).



The 3D acquisition device

Competence

The potential of authentication by using biometric features especially in conjunction with the acquisition of three-dimensional faces lead to the development of a reference system for three-dimensional face recognition based on a 3D scanner by Polygon Technology. The surface and the texture of the persons head is acquired with a stripe projection

in combination with a color camera. After acquisition the face data is rotated to a canonical frontal view establishing a common coordinate reference frame for the following matching with different database faces.

The question whether the expected enhancement of performance and security of 3D face recognition systems is fulfilled by of-the-shelf products and prototypes was examined in a field test on behalf of the german Federal Office for Information Security (BSI).

The experience and knowledge in the field of biometrics and 3D face recognition are contributed to the international standardisation process.

Future

The further development and improvement of 3D face recognition algorithms and devices is supported in the project *3D Face* which is funded by the European Commission within the Sixth Framework Program for Research. The consortium consists of leading European research institutes and industry partners. Besides increasing recognition performance and improving the scanning technology an important further aspect in scope is ensuring privacy of biometric data and its templates.