B6   3D Morphometric Computer-Assisted Comparison of Faces, Hands, and Other Body Features in Databases

Zeno J. Geradts, PhD*, Ana Slot, MFS, and Arnout C. Ruifrok, PhD, Netherlands Forensic Institute, Ministry of Justice, Laan van Ypenburg 6, Den Haag, 2497 GB, NETHERLANDS

The goal of this presentation is to provide a methodology for comparison, using Likelihood Ratios (LRs) for the comparison in addition to the use of reconstruction images, limitations, and possibilities.

This presentation will impact the forensic science community by showing how to combine conclusions of biometric features with a Bayesian framework.

In forensic image analysis, the question is often asked if the person on a certain image (e.g., from CCTV, documents, child porn) is the same as the suspect. Sometimes only a part of a body is visible, so only parts of a body are compared with the suspect.

The method used for comparison of objects and of humans is to position the person or object in the same position as the questioned image. If the camera system is not available, a 3D image will be made of the person, such that the 3D image can be positioned in the same way. For facial comparison, there is a methodology for comparison which is used in different scenes.

On recordings of certain crimes, the face is not always (properly) shown, unlike the hands. Therefore, the need has arisen to develop a method for the identification of people based on their hands. The research method that is applied for hand comparison is based on morphology, anthropometry, and biometry of hands. A manual test (checklist) was created which includes characteristics of both the back of the hand (e.g., the subcutaneous vascular pattern in the back of the hand) and the palm of the hand (e.g., palm line pattern). Features that comprise both parts of the hand are also included (e.g., proportions and typica). To assess the location of pigmented lesions, the hand can be segmented into 14 regions using readily discernible anatomical landmarks. Then, each hand can be assessed for the number of features found in each area. Furthermore, a database is available that not only contains many hands, but also scripts that can compare images and provide identification rates. Initially, the scripts were only capable of identifying the palms of the hands. Recently, they are also capable of analyzing the backs of the hands. For other parts of the body, such as the abdomen and genitals, there is no structured approach known to the authors; however, similar methods can be used. In casework, this study focused on different features of the body, where the skin characteristics as well as the shapes were used. The reference images of the body are taken by a forensic physician. During the comparison, different features are compared manually and the investigator will provide information on apparent similarities and differences which are further evaluated by classifying features as:

1.   WD - Weakly discriminating, e.g., shape and size of body parts.
2.   MD - Moderately discriminating, e.g., lines and position of veins.
3.   SD - Strongly discriminating, e.g., the shape and position of a scar or pigmentation.

The comparison should preferably be performed by three independent investigators. The lists are combined after careful deliberation by the investigators into the list of observations added to the report. This list of observations can be used to check the reported comparison results and conclusions.

Concerning the forensic hand comparison, it has been tested to ascertain whether the manual or automated method performs better when analyzing hands from the database. Currently, it is being investigated to determine if the tests work with "homemade" photos as well. Eventually, the aim is to investigate hand images made by CCTV systems, which are often of very poor quality. There is a need for an automated comparison and a more statistical approach for this kind of research. Large databases with standardized image material could be helpful in having a Bayesian approach in this biometric comparison. Since it is not yet perfected for facial comparison, it is expected that, in the meantime, the visual comparison based on features and describing the differences and the similarities will be an important approach for this type of examination.

Facial Comparison, Hands, Other Body Features