B23 Standardizing 3D-3D Facial Superimposition for Identification From Next Generation Video Surveillance Systems: A New Challenge for Forensic Anthropology and Digital Image Experts

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After attending this presentation, attendees will gain knowledge concerning advanced technologies and the modern applications of forensic anthropology in personal identification from video surveillance systems of living individuals.

This presentation will impact the forensic science community by providing a new method for assessing identification of culprits filmed by 3D video surveillance systems.

The identification of culprits from video surveillance systems is frequently performed by comparing facial features and presents relevant problems regarding both the reliability of methods used and the quantification of the degree of matching between the culprit and the suspect's face. Video surveillance devices provide a film of the scene, and therefore give only 2D images of the culprit, which can be compared to a 3D model of the suspect's face, usually obtained by a laser scanner or stereophotogrammetry, in a 2D-3D superimposition. The attempts actually recorded in literature at standardizing and quantifying the probability of identification are applicable only to ideal conditions of head position and quality of image, and do not provide a conclusive indication concerning the identification.

However, in the near future video surveillance systems will provide a 3D image of the filmed person, which may allow the operator to perform a 3D-3D superimposition between the 3D model of culprit's face and the 3D scan of the suspect. The application of 3D-3D superimposition promises to overcome the limits concerning the probability of correct identification, a difficult task in 2D-3D comparison techniques.

A pilot study on 55 3D-3D superimpositions was devised: the face of ten individuals underwent two scans by stereophotogrammetry (VECTRA-3D) which provided a 3D model of the face of each subject. The time period elapsed between the two scans went between few minutes and 32 months. On each 3D facial model, nine landmarks (right and left endocanthion, right and left exocanthion, right and left cheilion, on the midline selion, pronasale, and subnasale) were identified by VAM software; the first scan of each individual was then superimposed with the first scan of all the other nine subjects. The superimposition of the two 3D models was performed in order to reach the best match between the corresponding landmarks. The same procedure was performed also between the two scans taken from the same individual. In total, 55 superimpositions were performed. In all the cases, the Root Mean Square (RMS) value of point to point distances between the two models was calculated. When the two superimposed models belong to the same individual, the RMS value was on average 1.58 mm (SD: 0.61 mm), whereas when the two models were taken from different persons, the same value was 4.54 mm (SD: 2.02 mm). The difference between the results obtained in the two groups was statistically significant ($p<0.0001$).

This pilot study shows that the judgment of identification based on 3D-3D superimposition may provide reliable results concerning the definition of a threshold for reaching a diagnosis of identificaton; in addition, this protocol may allow scientists to give a probability concerning identity. The improvement of technologic devices of scene acquisition and the development of specific methods of 3D-3D comparison may provide in the near future relevant advantages in this recent and difficult field of forensic anthropology.

Personal Identification, Video Surveillance System, Stereophotogrammetry

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