H127 Robber's Personal Identification by Superimposition and Metrical Analysis Between Recorded Images and 3D Photogrammetric Avatar of the Suspect: A Pilot Study

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After attending this presentation, attendees will become familiar with the use of 3D morphometric comparison to seek a robber's personal identification.

This presentation will impact the forensic science community by showing an objective but non-invasive technique for obtaining a robber's personal identification through an analysis of recorded images and 3D photogrammetric avatar superimposition.

In the past few years, the technological advancement in personal identification systems resulted in a large production of scientific studies and an increased production of devices and commercial software. Facial identification through analysis of pictures taken from video surveillance systems still remains a difficult issue from a technical point of view.

Currently, nearly everywhere, there are video systems, webcams, digital cameras, and cell phone cameras that are able to film facial images and easily transmit, share, and store them. As a consequence, a video documentation of a criminal act often exists.

Expert analysis is then necessary to either confirm or exclude a specific individual as the subject depicted in an image. Personal identification, however, may be easy when close-up pictures are available or when the subject presents specific features or defects.

Personal identification based on 3D digital photogrammetry presents a natural evolution of previous research in this field by Parameterized Superimposition (PS). The experience was based on 2D/2D comparison between video frames taken from the surveillance camera system during a robbery and frames of the suspect brought back to the same place the robbery was perpetrated.

In the first phase, recorded images of the robber were studied and improved. Frames with a better view of the robber's face landmarks were chosen. Then, the court took the alleged offender into custody. The suspect was transported to the location of the robbery and placed in the same position as the frames from the video footage. Finally, a quantitative comparison between the image of the robber's face and the suspect's face was carried out. For that to be possible, the crime scene—often a bank or a shop—has to stay closed during the investigation and total cooperation from the suspect is necessary.

The purpose of this study is to test a new technique based on 3D photogrammetric avatar: photogrammetry currently provides the most cost-effective 3D capturing system, being fast, inexpensive, and non-invasive; the equipment necessary for acquisition is easily transportable and offers high reliability. The technique was demonstrated to be suitable for capturing facial morphology for clinical and anthropological use.

The new technique should overcome the limits of the PS technique, while maintaining the same quality level of objectivity and accuracy.

This technique involves four steps:

- **Preparatory Phase**: In which the recorded images of the robber are studied and improved. Frames with a better view of robber's face landmarks are then chosen.
- **3D Acquisition Phase:** During which a 3D photogrammetric avatar of the suspect face is created; this phase only requires four photos which are made simultaneously with a calibrated camera.
- **Superimposition Phase:** Preparatory for the final step, involves a meticulous spatial orientation of the 3D avatar in the same position taken by the offender in the selected frames. A snapshot of the 3D avatar is then taken.
- **Metric Image Analysis:** A quantitative comparison between the image of the robber's face and the snapshot obtained is used. To perform this step, it is necessary to clearly recognize at least five landmarks on the robber's face using suitable software. Landmarks are chosen and allocated on individual images in relation to the spatial position of the faces, depending on the attitude taken by the individual. The same points are marked on the suspect's face obtained at the end of the best superimposition. Repeated landmarking by different observers allows the detection of random errors and controls the quality of the landmarking practice within and between operators, minimizing variability. The absolute and relative distances between the marked points, the perimeters and the areas of the triangles obtained by connecting the points, and the compactness indexes are automatically calculated on both images in the analysis. Two series of five sets of numerical parameters can then be compared.

 ** Presenting Author*

Promising results of a preliminary study, involving experimental subjects and cross comparisons between them are presented.

Identification, Robbery, 3D

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