B33 Assessing Skin Detail of the Dorsal Surface of the Hand: A Comparison of Methods

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After attending this presentation, attendees will have an understanding of two different techniques for segmenting the dorsal surface of the hand for use in image analysis. A comparison of the two methods will generate a greater awareness of the process of evaluating skin features commonly found on the dorsal surface of the hand and used in forensic image comparisons.

This presentation will impact the forensic community by assessing two different grid systems that may be employed in the course of a forensic image comparison. By knowing the strengths and weaknesses of each system, an examiner will be able to conduct a more thorough analysis when attempting to identify an individual through an image comparison.

The skin features examined in this study include: freckles, moles, sunspots, scars, and any other features of de-pigmentation or hyper-pigmentation. As these skin features vary in appearance, both in spatial distribution and geometric shape, each characteristic may be a potentially valuable resource when conducting comparisons to establish individuality. While such marks have been employed in facial recognition, hands are another area of the body that may be captured in images of forensic interest.

Two methods are assessed in the current study; both are grid systems that segment the dorsal surface of the hand into numerous regions. The first method, presented by Malone, includes 14 regions.[1] The second method, presented by Macdonald-McMillan, includes 24 regions.[2] Both methods use anatomical landmarks to divide the dorsal surface of the hand into its respective regions. The regions are then used to determine the location and spatial relationships between skin features. It is hypothesized that the method with more regions will generate more unique results, but an additional aim of the research is to determine the forensic practicality of each method. Depending on the situation, it may be more or less useful to have a greater number of regions to examine.

Each of the hand segmentation techniques was applied to a collection of 233 images. These images of hands were collected between the years 2003 – 2005, as part of the Computer Vision Research Lab Biometric Data Set at the Department of Computer Science and Engineering, University of Notre Dame. Each method was able to accurately quantify the features found in each of the regions generating descriptive statistics on the distribution and frequency of such skin features. Once the images of hands were assessed by both methods, the results were statistically compared. The advantages and disadvantages of each method were then examined.

Through this comparison of methods, an examiner is better equipped to perform photographic comparisons of the dorsal surface of the hand and to defend his or her conclusions in the courtroom. With the abundance of digital images and the potential for skin features to be examined, more research is required to establish consistency within the field of image comparisons.

*The opinions or assertions constrained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

References:

1. Malone, C. Photographic Analyses Using Skin Detail of the Hand: A Methodology and Statistical Evaluation. Proceedings of the *American Academy of Forensic Sciences Proceedings;* 2012:143-144, Atlanta, GA.
2. Macdonald-McMillan, B. (2011). *The Quantification of Dorsal Hand Features of Interest to Assist Forensic Human Identification.* University of Dundee, MSc Thesis.

Image Comparison, Hand Identification, Image Analysis

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