

Relatively Permanent Pigmented and Vascular Skin Marks as Novel Skin Biometrics for Forensic Analysis

Lisa Altieri¹

1. University of California Los Angeles

✉ **Corresponding author:** Lisa Altieri, altieri.lisa@gmail.com

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Abstract

Relatively Permanent Pigmented or Vascular Skin Marks (RPPVSM) are skin marks that occur as a result of increased pigmentation (e.g., nevus and lentigo) or vascular proliferation (e.g. cherry hemangioma). RPPVSM have the potential to be an effective biometric trait for forensic identification because they are stable and common lesions in Caucasian, Asian, and Latino populations. The purpose of this study was to determine the spatial distribution and inter-observer error rates for RPPVSM detection. A dermatologist who is an expert in the field of skin biometrics established that RPPVSM are skin marks that are greater than 1mm and present for at least 6 months. Forty-three digital photographs of the back torsos of 16 Caucasian, Asian, and Latino males were collected. Three board-certified dermatologists examined and manually marked RPPVSM on the photos. Empirical testing showed that the RPPVSM in middle to low-density patterns tend to form an independent and uniform distribution, while RPPVSM in high-density patterns tend to form clusters. Several pilot studies were done comparing inter-observer variability between three dermatologists, and the correspondence rates for identifying RPPVSM ranged from 48.8% to 77.7%. These pilot studies highlight technical challenges in photography and the definitions of RPPVSM. Because RPPVSM are distributed independently and randomly, they can be used for forensic identification based on skin marks. Intra-observer variability will be tested in a future study. The results from this project will be used as a performance standard for an automated RPPVSM detection algorithm.

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