



B17 Relatively Permanent Pigmented or Vascular Skin Marks (RPPVSM): Skin-Based Personal Identification on Digital Evidence

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After attending this presentation, attendees will gain understanding on Relatively Permanent Pigmented or Vascular Skin Marks (RPPVSM) for identifying criminals and victims in digital evidence, especially in photographs and videos. This includes uniqueness of RPPVSM patterns, statistical analysis of RPPVSM, potential error rates in matching RPPVSM evidence, and reliability of RPPVSM recognition by dermatology experts. RPPVSM include but are not limited to nevus, lentigo, cherry angioma, and seborrheic keratosis.

This presentation will impact the forensic science community by exposing it to scientific basis and practical application of RPPVSM in forensic investigation. Attendees will be presented with dermatological description of RPPVSM and their stability over time, a statistical model for estimating the discriminative power of RPPVSM patterns, potential error rates in claiming an identity based on RPPVSM patterns, and inter-examiner variability of RPPVSM analysis in digital photographs.

As multimedia technology becomes more prevalent in everyday life, the capability for extracting evidential information from images and videos during forensic investigation becomes increasingly crucial. For example, in the attempt to search for suspects of child sexual exploitation offenses (e.g., child pornography), forensic investigators often link related digital evidence images/videos found in different cases. Not rarely, the collected evidence images/videos show only non-facial skin of the suspects (e.g., back, chest, thigh, and arm), making face recognition impossible. While tattoos, scars, and birthmarks have some information for identification, they are not always available. However, it is not unusual to observe some other skin marks in these images/videos (e.g., nevus), which can provide valuable information to the investigation.

Skin marks have been regularly used in criminal investigation for years. Birthmarks and nevi are commonly utilized in suspect verification. Nevi were used in the trial of *United States v. Michael Joseph Pepe (2008)*, a sexual exploitation case involving seven pre-teen girls in Cambodia. In this case, the pedophile was identified using a nevi pattern located on his left thigh. The nevi were recognized by a U.S. board certified dermatologist. While it had been known that skin marks are useful for identification, unlike in fingerprint and DNA analysis, their scientific basis for identification had not been established at that moment. The number of skin marks sufficient for authenticating an individual, the error rates of such an identification approach, and the reliability of RPPVSM recognition by experts are fundamental questions that require scientific studies to answer.

Over the past three years, significant research efforts have been made to answer these questions. Statistical analysis on Caucasian, Asian, and Latino populations revealed that Caucasians tend to have more RPPVSM than Asians and Latinos, and that RPPVSM tend to form either a clustered distribution or a uniform and independent distribution.¹ Individuality study on the independently and uniformly distributed RPPVSM demonstrated that seven RPPVSM can be considered sufficient for individualization.² The error rates in verification and identification can be estimated using a statistical point-matching model.² Current research effort is focused on the assessment of the reliability of RPPVSM recognition by different experts. Four dermatology-trained medical doctors have been recruited for this study. Each expert will perform RPPVSM recognition on over 50 Caucasian and Asian skin images with different quality (e.g., compression rate, image contrast, and occlusion). The consistency among different experts will then be analyzed. Furthermore, the effect of different image quality on their performance will also be studied.

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References:

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