Determining the Age of Fingermarks: No Longer a Myth

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INTRODUCTION

Determining the time a latent fingerprint has been deposited can be of great value to law enforcement to increase the probative value of evidence in court. Placing the alleged criminal within the timeframe of the crime can speed up and ease trials.

The objective of the project is to design an inexpensive and easy-to-apply methodology to statistically determine the aging process (i.e., degradation) of latent fingerprints after visualization with the powder reagent TiO2 (Titanium Dioxide).

METHODS AND TECHNIQUES

- Monitored environment: Temperature, RH%, air currents, time and intensity exposure to sun-light indoors (i.e. direct light, shade and darkness).
- Surface material for deposition: Plastic (polystyrene) and glass.
- Type of fingerprint secretions: Sweaty (eccrine-rich) and greasy (sebaceous-rich).
- Fingermarks’ developer: One for all samples.
- Fingermarks’ developer: Titanium Dioxide (white powder).
- Total number of samples: 310.
- Aging period: 6 months, 11 collection periods.
- Sample selection: at random from the pool of depositions.
- An area of 1x1 cm was selected from the centre of each fingermark.
- Data collection performed by computer imaging software and 3 to 5 analyses were performed for every visual parameter of degradation.
- Visual fingermark degradation parameters evaluated:
  - Number of minutiae, Width of the ridges, Colour contrast between ridges and furrows, Number of discontinuities.

Quantification:
- For minutiae count, the ratio = initial number of minutiae at “t” time/initial number of minutiae.
- For width of ridges, a template was designed to measure 30 points from at least 5 different ridges.
- For colour contrast, all selected areas were analysed excluding artefacts, and the ratio applied.
- For number of discontinuities, a selected area of 0.5 mm2 was analysed from the centre of each image.

RESULTS AND DISCUSSION

For each of the combinations of substrate, secretion type and light condition, separate analyses were performed for every visual parameter of degradation.

Degradation parameters were grouped as:
- SNIPs (Subject Non-Independent Parameters), as being independent from the original donor’s fingermark for determining its relative age.
- SIPs (Subject Independent Parameters), as being dependent on the original donor’s fingermark for determining its relative age.

Statistical analyses were individually performed per each parameter, obtaining degradation patterns for all experimental conditions.

The results for “width of ridges” and “ridge discontinuities” are not shown as data analysis is currently in progress.

The results for “minutiae count” and “colour contrast” are referenced below.

CONCLUSIONS

The feasibility of estimating the age of latent fingerprints by visual means has been proven.

The most relevant results are:
- It has been shown that direct exposure to light has no significant effect on any of the 4 parameters for greasy samples on glass.
- Contrary to common belief, fingerprint images are not always better preserved in the dark.
- The number of minutiae remains unchanged over time for fingermarks exposed to direct light. Depositions on plastic show a faster decrease in the number of minutiae.
- The colour contrast analysis shows the observation of the shape of the colour profile together with the Mean/SD for a correct interpretation of patterns of degradation.
- The width of ridges increases or decreases depending on the combination of factors, according to preliminary results.
- The number of discontinuities by itself is not informative and requires normalization with the powder reagent TiO2 (Titanium Dioxide).

FUTURE PROSPECTS

The combination of visual parameters of degradation will allow a robust mathematical formulation of aging patterns; producing an estimation of the deposition time of a latent fingerprint.

Further studies with the inclusion of more donors and developers are necessary to confirm, refine, and standardize these findings.

The assessment of the age of latent fingerprints could be included as a new phase in the examination process to increase the probative value of evidence.

**References**


