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## C4 Forensic Image Comparison of Feet

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The goal of this presentation is to develop a biometric method (observation checklist) for foot comparison via images. On recordings of certain crimes, such as child abuse situations, the face is not always (properly) shown, unlike other body parts such as the feet. In such cases, feet can offer a solution for identifying the perpetrator. Therefore, the need has arisen to develop a method for the identification of people based on images of their feet.

This presentation will impact the forensic science community by providing a framework for foot comparison which can be used in casework.

To be able to evaluate the proposed method, a Netherlands Forensic Institute (NFI) foot database of images (left and right feet) was created. The NFI foot database of images consists of 52 subjects (19 females and 33 males). Eight photographs, four of each foot, were extracted from each subject; the four photographs were from different sides.

During the project, a study was performed to evaluate the potential of using numerical features for the observation checklist. The dispersion was observed to conclude which numerical features would be good individualizing factors. Ten out of sixteen features were dispersed enough to be used in the observation checklist (standard deviation  $>0.04$ ). The repeatability and reproducibility of the model was studied and it was concluded that the length ratios of the toes have the smallest values. Another factor studied for the applicability of the numerical features was the foot's daily changes; the toes' length ratios have the smaller daily change.

The proposed identification checklist has the potential to be effective on actual cases of perpetrator identification. The accuracy of the tests is always above 90%, with the highest score being 98.34% of the top-side test and the lowest being 90.30% of the poor quality test. Furthermore, it was observed that the use of the proposed method improved the results by an average of 10% compared to not using it.

A probability format was suggested as a means for reporting. As the checklist consists of morphological features which are very distinctive for the comparison and scientists have not found a way to calculate the Likelihood Ratio (LR) from non-numerical features, the needed ratio cannot be estimated; however, a statistical analysis was performed to check the potential of reporting with LR for the suggested numerical features. Again in the bivariate analysis, the combination of toe length ratios gave maximum probability densities compared to the other combinations. In addition, the larger LR for a specific case was calculated on the sole-side image from which six numerical features can be extracted.

To conclude, although the proposed identification checklist has all the potential to be used on actual cases of perpetrator identification from foot imagery, more research is recommended.

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### Feet Comparison, Image, Biometric