Science report. However, research in this area is not only aimed at changing the perception of fingerprint evidence in the legal and scientific communities, but to provide fingerprint practitioners, and more widely the actors of the criminal justice system, with tools to support casework operations. In order to investigate the benefits, impacts and challenges of the use of fingerprint statistical models on casework operations, the model developed by the Forensic Science Service (UK) was used during a field study. The fingerprint cases from a fingerprint bureau were duplicated. The fingerprint comparisons were processed using the statistical model in parallel to the current approach. The number of potential additional detections and indicators of the improved level of quality assurance were measured. The results of this study will be reported during this presentation.

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Analysing complex inference problems in forensic science using Bayesian networks: The example of the two-trace transfer problem

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Forensic scientists across all forensic disciplines are confronted with the need of addressing increasingly complex inference problems for assessing the value of scientific evidence. Two-trace transfer problems constitute a typical example for this. They are a realistic problem which, up to now, forensic statisticians have addressed with an algebraic approach for calculating likelihood ratios (LRs). Despite their valuable formal rigour, algebraic approaches may lead to mathematically sophisticated expressions at the expense of transparency, and possibly also comprehensibility, for non-mathematicians. With regard to this issue, we investigate a graphical approach based on the construction of probability models, i.e., Bayesian networks (BNs), to tackle such inference problems. On the one hand, the visual transparency of BNs easily lends them to logical extensions to include additional variables and to take into account subtle dependencies that may exist among these variables. On the other hand, they offer a mathematically robust and structured environment for intricate probabilistic calculations that further allow the user to deduce the corresponding mathematical expressions of interest. We illustrate the potential of this approach by using BNs to frame the two-trace transfer problem for activity-level propositions. In this problem two items of the same type of trace evidence, but with different intrinsic characteristics, are recovered on a crime scene. A suspect's sample matches one of these two items. The evaluation of the corresponding activity level LR must thus logically combine the probabilities related to the transfer event of each of these traces. The problem is addressed here by first creating a BN, and then deducing the corresponding LR formula from the graphical model. This approach was found to support the formulae published so far and clearly illustrates the trains of thought and assumptions underlying the mathematical expressions. Moreover, the organised visual structure of the BN easily lends itself to an extension to traces by transforming it into an object-oriented BN, an option currently available in BN software allowing for a hierarchical configuration within the network. The solutions we propose illustrate the advantages of analysing complex inference problems with BNs and suggest themselves as a means for addressing the greater challenges of coherently combining the values of different categories of evidence.

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Logically correct concluding and rational reasoning in evidence evaluation

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Introduction

This presentation deals with the implementation of logically correct, balanced, robust and transparent forensic reporting. The Netherlands Forensic Institute (NFI) produces about 35,000 reports per year in 43 fields of expertise. About 20,000 of those reports are complete statements including a forensic interpretation and conclusion. The improvement of the quality of the reporting is an ongoing activity of the NFI, but in the last 3 years the authors' efforts towards transparency were focused on rendering the conclusions of the forensic reports more uniform, transparent, balanced, and logically correct. For the following years we envisage to improve the transparency of forensic reasoning, using Bayesian Networks (BNs) for explicit and rational reasoning. We will discuss the implications for reporting, casework and R and D, as well as internal and external education aspects. A very short introduction to Bayesian Networks will be given, and the improvement efforts will be related to the recommendations for improvement of forensic science in the United States by the National Academy of Science.

Logically correct conclusions

At the NFI, the first step towards transparent forensic conclusions consists in reporting logically correct forensic conclusions. This requires defining a correct set of hypotheses to be considered, and estimating the ratio of the probabilities of the analytical findings, when one or the other hypothesis is taken to be true (Likelihood Ratios). The estimation of those probabilities should be quantitative where possible (objective estimation) and when this is not feasible verbal scales can be used (subjective estimation). Gathering more empirical data to support the estimations requires a (long term) R and D effort. Finally, the verbal scales will need to be calibrated to quantitative likelihood ratios.

Transparent rational reasoning

The next phase will include promoting the use of Bayesian Networks (BNs). BNs can make the structure of the forensic reasoning process and the conditional probabilities involved explicit. We foresee the use of BNs for the interpretation of the evidence at the activity level and for the interpretation of combined evidence, but also for case pre-assessment and to assess in which part of the forensic processes R and D is most needed. The practical implementation of such a tool clearly will necessitate an effort in terms of education, for developers of BNs as well as BN users in casework, and readers of reports.

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Admissibility of scientific evidence — An old problem in a new era

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The paper presents the position of jurisdiction (primarily a Polish one) in relation to so-called new scientific evidence connected with identification of person. However due to a short time of use of this kind of evidence it was not unconditionally accepted by the courts. Taking the principles of admissibility of scientific evidence in the US