A NEW APPROACH TO PROBABILISTIC MIXTURE ANALYSIS SOFTWARE

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A shift is occurring from binary (presence/absence) methods of evaluating DNA mixtures, to probabilistic modeling approaches, as DNA analysts are required to evaluate increasingly complex mixtures and low template DNA in evidence samples. Many different variables affect the final peak heights seen in a sample. These variables- whose effects may not be known accurately- include concepts such as concentration, number of contributors, stutter, STR repeat sequence complexity, peak height variation, and degradation.

Mixture profiles are compared to hypothetical profiles based on these parameters and hypothetical combination of genotypes present in the sample in order to calculate how probable it is that a given individual contributed to the mixture. Integration over a large number of interrelated parameters is required to calculate relative probabilities, but doing so directly is not feasible. Marcov Chain Monte Carlo (MCMC) is widely used to approximate such complex integrals with high accuracy.

Teaming with forensic and university researchers, we developed a software framework that can be run in casework or research mode. Casework mode is used to process samples following a validated workflow. Research mode provides forensic research and development scientists with an easy to use, transparent tool to test models they develop in the ongoing progression of improving methodologies for mixture evaluation. The rationale, development goals and overview and demonstration of a new, transparent software for continuous probabilistic mixture analysis will be presented.

Development goals for the software include: rigor, ease-of-use, transparency, ability to lock down validated workflow(s), separation of model and software to provide a framework to fully test new models. Established, validated methodologies are incorporated into a transparent software; making it easy for analysts to clearly explain the methodology to juries and for researchers to incorporate additional variables and test new models as the science continues to evolve. As new models are developed and validated in research mode they can be seamlessly transferred to casework as the development is accomplished within the same framework.