

Criminalistics Branch

Forensic & Analytical Science Service
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13 November 2023

To: Special Commission of Inquiry into LGBTIQ hate crimes

Re: Request for assistance regarding use of Artificial Intelligence (AI) in Forensic Biology/DNA at the Forensic & Analytical Science Service (FASS).

I will preface this response by acknowledging that I am not an expert in Artificial Intelligence (AI) technology. I will restrict my comments to AI technology currently in use at FB/DNA at FASS and areas highlighted as likely to use AI.

The use of Artificial Intelligence technology is in its infancy within the FB/DNA discipline.

Sperm Identification

At FASS FB/DNA, AI is used with the Zeiss-MetaSystems Axio Vision Z2 scanning microscope (SpermSearcher) methodology using Metafer software. SpermSearcher is an automated microscope that has been programmed to scan microscope slides looking for cells that resemble sperm and take images of potential sperm candidates. Microscopic detection of sperm cells is a confirmatory test for the presence of semen, which can be important information, especially in sexual assault allegations.

AI was used to develop classifiers to identify potential sperm cells. This was achieved by supplying the Metafer software with over 3800 known sperm images and over 1400 known non-sperm images. The software generated an artificial neural network (ANN) which could sort through all captured images and rank them sequentially according to which images are most likely to be sperm. After this ranked gallery of potential sperm images is created, a trained forensic expert will review the images and confirm whether they are indeed sperm cells. Thus, AI trained a software system to simplify and streamline processing of microscope slide examination, while the trained biologist still maintains the responsibility of identifying the presence of sperm. Validation of the SpermSearcher (and related software) showed that the instrument was able to accurately detect sperm and effectively rank the gallery to allow efficient identification.

FASS was one of the first FB/DNA laboratories worldwide to utilise this technology.

Expert DNA Software

There are software packages that use ANN for analysis of raw DNA data into human comprehensible DNA profiles. DNA profiles contain peaks on a graph that can either be real (i.e., from a person), or an 'artefact' (erroneous peaks caused as a by-product of DNA analytical processes; not originating from a person). Both real peaks and artefacts typically happen in predictable patterns, so a trained and experienced operator can distinguish between them.

The ANN used in DNA typing software allows for automated pattern analysis to identify real and artefact peaks and produce an analysed DNA profile. Software can also be trained to predict the number of DNA contributors present in a DNA profile. This is an important consideration in downstream DNA identification processes, where comparisons to the DNA profiles of known individuals occurs.

The ANN is developed by exposure to significant numbers of DNA profiles from known individuals. All types of DNA profiles from simple to very complex will be run through the software to train its ANN capability.



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Following ANN development, extensive validation is required to ensure the DNA profile 'calls' are accurate to laboratory standards.

The FASS FB/DNA laboratory are not currently using any DNA software using AI or ANN functions. We will continue to explore software applications and are working with the software developers to provide DNA data to train software.

Data Analytics

The emerging use of AI in the field of data analytics is predicted to have future benefits to help optimize DNA collection practices to effectively target evidentiary DNA associated with a criminal offence.

Kind regards,

A handwritten signature in black ink, appearing to read 'Clint Cochrane'.

Clint Cochrane
Laboratory Manager, Forensic Biology/DNA
NSW Health Pathology, Forensic & Analytical Science Service