

Probabilistic DNA: Considerations for Implementation Independent Verification and Validation of Software

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Law Enforcement Use of Probabilistic Genotyping, Forensic DNA
Phenotyping, and Forensic Investigative Genetic Genealogy
Technologies
National Academies

March 13 2024





As citizens of the modern world, we all know software has bugs. Probabilistic genotyping software is no exception.

Software engineers and computer scientists have well-established best practices for identifying and removing bugs that we should be following.

Software Verification and Validation (V&V)

- Well-established best practices, tools, and standards for building reliable software and iteratively identifying and removing defects
 - Requirements definition, design definition, unit testing, integration testing, acceptance testing, regression testing, bug/defect tracking, version control, debuggers, code coverage tools
- IEEE 1012 Standard for System, Software, and Hardware Verification and Validation
 - Used for critical software throughout the US government (e.g. Nuclear Regulatory Commission, NASA, aviation software)
 - Level of effort guided by integrity/severity level
- Peer review of scientific publications is **not** software verification and validation.
- Laboratory validation studies are **not** software verification and validation.

Independent Verification and Validation (IV&V)

- Who decides what is "good enough"?
- Team conducting V&V must be independent of developers.
 - Technical, managerial, and financial independence
 - Level of independence also guided by integrity/severity level.

You might think that developers of forensic software would be required to follow software engineering standards and best practices.

But this is often not true.

Software Engineering as a Key Scientific Community

- Probabilistic genotyping software should be required to follow software engineering standards
 - Software engineering community should be essential to establishing standards for forensic software more broadly.
- Admissibility of scientific evidence in federal and state courts (Daubert/Frye standards) requires judges to consider acceptance of the method by the "relevant scientific community".
 - Software engineering needs to be a key part of the relevant scientific community.

Fair and equal access in court

- IEEE 1012 style IV&V work up front *and* also then fair and equal access in court
- Both sides should have fair and equal access to inspect software
 - Don't use intellectual property law to protect from discovery or disclosure of problems.
- IEEE 1012 style IV&V work up front would make the work required in individual cases much easier
 - IV&V requires substantial resources and time and it should be the responsibility of the software vendor to present evidence that it has been completed.
 - Then for an individual case, the focus could be on what is specific to that case

Key Recommendations

- Probabilistic genotyping software should be independently verified and validated.
 - IEEE 1012 is general purpose, widely used for other critical software, and applicable to forensic software already.
 - Establish a timetable and incentives for achieving full compliance.
- Defendants should be given fair and equal access for their own testing.

Thank you!

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