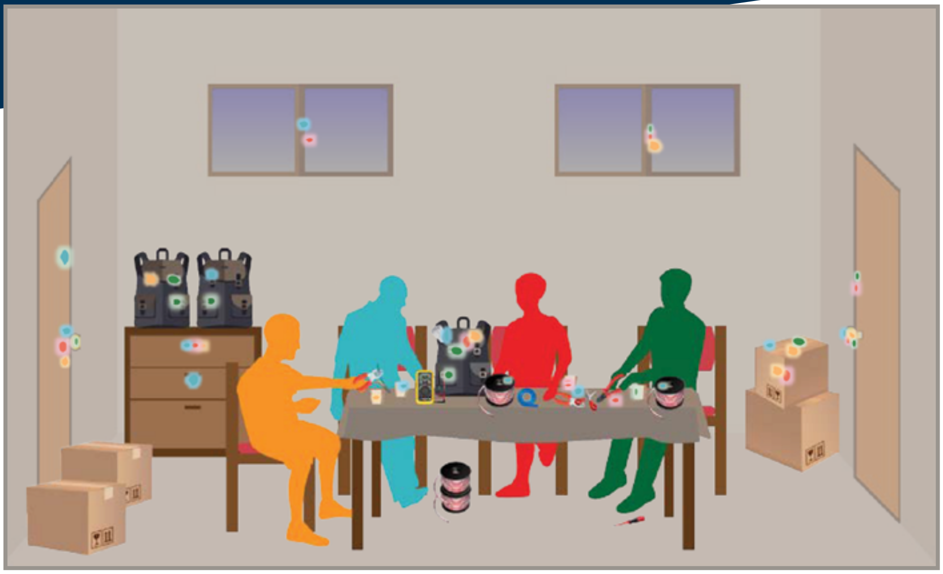
MIT LINCOLN LABORATORY

INNOVATION
HIGHLIGHT

Technology in Support of National Security

WWW.LL.MIT.EDU

IdPrism: Analysis of Complex DNA Mixtures



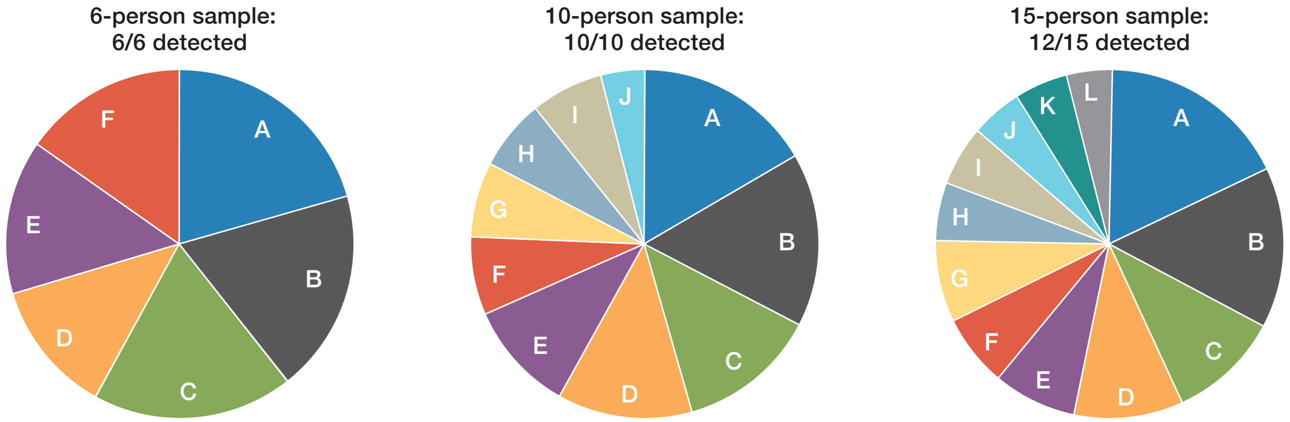
The identification of individuals via DNA collected from objects touched by just one person is a straightforward process. Realistically, DNA samples collected at most sites often contain trace quantities of DNA from multiple people. IdPrism was developed to identify the different people whose DNA is in those samples.

IdPrism is an integrated suite of software tools that can identify up to 10 individuals whose DNA is present within a complex-mixture sample. IdPrism utilizes modern DNA-sequencing technologies and novel forensic-inference methods to enable the automated and rapid analysis of complex, low-input operational DNA samples that cannot currently be analyzed.

KEY FEATURES

- Completes automated analysis in 10 minutes
- Enables ultrafast identification and mixture analysis searches against datasets of tens of millions of forensic profiles
- Includes tools for estimating concentrations of DNA contributed by individuals, predicting kinship relationships, and visualizing networks of DNA contributors
- Designed to be extensible, web based, and secure via user authentication and encrypted passwords

LINCOLN LABORATORY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY



The pie charts show the results of complex-mixture DNA analyses. In each pie chart, the wedge size corresponds to a subject's (identified by letter) estimated relative DNA contribution to the mixture.

Of all the leave-behind "signatures" on objects, only DNA provides a high degree of certainty that individuals have touched those objects. Current methods have difficulty analyzing complex human DNA mixtures from three or more contributors, especially in mixtures on touch samples with low DNA input, such as cash, doorknobs, or shared cellphones. Law enforcement would welcome a method to determine the individuals who may have touched evidence taken from a crime scene, and rescuers would appreciate the ability to identify who might have been in a disaster-damaged building.

Lincoln Laboratory developed IdPrism, an advanced DNA forensics system that integrates DNA sequencing, novel analysis tools, and a graphical-user-interface system with a backend relational database. DNA samples collected at a site of interest are prepared in a laboratory and entered into a massively parallel sequencer that characterizes the DNA.

IdPrism automatically detects the completion of sequencing runs and transfers the sequencer data to an analysis system. After the data are transferred, proprietary IdPrism algorithms process the sequencing data, store output data in a database, and compare new samples against all available DNA samples. Custom algorithms identify contributors to samples and estimate the concentration of DNA contributed by each match. IdPrism generates and displays tables and intuitive visuals to facilitate a deep analysis of the data. Reference samples uploaded to IdPrism are also compared with other reference samples to identify potential kinship relationships present among subjects in the database.

PATENT PENDING
US20210017592

More Information

D.O. Ricke et al., "IdPrism: Rapid Analysis of Forensic DNA Samples Using MPS SNP Profiles," *Proceedings of the 2019 IEEE High Performance Extreme Computing Conference*, 28 Nov. 2019.

INTERESTED IN WORKING WITH MIT LINCOLN LABORATORY?

Scan the QR code to learn more
www.ll.mit.edu/partner-us

| Contact the Technology Transfer Office
tto@ll.mit.edu