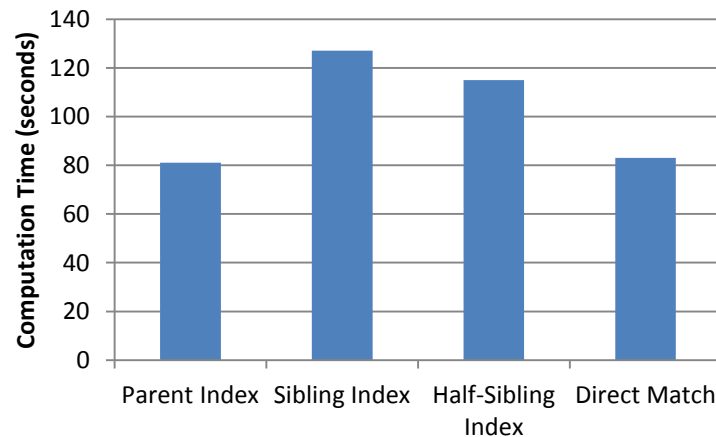


Software for DNA database searching for familial relationships

The Bonaparte Familial Search application is based on the validated¹ Bonaparte Disaster Victim Identification (DVI) software, currently in use at the Netherlands Forensic Institute. The Familial Search software is optimized for computing parent-, sibling- and half sibling indices and direct matches for very large databases (millions of profiles). These likelihood ratios are used to investigate possible familial relations between a crime scene DNA profile and offender DNA profiles in the database.

Performance

Bonaparte Familial Search is a highly optimized software application. To illustrate this we searched one suspect profile against 520,000 known profiles (all drawn from a Caucasian population statistics) on a single CPU, 6 core Intel Xeon server. The results are displayed in the graph below.



Typical performance is about 1,000 matches/second per core. A search against 10 million profiles on a 32 core machine would then take about 5 minutes.

Features

- Optimized algorithms for computing Parent Index, Sibling Index, Half Sibling Index (LR's)
- Computes LR's for Direct Matches
- Searches in specified database, specified folders or previous search results
- Custom population statistics

- Uniform mutation model with adjustable mutation rate
- Population allele frequencies independent on number of alleles
- Handles failed alleles (wildcard 'F')
- Lambda parameters (minimum count method) customizable¹
- Theta correction
- Log LR threshold or probability of detection can be specified
- All LR's computed and visible per locus
- Maximum number of mutations can be specified
- Transparent mathematical model²
- Algorithms validated at NFI (report in preparation)
- Automated import from external sources (CODIS, etc.; $\approx 10^5$ profiles/min.)
- Manual import (Excel, plain text)
- Database rewind functionality (for audits)
- Concurrent user system
- UNIX style access rights
- Export match results as pdf or Excel files

System and requirements

The Bonaparte Familial Search software is designed as client-server system. This means that one part of Bonaparte runs on a server (the computational core), while the other part runs on the user's desktop (the user interface). Users connect to the server via (secure) http. The client-server architecture allows for scalability; in case more computational power is needed, additional servers can be added. It is also ensures flexibility; the Bonaparte core can be integrated into existing infrastructure and used without the standard GUI.

Server requirements (recommended)

- 8GB RAM (32GB, but depends on size of database)
- 1 CPU (2 Intel Xeon 6-core or better)
- BSD, UNIX, Linux or Windows OS (FreeBSD 8)
- Tomcat 6 or 7, MySQL 5.1.xx, Java 1.6

Client requirements

- Java 1.6
- OS: Windows, Linux (Mac not tested yet)

Information

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¹Slooten, K., Validation of DNA-based identification software by computation of pedigree likelihood ratios, *Forensic Science International: Genetics* 5(4) 308-315, 2011, <http://dx.doi.org/10.1016/j.fsigen.2010.06.005>

²Mathematical model specifications available to (prospective) customers.