**Software for DNA database searching for familial relationships**

The Bonaparte Familial Search application is based on the validated 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.

![Graph showing computation time for different indices and matches](image)

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) customizable
- 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 model
- Algorithms validated at NFI (report in preparation)
- Automated import from external sources (CODIS, etc.; ≈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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Bonaparte is fully owned by Smart Research BV. Bonaparte is developed by Smart Research BV in close collaboration with the Netherlands Forensic Institute.

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