Speeding up NGS software development
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1. What is GATB?

**Motivation**
NGS technologies produce terabytes of data. Efficient and fast NGS algorithms are essential to analyze them.

**Objective**
The Genome Assembly Tool Box (GATB)
- is an open-source software
- provides an easy way to develop efficient and fast NGS tools
- is based on data structures with a very low memory footprint
- allows complex genomes to be processed on desktop computers

2. Software Solution
The GATB philosophy proposes a 3-layer construction to analyze NGS datasets

1. **GATB-CORE**: a C++ library holding all the services needed for developing software dedicated to NGS data.
2. **GATB-TOOLS**: a set of elementary NGS tools mainly built upon the GATB library (k-mer counter, contig, scaffold, variant detection, etc.).
3. **GATB-PIPELINE**: a set of NGS pipeline that links together tools from the previous layer.

3. Compact de Bruijn graph data structure
The core data structure of GATB is a de Bruijn graph that encodes the main information from the sequencing reads.

**Strength of GATB**
GATB makes this graph compact by using a Bloom filter (a space efficient probabilistic data structure) and by using a CFP additional structure that avoids false positive answers from the Bloom filter due to its probabilistic nature.

4. Workflow
Here is a typical workflow when working with GATB

GATB-CORE transforms the reads into a de Bruijn graph, saves it in a HDF5 file that can be opened by other tools developed with the GATB-CORE API.

5. GATB helps you as a NGS user

**GATB’s de Bruijn graph**: a basis for families of tools
- **Data error correction**
- **Assembly**
- **Biological motif detection**

Several tools based on GATB are already available:
- **Bloocoo**: K-mer spectrum based read error corrector for large datasets
- **Minia**: Short read assembler based on a de Bruijn graph. Results are of similar contiguity and accuracy to other de Bruijn assemblers (e.g. Velvet)
- **DiscoSNP**: Discover Single Nucleotide Polymorphism (SNP) from non-assembled reads
- **TakeABreak**: Detects inversion breakpoints without a reference genome by looking for fixed size topological patterns in the de Bruijn graph

6. GATB helps you as a NGS developer
The GATB C++ library gives you the opportunity to quickly develop new NGS tools that fit your needs.

**Major facts about the GATB C++ library**
- Object Oriented Design
- Simple and powerful graph API
- Simple and powerful multithreading model
- HDFS usage for data storage
- Fully documented with numerous code samples
- Complete test suite

Publications
R. Chikhi, G. Rizk: Space-efficient and exact de Bruijn graph representation based on a Bloom filter. Algorithms for Molecular Biology 2013, 8:22
G. Collet, G. Rizk, R. Chikhi, D. Lavenier: **Minia on Raspberry Pi**, assembling a 100 Mbp genome on a Credit Card Sized Computer. Poster at the JOBIM conference, 2013 Jul 1-4 (Toulouse) Best poster award

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For more details on GATB:
**http://gatb.inria.fr**

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