

🔗Bitanes2 - OpenMP Version

🔗Author

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- Betweenness algorithm developed by Ulrik Brandes
 - Brandes, Ulrik. "A faster algorithm for betweenness centrality." Journal of mathematical sociology 25.2 (2001): 163-177.

🔗Introduction

This is a simple OpenMP implementation of the betweenness centrality algorithm developed by Brandes. It was developed as a coursework for the "Parallel Programming Introduction" module offered at the University of São Paulo - Brazil.

🔗Licence

GNU General Public Licence (see LICENSE file).

🔗Prerequisites

- Usual GNU C compiler and runtime (including support to OpenMP):
 - GNU C Compiler (gcc, tested with version 7.1.1 20170630);
 - GNU C Library (glibc, tested with version 2.25);

🔗How to Download and Execute

1. Clone repo, access folder and download submodules:

```
git clone -b omp https://github.com/comododragon/bitanes2.git
cd bitanes2
git submodule update --init --recursive
```

2. Compile using make (see **Description of Compiling Options** for compiling settings):

```
make bin/bitanes2
```

3. (a) Execute, passing as argument the input graph, e.g.:

```
./bin/bitanes2 data/small/er_20_4_03.net
```

3. (b) By default, OpenMP will use the number of processors (`omp_get_num_procs()`) as number of threads. You can override this setting by passing the number of threads as argument:

```
./bin/bitanes2 data/small/er_20_4_03.net 8
```

4. The results will be available in the same folder as the input file, with the extension .btw (e.g. data/small/er_20_4_03.btw)

🔗Description of Compiling Options

The Makefile provided with this project has some compilation options:

```
make bin/bitanes2 DEBUG=yes GPROF=yes GCOV=yes
```

where:

- `DEBUG=yes`: Activate debug flag `-g`;
- `GPROF=yes`: Activate flags for profiling with `gprof`;
- `GCOV=yes`: Activate flags for coverage test with `gcov`;

If one wants to change the options after compiling once, run `make clean` first.

🔗Performance

All executions were performed on a Intel Xeon E5-1607. The sequential version (master branch) of this repository was used as baseline.

- Sequential
 - **Execution times:**
 - **Large graph 1 (2000 nodes, 31744 edges, filename `data/big/ba_2000_32_01.net`):** 2.535 s
 - **Large graph 2 (10000 nodes, 159744 edges, filename `data/big/ba_10000_32_00.net`):** 61.4 s
- OpenMP
 - **Execution times:**
 - **Large graph 1 (2000 nodes, 31744 edges, filename `data/big/ba_2000_32_01.net`):** 0.836 s
 - **Large graph 2 (10000 nodes, 159744 edges, filename `data/big/ba_10000_32_00.net`):** 31.372 s
 - **Speedup:**
 - **Large graph 1:** 3.03x
 - **Large graph 2:** 1.98x

🔗File Structure

- `bin`: folder for executable files;
- `data`: dataset of graphs;
 - `big`: large graphs (up to 10000 nodes);
 - `small`: small graphs (up to 20 nodes);
- `include`;
 - `common`;
 - `common.h`: procedures used for error detection and reporting (e.g. `assert`);
 - `graph.h`: header of graph data structure;
 - `list.h`: header of list/queue/FIFO data structure;
- `obj`: folder for object files (`.o`);
- `src`;
 - `bitanes2.c`: main function source;
 - `graph.c`: source of graph data structure;

- `list.c`: source of list/queue/FIFO data structure;
- Makefile: project makefile.