PolyVest 1.0

PolyVest is an efficient tool to estimate the volume of a convex polytope. It can handle instances with dozens of dimensions with high accuracy. It is mainly bases on a Multiphase Monte-Carlo algorithm. For further details about the algorithm, refer to [1].

Installation

As a courtesy, the PolyVest package for Windows contains pre-compiled 64-bit versions of Armadillo, LAPACK, BLAS and WinGLPK, as well as MSVC project files to compile the program. The MSVC project files were tested on 64-bit Windows 7 with Visual C++ 2012.

You may need to make adaptations for later versions of Windows and/or the compiler. It requires the following packages to compile:
✧ Armadillo   http://arma.sourceforge.net/download.html#windows
✧ WinGLPK   http://sourceforge.net/projects/winglpk/

PolyVest Input Format

The input of PolyVest is a convex polytope defined as the bounded intersection of finitely many halfspaces. To describe the polytope $\{b \geq Ax\}$ in N-dimensional space, where b is an $M \times 1$ vector, and A is an $M \times N$ matrix, the corresponding input file is given by a total of $2 + M \times (N + 1)$ numbers.

The first two numbers in the input file must be:
$$M\ N$$

Every N+1 following numbers define an inequality in $\{b \geq Ax\}$. For example, the ith inequality appears in the input as follows:
$$b_i\ -a_{i1}\ -a_{i2}\ \dots\ -a_{iN}$$

PolyVest supports both floating point numbers and integers in the input. Note that PolyVest does not identify LF (line feed) or NL (new line) characters, so it is fine that you put all numbers in a line.

Example

To illustrate the file format, let us consider the simple example of the square $\{(x, y) \in \mathbb{R}^2 : -1 \leq x, y \leq 1\}$. The file cube_2 is given by:

```
4    2
1    1    0
1    0    1
1    0    -1
1    -1    0
```
You can also write the file like this:
```
4 2 1 1 0 1 0 1 1 0 -1 1 -1 0
```

Invoking PolyVest

In the command line, you may run PolyVest as follows:

```
> PolyVest <input-file> <step-size-coef> [output-file]
```

The input-file is in the format as described above. The `step-size-coef` is a parameter that controls the sample size of PolyVest. The larger `step-size-coef`, the larger sample size and longer execution time. Usually, we choose 1600. The `output-file` is optional. PolyVest will append the result to file 'PolyVest.result' by default.

If you have any questions or if you have found some bugs, please contact me at gecj@ios.ac.cn.

References

[1]   Cunjing Ge, Feifei Ma. A Fast and Practical Method to Estimate Volumes of Convex Polytopes. *FAW 2015*: 52-65.