Volume Estimation of Convex Polytopes

Computing the volume of a convex body is an NP-Hard problem. Several methods for estimating convex polytope volumes exist, such as Algorithm 1 in [1]. The Algorithm 1 works by “cutting” a high dimensional polytope in simpler ones (ellipsoids) and computes their volumes via a Markov Chain Monte Carlo procedure. These “subvolumes” are used to estimate the volume of the original polytope.

Implementation

Baseline: A straightforward/unoptimized C or C++ implementation.

Optimized: A faster version using what you have learned in this course (e.g., vectorization and improving memory locality).

As fast as possible: An even faster version produced with more elaborate techniques, e.g., autotuning or specialized code generation. The use of profiling tools such as VTune to analyze performance bottlenecks and to understand “behavior” of the code is highly encouraged.

[1] https://arxiv.org/pdf/1401.0120.pdf