

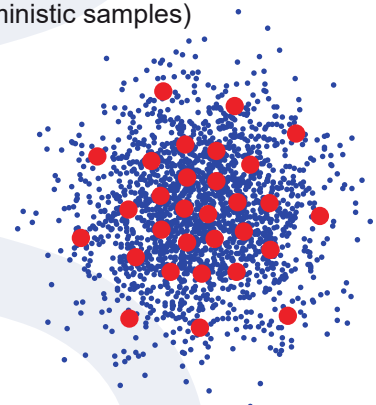
Deterministic Sampling Library in C++

Our institute is at the forefront in developing better-than-random, deterministic samples. Replacement of the commonly used random samples with deterministic ones yields faster convergence, i.e., more accurate results with fewer samples. Deterministic samples have a wide range of application scenarios, e.g., numerical integration or Monte Carlo simulation, state estimation, control, and uncertainty representation.

A major obstacle for widespread use of our methods is the availability of a fast implementation that can easily be invoked from all major scientific programming languages. Therefore we plan to create and publish C++ implementations of our most universal and widely used methods, as i) C++ can easily be compiled and run on all platforms, and ii) all important scientific languages provide widely used and well-documented bindings to invoke C++ code, so we can easily provide small wrapper functions for use in Python, Julia, Matlab, R, etc..

Interesting sampling methods we look forward to release in this way include

- Sample reduction (many random samples → few deterministic samples)
 - in Euclidean space (see picture)
 - on Riemannian manifolds
- Gaussian mixture sampling
- Anisotropic Gaussian sampling



What to do

- Understand respective deterministic sampling method
- Optional: prototype in higher language
- C++ implementation
- Profile to optimize speed
- Write wrappers for higher languages

Requirements:

Students with a background in computer science, mathematics, electrical engineering, or other engineering majors. Pre-knowledge in scientific programming and C++ programming is welcome. Strong self-motivation, reliability, endurance, mathematical skills, problem solving skills, and critical mind are expected.

Emphasis:

Theoretical Study

Software Implementation

Hardware Implementation

We offer:

- excellent support and advice
- highend infrastructure
- contact to industry and research partners

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