Pseudo-code of MpCN algorithm

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This is a pseudo-code of MpCN algorithm described in Kamatani [2014]. MpCN works efficient for both light-tailed and heavy-tailed target distributions. It is a derivative-free method.

Let $p(x)\mathrm{d}x$ be the target probability distribution on $\mathbb{R}^d$.

MpCN Algorithm

Choose $x \in \mathbb{R}^d$ and $\mu \in \mathbb{R}^d$. Run

- Generate $r \sim \mathrm{Gamma}(d/2, \|x-\mu\|^2/2)$.
- Generate $x^* = \mu + \rho^{1/2}(x-\mu) + (1-\rho)^{1/2} r^{-1/2} w$ where w follows the standard normal distribution.
- Accept x^* as x with probability $\alpha(x, x^*)$, and otherwise, discard x^*, where

$$\alpha(x,y) = \min\left\{1, \frac{p(y)\|x-\mu\|^{-d}}{p(x)\|y-\mu\|^{-d}}\right\}.$$

In the above, $\mathrm{Gamma}(\nu, \alpha)$ is the Gamma distribution with the shape parameter ν and the rate parameter α with the probability distribution function $\propto x^{\nu-1}\exp(-\alpha x)$. In our simulation, we set $\rho = 0.8$.

In practice, it is advisable to take a two-stage procedure.

Two-stage MpCN Algorithm

1. Choose $\mu \in \mathbb{R}^d$ and $x \in \mathbb{R}^d$. Run MpCN algorithm. Let $(x_1, \ldots, x_M)$ be the output.
2. Set $x = x_M$, $\mu = \sum_{m=1}^M x_m/M$ and run MpCN again.

References

Kengo Kamatani. Efficient strategy for the Markov chain Monte Carlo in high-dimension with heavy-tailed target probability distribution. *Arxiv*, 2014. URL `http://arxiv.org/abs/1412.6231`.