Subsampling I – Stochastic Gradient HMC

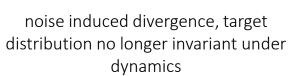
$$\nabla \tilde{U}(\theta) = -\frac{|\mathcal{D}|}{|\tilde{\mathcal{D}}|} \sum_{x \in \tilde{\mathcal{D}}} \nabla \log p(x|\theta) - \nabla \log p(\theta), \ \tilde{\mathcal{D}} \subset \mathcal{D}.$$

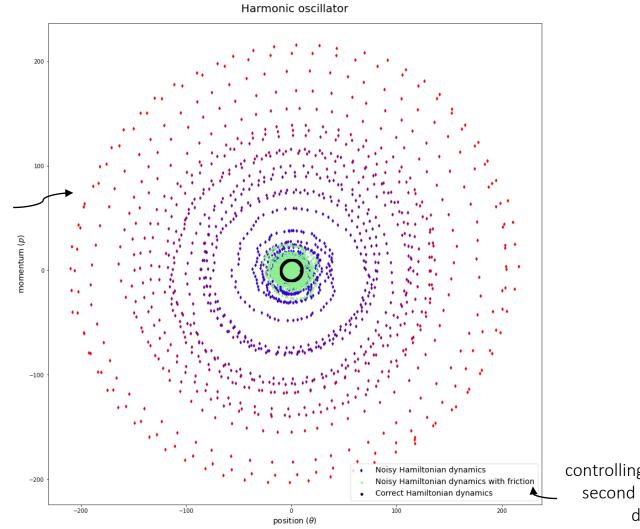
$$\begin{cases} d\theta = M^{-1}r dt \\ dr = -\nabla U(\theta) dt - BM^{-1}rdt + \mathcal{N}(0, 2Bdt). \end{cases}$$

$$\begin{cases} d\theta = M^{-1}r dt \\ dr = -\nabla U(\theta) dt - CM^{-1}rdt \\ +\mathcal{N}(0, 2(C - \hat{B})dt) + \mathcal{N}(0, 2Bdt) \end{cases}$$

Skip Metropolis-Hastings acceptance/rejection step, control induced error by keeping HMC integration stepsize small

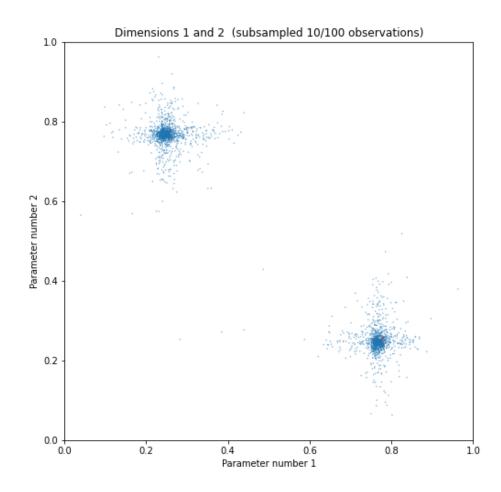
Noisy hamiltonian dynamics: oscillator

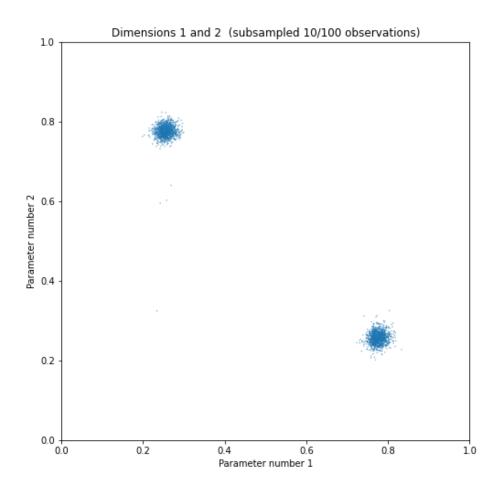




controlling divergence with second order Langevin dynamics

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No compensations (B=0,C=0)

Introduced friction (B=500,C=1500)