

---

# The Multiple-Try Metropolis and its Variations

---

**Xu Chen**

Department of Statistical Science  
xu.chen2@duke.edu

**Menglan Jiang**

Department of Statistical Science  
menglan.jiang@duke.edu

## Abstract

Markov chain Monte Carlo (MCMC) has been extensively applied in many complicated computational problems to sample from an arbitrary distribution. The fundamental idea is to generate a Markov chain whose invariant distribution is the target distribution. The traditional Metropolis-Hastings algorithm (MH) based on local search may suffer from slow converging problem since the sampler may get stuck in a local mode especially for multimodal parameter spaces. Multiple-try Metropolis (MTM) was proposed to overcome this difficulty by proposing multiple trial points and then sampling based on their importance. The numerical experiments illustrate that the sampler can efficiently explore the parameter space. This project will prove the validity of MTM and implement the algorithm and its variations including Griddy-Gibbs Multiple-Try Metropolis (MTM-Gibbs) and Langevin-within-MTM on artificial data and real dataset. Comparisons are made to show the superiority of the algorithm over traditional MH algorithms.

## 1 Introduction

### 1.1

### 1.2

## 2 The algorithm and its variations

## 3 Implementation

## 4 Optimization and high performance computing

## 5 Experimental results and comparisons

## 6 Conclusions

## References

- [1] Faming Liang, Chuanhai Liu & Raymond Carroll (2011) *Advanced Markov chain Monte Carlo methods: learning from past samples* vol:714 John Wiley & Sons
- [2] Jun S. Liu (2001) *Monte Carlo Strategies in Scientific Computing* Statistics, Springer-Verlag, New York
- [3] Jun S. Liu, Faming Liang & Wing Hung Wong (2001) The Multiple-try method and local optimization in Metropolis Sampling. *Journal of the American Statistical Association*, 95:449, pp. 121-134
- [4] Radford M. Neal (2011) MCMC using Hamiltonian dynamics. In Steve Brooks et al. (eds.) *Handbook of Markov chain Monte Carlo* Chapter 5, Chapman & Hall/CRC Press