7.2 The Metropolis Algorithm More Generally

Zongyi Liu

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The procedure described in the previous section was just a special case of a more general procedure in the Metropolis algorithm, named after the first author of a famous article (not a "metropolis").

In special case, we just consider (i) discrete positions (ii) on one dimension (iii) with moves that proposed just one position left or right. That simple situation made it relatively easy (believe it or not) to understand the procedure and how it works. The general algorithm applies to (i) continuous values (ii) on any number of dimensions (iii) with more general proposal distributions.

The steps of general case of the Metropolis algorithm are similar to the special one.

7.2.1 "Burn-in", Efficiency, and Convergence

If the target distribution is very spread out, but the proposal distribution is very narrow, then it will take a long time for the random walk to cover the distribution with representative steps. This is like trying to make a geographical survey of an entire continent (many thousands of kilometers wide) by repeatedly tossing a stone up in the air (a few meters at best) and occasionally moving to where the stone lands. Thus, when the proposal distribution is too narrow, the Metropolis algorithm is not very efficient: it takes way too many steps to accumulate a representative sample.

7.2.2 Terminology: Markov chain Monte Carlo

The metropolis algorithm is a specific type of Monte Carlo process. It generates a random walk such that each step in the walk is completely independent of the steps before the current position.

The Metropolis algorithm is an example of a **Markov chain Monte Carlo (MCMC)** process.