Baby steps: a simple illustration of the Metropolis algorithm

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### Abstract

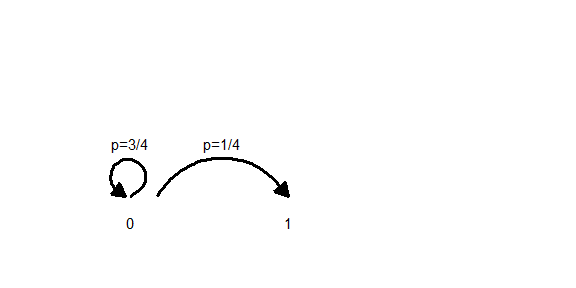
The Metropolis algorithm is a simple approach to generating random observations from a distribution where the density is known up to a proportionality constant. This algorithm is the easiest to understand and to implement of various methods used in Markov Chain Monte Carlo. In this paper, we show a simple example of the Metropolis algorithm to simulate the geometric distribution with =1/2, and describe the resulting simulation as analogous to a baby learning to walk.

### Introduction

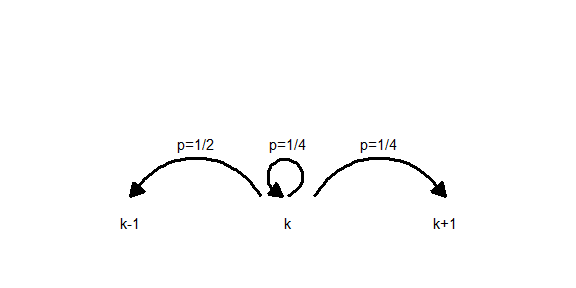
Consider a baby learning to walk. The baby is standing next to a couch, holding on for support. The baby decides to take one step away from the couch with probability 1/4 and stay next to the couch with probability 3/4. Once away from the security of the couch, the baby takes a step forward with probability 1/4, stays in place with probability 1/4, and steps backwards (towards the couch) with probability 1/2. How much time does the baby spend clutching the couch?

<https://fivethirtyeight.com/features/will-the-baby-walk-away-will-the-troll-kill-the-dwarves/>

You can solve this question easily with a computer simulation, but I derived the problem using the Metropolis algorithm to simulate a geometric distribution with p=1/2.



\*Figure 1. Baby walk



\*Figure 2. Baby walk