THE PRUNED-ENRICHED METHOD FOR SIMULATIONS OF CONTINUOUS TIME RANDOM WALKS

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We generalize the pruned-enriched method to simulate the probability distribution of the continuous time random walk (CTRW). The small probabilities that the pruned-enriched method can simulate could be many orders of magnitude smaller than the minimum probability obtained from the particle tracking method when the computational costs of the two methods are the same.

The pruned-enriched method is using the mean value of visited number of random walks with variable weights to calculate the probability density function (pdf). The key step of this method is the pruning-enrichment procedure for adjusting weights of random walks. If the weight of some random walk is much larger than the corresponding probability density, the random walk splits into a few copies with the same weight. The sum of the weights of these copies is equal to the original weight of the random walk. The enrichment steps avoid that small probability density is determined by a few samples with large weights. If the weight of some random walk is much smaller than the corresponding probability density, the random walk continues walking with a probability and with a new weight. The product of the probability and the new weight is equal to the original weight. These pruning steps eliminate the random walks with very small weights to save the computational costs.

We use a CTRW model on a one-dimensional lattice to test the pruned-enriched method The simulated results show that this method could quickly calculate small pdf , 30 orders of magnitude less than the minimum probability by the particle tracking method. In addition, we introduce a new criterion for the pruning-enrichment procedure, limiting the minimum of weights, which improves the efficiency very much.