Implementation of Sampling Methods in Probabilistic Graphical Models

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1 Importance Sampling

1.1 Sampling Process

Each node is sampled in topological order from the local proposal distributions. This approach ensures that parent nodes are sampled before their children, maintaining the consistency of conditional dependencies.

1.2 Weight Calculation

Samples are weighted by the ratio of the probabilities under the target distribution to the proposal distribution. The target distribution is the product of local target conditional distributions, while the proposal distribution is the product of local proposal conditional probabilities.

1.3 Conditional Probability Computation

The approximate conditional probability distribution is obtained by weighting the samples and normalizing them over the number of iterations.

2 Gibbs Sampling

2.1 Sampling Procedure

In each iteration, every node is sampled once considering its Markov Blanket, which includes its parents, children, and other parents of its children. This process is repeated for a specified number of iterations.

2.2 Distribution Approximation

The samples from Gibbs Sampling are weighted equally. The approximate distribution is computed by aggregating these samples and normalizing them to represent probabilities.