Accelerating Monte Carlo using Restricted Boltzmann machines

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Monte Carlo process

- Propose a change
- Accept change if energy is lowered
- If not, accept change weighted by a probability distribution
- Allow system to thermalize at a given temperature
- After thermalization, perform averages on observables

Disadvantages of Monte Carlo

- Steps wasted in thermalization
- Long autocorrelation time
- Near critical point, slows down due to energy not appreciably changing with sweeps

Proposed solution

- Show the RBM large number of configurations at given T
- Make it learn the distribution of these configurations
- Make it sample configurations based on this distribution

System chosen for analysis

- Ising model with nearest neighbor interaction, no magnetic field
- Spins denoted by +1 or -1
- 30 x 30 square lattice

Further extensions

- Teach RBM at different T
- Compare thermodynamic observables with full MC calculations