

Simulation laboratory 5: Markov Chain Monte Carlo methods

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Goals

MCMC:

- Understand how to draw from a complex distribution
- Use Markov Chain Monte Carlo methods

Implementation:

- 1 Markov Chain Monte Carlo
- 2 Metropolis-Hastings algorithm
- 3 Gibbs sampling

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- 4 My results

Markov Chain Monte Carlo

Exercise:

- Implement a Markov chain model representing the "machine" example introduced in the lecture.

Codes:

- ① **MarkovChain.m**: to implement
- ② **MarkovChainTest.m**: to test the implementation

TODO:

- Play with different state space, initial state and transition matrix.
- Extra question on MSE in **MarkovChainTest**.

- 1 Markov Chain Monte Carlo
- 2 **Metropolis-Hastings algorithm**
- 3 Gibbs sampling
- 4 My results

Metropolis-Hastings algorithm

Context:

- Professor M. sees that the students in his course are extremely emotional.
- He records their emotional states, which change every hour.
- In the total duration of the course, he records the following statistics:
 - Sad: 15 hours,
 - So-so: 20 hours,
 - Happy: 31 hours.

Metropolis-Hastings algorithm

Exercise:

- Implement a Metropolis Hastings to represent the emotional state of students.

Codes:

- 1 **MetropolisHastings.m**: to implement
- 2 **MetropolisHastingsTest.m**: to test the implementation

- 1 Markov Chain Monte Carlo
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Gibbs sampling

Exercise:

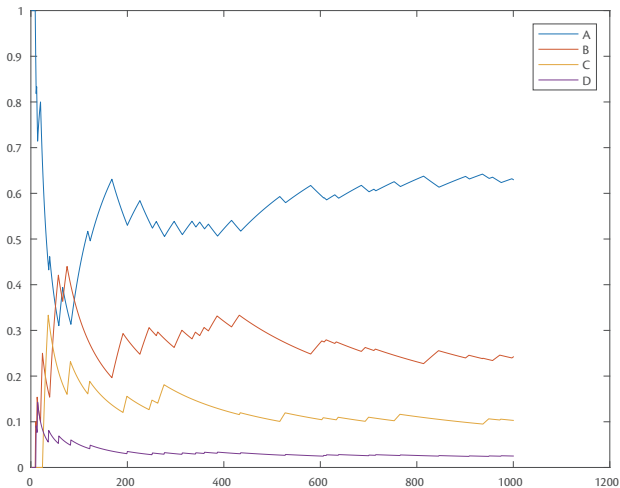
- Use the Gibbs sampling algorithm to draw from the bivariate normal distribution introduced in the lecture.

Codes:

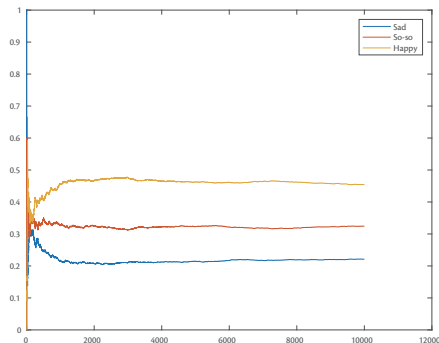
- 1 **GibbsSamplingBN.m**: to implement
- 2 **GibbsSamplingBNTTest.m**: to test the implementation

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Markov Chain Monte Carlo sampling



Metropolis-Hastings



- Accept: [2210 2941 3393]
- Reject: [1026 430 0]
- Simulated: [0.2217 0.3241 0.4542]
- Target: [0.2286 0.3178 0.4537]

Gibbs sampling

