

Statistical inference with Markov chain Monte Carlo algorithms

Workshop exercises, MuniHac 2024

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1 Understand

Try to get some basic understanding of the project.

1. Have a brief look at the Haskell source files and the Cabal file.
2. Run the sampler using `cabal run`.
3. Inspect the trace using `Tracer`. Can you observe the burn-in? What are ESS values?

2 Hack around

1. Change the seed (e.g., use a random seed). Does the seed affect parameter estimates?
2. Analyze the prior and likelihood functions. Play around with the prior function. Does the posterior function change?
3. Analyze the proposals. What does the `@~` operator do? What are sliding and scaling proposals? What is burn-in and what does "tuning a proposal" mean? Play around with the proposals. For example, turn off auto tuning or change proposal weights. Can you improve on my `Cycle` (see also the next exercise)?
4. Analyze the convergence of the chain. What are ESS values? Can you improve your ESS values without elongating run time?
5. Try a different model. For example, try a model M_0 with constant temperature. Have a look at the posterior function. Can we compare model M_0 with our original linear regression model M_1 ? See also the exercise below.

3 Become an expert

- (Stop,) load and continue a Markov chain (`Ctrl-C`; continuing from a checkpoint only works after burn-in). See also the `continue` function in `Climate.hs`.
- Use other data for your inferences (e.g., the wind speed).
- What is the marginal likelihood? We can calculate the marginal likelihood for a specific model using the `mcmc` library. Can you calculate the marginal likelihoods of M_0 and M_1 and their Bayes factor? Is the support for model M_1 significantly higher than the support for model M_0 ? Should we probably all become more active in informing our friends and family about climate change?