

Laboratory Session 06 : May 18, 2023

Exercises due : June 4, 2023

Exercise 1

- given the following un-normalized posterior distribution

$$g(\theta \mid x) \propto \frac{1}{2} \exp - \frac{(\theta + 3)^2}{2} + \frac{1}{2} \exp - \frac{(\theta - 3)^2}{2}$$

- draw a Markov Chain from the posterior distribution using a Metropolis-Hastings algorithm
- use a Norm(0, 1) as random-walk candidate density
- plot the sampled distribution
- analyze the chain with the CODA package and plot the chain autocorrelation
- try to use different burn-in cycles and thinning and plot the corresponding posterior distribution and the chain autocorrelation function. What are the best parameters ?

Exercise 2

- the European Medicines Agency (EMA) has authorized a list of COVID-19 vaccines, after having performed a scientific evaluation of the vaccines efficacy

The following vaccines are currently authorized for use in the European Union:

- Comirnaty (BioNTech and Pfizer)
 - VCOVID-19 Vaccine Valneva
 - Nuvaxovid (Novavax)
 - Pikevax (Moderna)
 - Vaxzeviria (AstraZeneca)
 - Jcovden (Janssen)
 - VidPrevtyn Beta (Sanofi Pasteur)
 - Bimervax, previously COVID-19 Vaccine HIPRA (HIPRA Human Health S.L.U.)
- analyze the initial test data reported on the EMA Web site for the following early Vaccines
 - Janssen [1]
 - Moderna [2]
 - AstraZeneca [3]
 - Jcovden [4]

and create a Markov Chain Monte Carlo JAGS or stan the efficacy of each Vaccine. Infer the 95% credibility interval.

Exercise 3

- according to the official COVID-19 vaccination data, 70% of the world population has received at least one dose of a COVID-19 vaccine. A global vaccination dataset is available [5]
- the European Centre for Disease Prevention and Control published a downloadable file [6] containing information on COVID-19 vaccination in the EU/EEA.
- analyze the data and produce the following plots:
 - number of vaccinated people (cumulative, daily and week average)
 - number of confirmed deaths by COVID-19, both cumulative and weekly average

References

- [1] https://www.ema.europa.eu/en/documents/overview/covid-19-vaccine-janssen-epar-medicine-overview_en.pdf
- [2] https://www.ema.europa.eu/en/documents/overview/spikevax-previously-covid-19-vaccine-moderna-epar-medicine-overview_en.pdf
- [3] https://www.ema.europa.eu/en/documents/overview/covid-19-vaccine-astrazeneca-epar-medicine-overview_en.pdf
- [4] https://www.ema.europa.eu/en/documents/overview/jcovden-previously-covid-19-vaccine-janssen-epar-medicine-overview_en.pdf
- [5] <https://ourworldindata.org/covid-vaccinations>
- [6] <https://github.com/owid/covid-19-data/tree/master/public/data>