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 veccines 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 Vacxcine 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 Markow Chain Monte Carlo JAGS or stan the efficacy of each Vaccine. Infere 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-medici_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-medicin_en.pdf

[5] https://ourworldindata.org/covid-vaccinations

[6] https://github.com/owid/covid-19-data/tree/master/public/data