Assignment 3 MAST90125: Bayesian Statistical Learning

Due: 11:59pm Saturday, 21 Octorber 2023

There are places in this assignment where R code will be required. Therefore set the random seed so assignment is reproducible.

Question one: Comparing techniques for fitting logistic regression (20 marks).

In this question, we will return to the dataset considered in previous lecture. As a reminder this dataset was the result of a study investigating what the optimal dosage of a new medication for influenza should be. A group of influenza patients were recruited, and administered various doses of the experimental medication. One week after administration of medication, the researcher examined the patients to see if symptoms had improved.

Consider a logistic regression,

$$\begin{aligned} y_i &\sim \text{Bin}(n_i, p_i) \\ \log(p_i/(1-p_i)) &= \mathbf{x}_i'\boldsymbol{\beta}. \end{aligned}$$

Assume a flat prior for $\boldsymbol{\beta}$ so that your results are more comparable to a standard logistic GLM.

	Dosage: x						
y_i	0	1	2	3	4	5	6
No improvement: 0	7	5	6	6	3	4	2
Improvement: 1	3	5	4	4	7	6	8

You need to compared estimation based on

- Normal approximation based on posterior modes (standard glm)
- Fully Bayesian posterior inference (fitted using the Metropolis-Hasting algorithm)
- Fully Bayesian posterior inference (fitted using the HMC algorithm)
- Approximate Bayesian inference using the expectation-propagation algorithm.

You can draw figures regarding estimated parameters to compare results obtained by the above methods.