

Homework 3

Due: September 23, 2024

From the class website, get the CSV file named “SleepySubjects”. Use the data to conduct a Bayesian linear regression that assesses the effects of how much sleep a participant got the night before on response latencies. In this experiment, participants performed an anti-saccade task where a stimulus appeared on either the right or left of a central fixation point, and participants had to look away from the stimulus. We are interested in how quickly they were able to perform this anti-saccade. Quick latencies (i.e., smaller numbers) are indicative of superior performance. There is not much literature about what how anti-saccades are affected by sleep. One could imagine that less sleep leads to worse (slower) performance or that less sleep would make it easier to not follow the natural inclination to look toward a stimulus.

To complete this assignment, you can modify the VisualSearch.R code that is available on the class website.

1. Create a model where latency on the anti-saccade task (“AntiLatency”) is a function of how much sleep a participant got the previous night (“SleepLstNt”). Write a paragraph defending the priors you have selected.
2. Summarize the results of the Bayesian analysis. Make a plot of the data and superimpose a best fitting line. Sample other intercepts and slopes from the posterior distribution and also superimpose those on the data plot. Describe the relationship between sleep and anti-saccade latency.
3. Given your analysis, what is the probability that the slope is positive? Explain how you compute this probability.
4. Suppose a new subject shows up for the experiment and says that they had 8.8 hours of sleep last night. What you do predict their anti-saccade latency to be? (Be sure to combine predictions from multiple (thousands) of draws from the posterior distribution.)
5. Run a frequentist linear regression. If the data frame is “SSdata”, then the R code would look like:

```
lmModel <- lm(AntiLatency ~ SleepLstNt, data=SSdata)
print(summary(lmModel))
```

Discuss differences between the Bayesian analysis and the frequentist linear regression. Repeat your Bayesian analysis with priors that lead to results similar to the frequentist linear regression. Discuss the properties of those priors.

6. Repeat your Bayesian analysis with ridiculous priors (e.g., very different from properties of the data). Summarize what happens to the analysis results.