Assignment 2

Overview

This assignment focuses on the dataset originally published under the title "Money Earlier or Later? Simple Heuristics Explain Intertemporal Choices Better than Delay Discounting," by Ericson et al. in Psychological Science (2015; https://doi.org/10.1177/0956797615572232). If interested, you may also wish to see Wulff & van den Bos (2018; https://doi.org/10.1177/0956797616664342) for informative re-analyses of these data. Both papers are included in the zip file containing this assignment. You don't absolutely have to read either paper to complete the homework assignment, but browsing them may help to put the analysis in context.

In this experiment, 1000 participants were recruited and randomly assigned to one of five conditions. Each participant completed 25 trials in which they were asked to choose between an instant or delayed (and higher) reward. The values presented in the choices were the same in each condition, however the framing of the question changed in each condition.

Your tasks will be to:

1. Recode 2 specific models from the paper as Bayesian hierarchical logistic regressions. (50%)
2. Compare the percentage of Larger-Later choices by framing condition using a robust Bayesian ANOVA-like model. Answer the question, "Do the framing conditions change behavior?" (50%)

The percentages in parentheses indicate the percentage of the grade each component is worth. Specific details of each component are given below.

You can download the dataset from the OSF at https://osf.io/9uxve/. You should download the analysis_code.zip file. It contains the choice.csv file already so you don't need to download that separately. Write your R Markdown file so that it runs from the "analysis_code" folder that you will download from the OSF repository. Add a directory called "models" in which to save your JAGS models.

All plots and code should be submitted as one pdf or html file. Turn in the .Rmd and JAGs model text files as well.

Please remember to upload your submissions to the Assignment 2 dropbox and not your general dropbox!

Part 1. Recode 2 specific models from the paper as Bayesian hierarchical logistic regressions.

Fit the following GLMs as Bayesian hierarchical logistic regressions to the data from each of the five experimental conditions separately. Use Subject as the grouping variable within the hierarchical model.

To select a given condition (e.g. the standard MEL) you can use the following function included with the data on OSF:

```
source("lib/deps.R") #this directory and code is part of the OSF download
Data1 = load.data(1) # The Absolute Gains condition is coded as 1
Data2 = load.data(2) # The Relative Gains condition is coded as 2
Data3 = load.data(3) # The standard MEL condition is coded as 3
... etc ...
```

- DRIFT (Difference Ratio Interest Finance Time) model.
  - This model includes four regressors. See lines 26-29 in the included `lib/load_data.R` file for regressor definitions.
    *`LaterOptionChosen ~ Intercept + DriftD + DriftR + DriftI + DriftT`
- ITCH (Intertemporal Choice Heuristics) model.

- This model also includes four regressors. See lines 20-23 in the included `lib/load_data.R` file for regressor definitions. *`LaterOptionChosen ~ Intercept + G + R + D + T`

Note: You will need to combine portions of the `simpleLogistic.txt`, `linearHierMultRegrRobust_loopX.txt`, and `bernModel.txt` JAGS models to fit these models as hierarchical logistic regressions. Also, note that the regressors are already scaled when loaded by `load.data()`, and that the participant IDs are not sequential from 1:N. Therefore using the syntax `for ( i in 1:Nsubjects)` will cause an error in JAGS if you do not first create another ID variable that is sequential from 1:N.

Things to turn in for part 1:

a) Correlation plots of the posterior chains for the group-level parameters from the the DRIFT and ITCH models for each condition. Ideally, you should create these plots with the ggpairs function from the GGally library if you are using R. This will also create the density plots for b below.

b) Plots of the densities or histograms of the posterior chains for each group-level regressor in each model. Again, a) and b) can be combined in a single graphic.

c) Summary tables of the posterior chains for each group-level regressor in each model and condition (5 x 2 = 10 tables).

d) All R or Matlab + JAGS code used to fit the models. JAGS models should be saved in a folder called "models" and assume that your R/Matlab code will be run from the directory above models such that any model can be found at models/myModel.txt

Part 2. Do the framing conditions change behavior?

Compare the percentage of Larger-Later choices by framing condition using a **robust** Bayesian ANOVA-like model. You will need to read in all conditions from the raw data in "data/choices.csv" to conduct this analysis. You may assume that the variance within each group is equal for the purposes of this assignment.

```
Data=load.data(0) #0 loads all conditions
```

Compute the mean of Data$LaterOptionChosen for each subject. *Tip*: use `aggregate` or similar functions in R for this first step. Then compare these means by condition using a "Bayesian ANOVA". Include contrasts for Standard MEL versus each of the other 4 conditions as well as one contrast for the two Absolute conditions (Numbers 1 & 4) versus the two Relative conditions (Numbers 2 & 5). Thus, there will be 5 contrasts in total. Set the ROPE to be [-0.1, 0.1] for all contrasts.

- Condition: The numeric index of the condition to which a participant had been assigned. In the data set, there are five conditions, listed below. In the analysis code, there are also references to Condition 0, which is defined as the union of all of the data rows from all of the five true conditions.
  - 1 - Absolute Gains
  - 2 - Relative Gains
  - 3 - Standard MEL
  - 4 - Absolute Losses
  - 5 - Relative Losses

Things to turn in for part 2:

a) All R/Matlab + JAGS analysis code. Again, the JAGS model should be saved in a folder called "models" and you should assume that your R/Matlab code will be run from the directory above models such that any model can be found at models/myModel.txt

b) A “moustache plot” of the data and posterior predictive distributions for all five conditions similar to that shown in the lecture.

c) Histograms or density plots of the differences for each of the 5 contrasts indicating both the 95% HDI and ROPE.