Project Epsilon progress report
The Neural Basis of Loss Aversion in Decision-Making Under Risk

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1 Introduction

The study *Neural Basis of Loss Aversion in Decision-Making Under Risk* [1] focuses on decision-making process, especially on the correlation between the neural activity and the reluctance to lose. 16 people were presented 255 gambling situations with a 50% of success. Each situation was associated with a potential gain and loss that were randomly selected. The gains were ranging from $10 to $40 while the losses from $5 to $20. The participants were asked to assess their level of willingness to accept or reject the gamble using a 4-point likert scale [1: strongly accept, 2: weakly accept, 3: weakly reject, 4:strongly reject]. The response time was also recorded for each case. The imaging data were collected using the fMRI method. They were processed and analyzed in order to identify the regions of the brain activated by the decision making process. This study also investigated the relationship between the brain activity and the behavior of the subjects towards the gambling situations using a whole-brain robust regression analysis.

2 The data

The data we are using can be found on the OpenfMRI website at the following address: `https://www.openfmri.org/dataset/ds000005`, the dsnum is ds005. For our project, we are specifically using the behavior data and the BOLD data that are organized.

For each of runs per subject (3), the behavior data contains the timestamp of each survey question (onset), the gain/loss combinations (gain and loss), the response for the particular trial (respnum) from the 4-point likert scale. The researcher created a response category (respcat) to be used in their binary choice model that combines the "reject" answers together on one hand and the "accept" answers together on the other hand. BOLD data contains compressed 4-dimensional brain images for each subject's run. The folder also comport Quality Assurance (QA) files and a report.

3 Our Process

3.1 Challenges

One of the biggest challenges was to understand the paper and the fMRI data. Especially in our case given that we want to make a literature review in order to find the proper parameters (especially) the shape parameter) of the Gamma function used to model the hemodynamic response. As mentioned before, we also had difficulties with the workflow on git and version control management, especially with the branch management and Travis checks. Consequently, our code review process was not working well. As a team, because of our conflicting schedules, we had difficulties to meet at 5. Besides the class time, we were

eventually able to set up a weekly meeting. The rest of the communication was done via emails essentially or on the GitHub platform.

3.2 Improving reproducibility

In order to be successful, we will need to improve the reproducibility of our project. For that, we need to work on adopting a systematic approach for code organization following the combo: functions - scripts - tests, and also our code syntax following python guidelines (PEP 0008). We also need to work on our code review process. We also need to generate the supporting documentation to improve the usability of our project. We also would like to exchange with other groups working on the same study in order to complement our understanding of the data and analysis.

4 Feedback on the class

Here are a few feedback we have for the class:

- We appreciate the model with 3 (or 4) supervisors having their own expertise.
- We would like more exposure to machine learning.
- The lectures on git workflow and collaboration were very useful but fast-paced.
- The lecture on linear algebra was a good refresher but a little bit too theoretical for this project-based class.
- We would like more linear regressions course focusing on the implementation.

We also have a ideas of improvement for the class:

- We propose to support the lecture with slides or handouts with the fundamentals (e.g. git) command for collaborative work) we can refer to after class.
- We propose to provide a support document with the most used statistics definitions for a good analysis design and interpretation of our data.

References

[1] S. M. Tom, C. R. Fox, C. Trepel, and R. A. Poldrack, *The neural basis of loss aversion in decision-making under risk*, Science, 315 (2007), pp. 515–518.