Project 19: Temporal difference learning

1) Implement the temporal difference learning algorithm, as described by Schultz et al. (1997). Show that this implementation can reproduce the key properties of dopamine response simulated in Figure 3 of that paper.

2) Show that the model can account for the manipulations of expectation and reward magnitude reported by Eshel et al. (2015, Figure 1). Under the assumption that stimulation of GABA neurons in the VTA increases the value function, show how the model can account for the results of GABA manipulations (Figure 2 and 3). Finally, show that the model can account for changes in learning, under the assumption that licking rate is proportional to the value function. [Don't worry about modeling every detail of these graphs; the important thing is to capture the qualitative patterns. It's also unnecessary to model all the control mice results.]

3) Why are GABA neurons well suited to implementing value subtraction?

References:

Eshel, N., Bukwich, M., Rao, V., Hemmelder, V., Tian, J., & Uchida, N. (2015). Arithmetic and local circuitry underlying dopamine prediction errors. *Nature, 525,* 243-246.

Schultz, W., Dayan, P., & Montague, P. R. (1997). A neural substrate of prediction and reward. *Science 275*, 1593–1599.