Reinforcement Learning with Matlab

By Lisa Juarez and Brad Grasser

What did I do?
Using Matlab programming, we created a world and an agent (animal) setting up a reward for the animal to reach. With every step it takes it puts a small amount of value, each time increasing, until it reaches the reward, the highest value.

In the learning process, we programmed the animal to record the past steps it took and their value so in the future it learns the best way to reach the reward. To do this we used a few different algorithmic formulas such as:

\[ \text{Delta} = \text{Reward} + (\gamma \times v(t) - v(t-1)) \]

newMove = potentialMoves(find(max(potentialValue)==potentialValue));

This allows the animal to learn the difference of the values selecting the highest values to reach the reward.

How do we learn?
After going through 100 simulation runs for every 100 trials the agent/animal learns which path to take in the same ‘maze’. Its just how people learn after doing one thing over and over again and learn the certain way to do it.

Overall, I researched how the animal makes decisions and learn to get to the reward. In this case it’s Reinforcement Learning.

Conclusions
After creating all the elements and functions I needed to create the programming, I noticed that a reinforcement Learning agent must prefer actions that it has tried in the past and found to be effective in producing a reward. In order to discover such actions, it has to explore new actions. The agent has to exploit what it already knows and explore in order to obtain the reward and make better action selection in the future. Failing has to be part of this process as well.

Acknowledgments: C. Debi, Neuroscience Program, Earth Sciences Dept., Dornsife college Dr. Arbib’s Lab group, Young Researchers Board.

Dopamine being transferred across two neurons.

Getting deeper
- Dopamine is a simple organic chemical in the brain and bodies of animals. This acts as a neurotransmitter – a chemical released by nerve cells to send signals to other nerve cells. The brain includes different kinds of neurotransmitter systems, one is the role of reward-motivated behavior, a kind of reward depending on its value increases the level of dopamine in the brain.