Letter to Editor
Published: 04 Dec, 2020

Journal of Psychiatry and Behavioral Health Forecast

Modeling Human's Decision Making by the Hybrid of Model-Based and Model-Free Reinforcement Learning Algorithms

*Mehrjerdi N[1], Janghorbani A[2] and Gharibzadeh S[3]**

[1]Department of Biomedical Engineering, Amirkabir University, Tehran, Iran

[2]Department of Biotechnology, Semnan University, Semnan, Iran

[3]Institute for Cognitive & Brain Sciences (ICBS), Shahid Beheshti University, Tehran, Iran

Dear Sir,

In psychology, decision making is recognized as the result of cognitive and learning processes. This process occurs by choosing a belief or action from a variety of options. The decision-maker learns to find the best method by repeating actions for reaching a goal and producing as much dopamine as possible [1]. In the field of engineering, the decision making process in human is simulated by a model named reinforcement learning. In this paper, two models of model-free and model-based and also a hybrid of them are used for the modeling of human's decision making [2,3]. In this study, we observe that the hybrid learner has the most coincidence with human subjects' decision making process. The reason is that the hybrid learner covers more features of human decision making than the first two models. We use a simple task for model validation by aggregating data obtained from participants. The task is designed in a dynamic environment, and with four steps in each trial where each participant should try to find the best action in each step to recognize how to receive the most reward in each trial. Actions that participants decide to take are accumulated as data for our analyses. Later, we use these data for estimation of the significant parameters in the model's learning process, and finally, we compare data obtained from participants and the model. This comparison is done by calculating the number of times the optimal paths have been used during the game trials. Hence, we have two comments in this field:

1. One of the most essential parameters in reinforcement learning is the temperature parameter(τ), which is used in the "softmax" is credited to John S. Bridle in two 1989 conference papers [4]. It plays the role of balancing between exploration-exploitation in decision making. This parameter has a significant impact on the optimal action selection procedureby the model. We estimate the optimal value of the parameter using participants' data equal to 4.29, which we use in all three of our models.

2. On the other hand, this study investigates the effect of the number of learning trials on the participants' learning process. To achieve this goal, the participants are divided into two groups. The participants in the first group pass 80 trials of learning before entering the second session, while those in the second group have only 40 chances to learn the optimal path. As expected, the first group obtains better results in the beginning (because of 40 more learning trials in the first session), but from the 10thtrial, a rapid growth trend in learning was observed in both groups. Finally, participants in both groups choose one of the optimal paths, on average, 30% of the time.

References

1. Perry EK, Ashton H, Young AH. Neurochemistry of consciousness: Neurotransmitters in mind. John Benjamin's Publishing. 2002.
2. Daw ND, Gershman SJ, Seymour B, Dayan P, Dolan RJ. Model-based influences on humans' choices and striatal prediction errors. Neuron. 2011; 69: 1204-1215.
3. Glascher J, Daw N, Dayan P, O'Doherty JP. States versus rewards: dissociable neural prediction error signals underlying model-based and model-free reinforcement learning. Neuron. 2010; 66: 585-595.
4. John SB. Probabilistic Interpretation of Feedforward Classification Network Outputs, with Relationships to Statistical Pattern Recognition. Neurocomputing. 1989.

OPEN ACCESS

*Correspondence:
Shahriar Gharibzadeh, Institute for Cognitive & Brain Sciences (ICBS), Shahid Beheshti University, Tehran, Iran.
E-mail: s_gharibzade@sbu.ac.ir

Received Date: 12 Oct 2020
Accepted Date: 30 Nov 2020
Published Date: 04 Dec 2020

Citation: Mehrjerdi N, Janghorbani A, Gharibzadeh S. Modeling Human's Decision Making by the Hybrid of Model-Based and Model-Free Reinforcement Learning Algorithms. J Psychiatry Behav Health Forecast. 2020; 3(2): 1018.

ISSN 2643-802X