The Misbehavior of Reinforcement Learning

By lkaplan
Created 4/10/2014
By lkaplan April 10, 2014

Gianluigi, Mongillo, Hanan Shteingart, and Yonatan Loewenstein. 2014.

Abstract:

Organisms modify their behavior in response to its consequences, a phenomenon referred to as operant learning. The computational principles and neural mechanisms underlying operant learning are a subject of extensive experimental and theoretical investigations. Theoretical approaches largely rely on concepts and algorithms from reinforcement learning. The dominant view is that organisms maintain a value function, that is, a set of estimates of the cumulative future rewards associated with the different behavioral options. These values are then used to select actions. Learning in this framework results from the update of these values depending on experience of the consequences of past actions. An alternative view questions the applicability of such a computational scheme to many real-life situations. Instead, it posits that organisms exploit the intrinsic variability in their action-selection mechanism(s) to modify their behavior, e.g., via stochastic gradient ascent, without the need of an explicit representation of values. In this review, we compare these two approaches in terms of their computational power and flexibility, their putative neural correlates, and, finally, in terms of their ability to account for behavior as observed in repeated-choice experiments. We discuss the successes and failures of these alternative approaches in explaining the observed patterns of choice behavior. We conclude by identifying some of the important challenges to a comprehensive theory of operant learning.

Journal:
Proceedings of the IEEE

Volume:
102

Issue:
4

Pagination:
528-541

Date Published:
04/2014

ATTACHMENTS

* pdf (277.3 KB)
UPCOMING EVENTS

Learn more about our exciting upcoming events!

read more

Studying at ELSC

Our Int'l Ph.D. program provides outstanding students with top-notch courses in computational neuroscience.

read more

The Building

The Jerusalem Brain Sciences Building will provide a state-of-the-art research and teaching facility for the Edmond and Lily Safra Center for Brain Sciences.

read more

ELSC Media Channel

Get into our media channel and investigate ELSC's latest videos: seminars, public lectures, courses and video articles.

read more

Source URL: https://elsc.huji.ac.il/loewenstein/publications/misbehavior-reinforcement-learning