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Controlling neuronal fluctuations for directed exploration during reinforcement learning

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Introduction

Neuronal and synaptic fluctuations have both been proposed to underly reward controlled learning [1,2] and have been used to explain song learning in songbird area RA [3]. The songbird area LMAN provides perturbations to area RA that are necessary for learning [4], suggesting that LMAN might target specific subsets of RA neurons and control the corresponding noise level for directed experimentation. Here we explore this hypothesis by investigating algorithms for controlling the amount of noise in order to yield efficient reinforcement learning in large networks. Our research is guided by previous work on exploration for learning which exploits information gain [5]. We find that noise control can strongly increase learning efficiency thereby attenuating the curse of dimensionality. Our results suggest that area LMAN controls experimentation by targeted control and injection of noise into RA, which might have testable implications also for learning in other motor pathways.

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