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Adaptive optimal training of animal behavior JI HYUN BAK, Korea Institute for Advanced Study, JUNG YOON CHOI, ATHENA AKRAMI, ILANA WITTEN, JONATHAN PILLOW, Princeton University — Neuroscience experiments often require training animals to perform tasks designed to elicit various sensory, cognitive, and motor behaviors. Training typically involves a series of gradual adjustments of stimulus conditions and rewards in order to bring about learning. However, training protocols are usually hand-designed, and often require weeks or months to achieve a desired level of task performance. Here we combine ideas from reinforcement learning and adaptive optimal experimental design to formulate methods for efficient training of animal behavior. Our work addresses two intriguing problems at once: first, it seeks to infer the learning rules underlying an animal's behavioral changes during training; second, it seeks to exploit these rules to select stimuli that will maximize the rate of learning toward a desired objective. We develop and test these methods using data collected from rats during training on a two-interval sensory discrimination task. We show that we can accurately infer the parameters of a learning algorithm that describes how the animal's internal model of the task evolves over the course of training. We also demonstrate by simulation that our method can provide a substantial speedup over standard training methods.

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