Continuous-Time Neural Reinforcement Learning for Decision-Making Problems

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Presentation Abstract Summary When acting in a real environment, animals have to reach both accurate and rapid decisions, by distinguishing relevant information from the un-relevant ones. This process is known as decision-making, and requires a continuous collection of sensory information to commit toward an action. Moreover, animals often learns from very sparse signals -- the rewards -- given only at the very end of a task. Here, we used a continuous-time neural Reinforcement Learning framework, CT-AuGMEnT, which uses working memory units to collect recent sensory information, and attentional feedbacks for spatial credit assignment. We trained CT-AuGMEnT on a motion-discrimination task when multiple alternatives are given, showing that the model learns to discriminate what evidence accumulate, reaching comparable performance with the animals' behaviour. Indeed, our model predicts how the task difficulty affects both performance and the reaction-times: a measure only accessible when continuous-time models are considered.

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