Relational Episodic Inference for Fictive Planning

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The neural computations guiding pattern completion of related similar episodes are typically investigated separately from fictive planning. In the relatively few mechanistic models integrating episodic memory and planning, memories are passively sampled during decision-making in a unitary fashion insensitive to their granular structure. This limited approach encounters difficulty when attempting to capture how humans make inferences about fictive scenarios for which individual episodic memories may be only partially relevant. Addressing this issue, we develop a sample-based approximate inference approach, called relational episodic inference. We find that our relational episodic inference model captures how efficient fictive planning is facilitated by the flexible integration of fragmentary elements of episodic memories. We compare the relational episodic inference approach to an episodic RL sampling model. Under time constraints, we observe that our model results in more effective future inference than extant episodic RL approaches. Furthermore, the model exhibits the capacity to flexibly sample within and across episodes in a recurrent network model of the entorhinal-hippocampal circuit. Taken together, these preliminary simulations lend support to the idea that relational episodic inference could serve as a potential computational framework for flexible and generalizable episodic memory-guided inference.