Continual learning in the brain

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Learning in the brain is continual. Many artificial learning systems, however, have specialized training phases beyond which updates to the learning system cease. Artificial systems that strive to achieve continual learning face problems such as catastrophic forgetting (learning new schema results in forgetting of schema learnt prior) and/or lack of convergence and robustness in the process of new learning. The problem of *continually encoding new features while not hindering* prior learning or the stability of the system is at the center of learning systems — natural or artificial. How does the brain achieve this feat?

The hippocampus is a key brain region that has been implicated in spatial navigation and memory encoding. The landmark discovery of place cells (cells that respond to specific locations of the external world) in the hippocampus was recognized by the 2014 Nobel Prize in Physiology and Medicine (https://www.nobelprize.org/prizes/medicine/2014/summary/). Although the implications for the presence of place cells has been explored more thoroughly, the question on how stable place cells are formed *continually* as the animal traverses its environment are only beginning to be understood. The broad question addressed in this project would be on how the hippocampus achieves *stable continual learning, without catastrophic forgetting*. The project involves training in neuroscience techniques as well as computational techniques to understand brain function.

Prerequisite: A keen interest for learning new things and an attitude engrained in innovation and intellectual exploration.

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