Modular Task Learning in an Embodied Two-Dimensional Visual Environment

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Presentation Abstract Summary Animals (especially humans) exhibit a remarkable ability to rapidly learn new tasks, and switch between them flexibly. However, the algorithmic and neuroscientific basis for how brains accomplish this, is largely unknown. A reasonable hypothesis is that brains achieve flexible task learning with light-weight, shallow, task-specific modules that are dynamically allocated on top of a deep, largely stable general-purpose underlying sensory representation. In this work, we investigate module architectures embedded within an embodied visual environment in which an agent receives a stream of images and rewards from a server, and chooses two-dimensional positions as actions on each time-step. This environment is designed to emulate the physical conditions of touchscreen apparatuses commonly used in visual neuroscience and psychophysics experiments. Under this environmental constraint, we show that very simple changes in the nonlinear motifs deployed in such a module can significantly influence both its single-task learning efficiency, and its ability to quickly transfer knowledge to new tasks.

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