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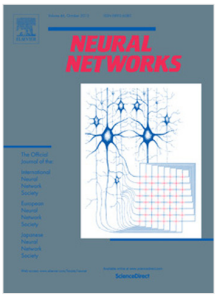

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Lifelong Learning of Human Actions with Deep Neural Network Self-Organization

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Abstract

Lifelong learning is fundamental in autonomous robotics for the incremental acquisition of knowledge through experience. However, most of the current deep neural models for action recognition from videos do not account for lifelong learning but rather learn a batch of training data of actions. Thus, there is the need to design learning systems with the ability to incrementally process available perceptual cues and to adapt their behavioral responses over time. We propose a self-organizing neural architecture for incrementally learning action sequences from videos. The architecture comprises growing self-organizing networks equipped with recurrent connectivity for time-varying patterns. We use a set of hierarchically arranged recurrent networks for the unsupervised learning of action representations with increasingly large spatiotemporal receptive fields. Lifelong learning is achieved in terms of prediction-driven neural dynamics in which the growth and the adaptation of the recurrent networks are driven by their capability to reconstruct temporally ordered input sequences from lower-level layers. Experimental results on a classification task using two action benchmark datasets show that our model is competitive with state-of-the-art methods for batch learning also when a significant number of sample labels are missing or corrupted during training sessions. Additional experiments show the ability of our model to adapt to non-stationary input avoiding catastrophic interference.

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