Modeling Human Cognitive Flexibility with Extemporaneous Networks

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Abstract

Research in cognitive science and machine learning suggests that learning systems can use small subsets of valuable training items in order to quickly learn to achieve good task performance. We hypothesize that people often use small subsets of stored exemplars to quickly train new neural networks, called extemporaneous networks, when faced with tasks for which they do not currently have dedicated networks. We explore this hypothesis using participants' responses in a behavioral experiment to identify easy versus difficult training items. We find that a network confidence measure indicates a network trained with a small set of good items provides the best account of participants' reaction times. Furthermore, computer simulations demonstrate that learning systems can achieve good performance when trained with small sets of easy exemplars. Our results indicate that humans may complete tasks using extemporaneously-created networks trained internally on small datasets.