

UC Merced

Proceedings of the Annual Meeting of the Cognitive Science Society

Title

Learning Evolved Combinatorial Symbols with a Neuro-symbolic Generative Model

Permalink

<https://escholarship.org/uc/item/9c56r6xb>

Journal

Proceedings of the Annual Meeting of the Cognitive Science Society, 43(43)

Authors

Hofer, Matthias

Le, Tuan Anh

Levy, Roger

et al.

Publication Date

2021

Copyright Information

This work is made available under the terms of a Creative Commons Attribution License, available at <https://creativecommons.org/licenses/by/4.0/>

Peer reviewed

Learning Evolved Combinatorial Symbols with a Neuro-symbolic Generative Model

Matthias Hofer

MIT, Cambridge, Massachusetts, United States

Tuan Anh Le

MIT, Cambridge, Massachusetts, United States

Roger Levy

Massachusetts Institute of Technology, Cambridge, Massachusetts, United States

Josh Tenenbaum

MIT, Cambridge, Massachusetts, United States

Abstract

Humans have the ability to rapidly understand rich combinatorial concepts from limited data. Here we investigate this ability in the context of auditory signals, which have been evolved in a cultural transmission experiment to study the emergence of combinatorial structure in language. We propose a neuro-symbolic generative model which combines the strengths of previous approaches to concept learning. Our model performs fast inference drawing on neural network methods, while still retaining the interpretability and generalization from limited data seen in structured generative approaches. This model outperforms a purely neural network-based approach on classification as evaluated against both ground truth and human experimental classification preferences, and produces superior reproductions of observed signals as well. Our results demonstrate the power of flexible combined neural-symbolic architectures for human-like generalization in raw perceptual domains and offers a step towards developing precise computational models of inductive biases in language evolution.